



**ASSESSMENT OF SPECIES COMPOSITION, DIVERSITY
AND BIOMASS IN MARINE HABITATS AND
SUBHABITATS AROUND OFFSHORE ISLETS
IN THE MAIN HAWAIIAN ISLANDS**

January 2008

COVER

Colony of *Pocillopora eydouxi* ca. 2 m in longer diameter, photographed at 9 m depth on 30-Aug-07 outside of Kāpapa Islet, O'ahu.

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**Final report prepared for the Hawai'i Coral Reef Initiative
and
the National Fish and Wildlife Foundation**

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**Bishop Museum
Hawai'i Biological Survey**

Bishop Museum Technical Report No 39

**Honolulu, Hawai'i
January 2008**

Published by
Bishop Museum Press
1525 Bernice Street
Honolulu, Hawai'i

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Printed in the United States of America



ISSN 1085-455X

Contribution No. 2008-001 to the Hawaii Biological Survey

EXECUTIVE SUMMARY

The marine algae, invertebrate and fish communities were surveyed at ten islet or offshore island sites in the Main Hawaiian Islands in the vicinity of Lānaʻi (Puʻu Pehe and Poʻo Poʻo Islets), Maui (Kaemi and Hulu Islets and the outer rim of Molokini), off Kaulapapa National Historic Park on Molokaʻi (Mōkapu, ʻŌkala and Nāmoku Islets) and Oʻahu (Kāohikaipu Islet and outside Kāpapa Island) in 2007. Survey protocol at all sites consisted of an initial reconnaissance survey on which all algae, invertebrates and fishes that could be identified on site were listed and or photographed and collections of algae and invertebrates were collected for later laboratory identification. Following the reconnaissance surveys, quantitative estimates of coral and algal coverage and size and biomass of fishes along 25 m transects were conducted at each site and their locations were recorded using GPS.

A total of 1486 total taxa were identified for all sites ranging from 181 at Poʻo Poʻo to 126 at Kāpapa. The most algal taxa occurred at Kāpapa and Hulu and the fewest at ʻŌkala, the most invertebrates at Poʻo Poʻo and the fewest at Hulu, and the most fish at Nāmoku and the fewest at Kaemi. Substantial variation was found in the coral species richness, total cover and size class distributions among the islets, with the highest values in cover occurring at Molokini rim, with nearly as high coverage occurring at Kāpapa, where the largest corals also occurred. Coral cover was lowest at Poʻo Poʻo, where the bottom was largely covered by fine sand/silt, in contrast to all other sites where limestone or basalt was the primary substratum. Highest algal cover was at the normally turbulent site at Kaemi where basalt boulders had abundant macroalgae, especially of *Dictyopteris australis* and *Sargassum* sp. Fish biomass for total fish, primary consumers and targets species was highest at Kāpapa and highest for secondary consumers at other the Oʻahu site Kāohikaipu. Values for all of these categories were lowest at Poʻo Poʻo, Hulu and Puʻu Pehe, the latter site lying within a limited take MLCDC where all but shore-based pole fishing is restricted. Therefore, for all but apex predators highest fish biomasses occurred at the two Oʻahu sites, near populated shoreline areas.

No introduced or cryptogenic algae were found on the surveys, and the only invasive introduced invertebrate was the snowflake octocoral *Carijoa riisei*, which occurred at seven of the ten sites and was abundant in caves at Poʻo Poʻo and ʻŌkala. The introduced fishes *Lutjanus kasmira*, *Lutjanus fulvus* and *Cephalopholis argus* were infrequently observed at six, four and three sites respectively. No endangered or threatened species were observed at any site, but four rare or uncommon algae species were recorded at one to three sites.

The overall condition of the reef communities at all but one site (Poʻo Poʻo) was considered good to excellent, and the high coral cover and fish biomass at the Oʻahu sites was surprising. Equally surprising was the contrast in reef characteristics at some sites such as Puʻu Pehe and Poʻo Poʻo off south Lānaʻi and Kaemi and Hulu off north Maui that were near each other and had very similar environmental characteristics but had starkly contrasting biological communities and sediment cover. The low fish biomass values at Puʻu Pehe within the Manele MLCDC suggest that poaching may be occurring in this area, and we recommend that

enforcement be strengthened and the MLCD boundary be extended to Po'ō Po'ō. We strongly recommend that the Islets within the Kaulapapa National Historic Park be designated a restricted take Marine Protected Area, that this MPA and the Park boundary be extended to include Mōkapu Islet, and that a cooperative agreement be developed between the National Park Service and the State of Hawai'i that would enable enforcement of fishing and access regulations by on-site park rangers.

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I. INTRODUCTION

Many coastal reef areas around the main Hawaiian Islands are subject to various levels of disturbance from coastal pollution, overfishing, over-lapping and often conflicting uses by various user groups, and alien species-associated phase shifts that have occurred around populated areas. Because of their remoteness, it can be assumed that reefs in the vicinity of offshore islets have been more insulated from these impacts from land-based or anthropogenic disturbances. Reefs and sub-habitats in the vicinity of offshore islets may function as relatively intact ecosystem complexes that have received limited impact from terrestrial sources. As such, offshore islet reefs may represent some of the last fully intact coral reef areas, with the greatest potential for functional and intact coral reef ecosystem marine reserves in the main Hawaiian Islands.

Hawaii's offshore islets may also be the last refuge for rare coastal species. Because offshore islets are often isolated and difficult to access, they may be assumed to have a good chance of remaining relatively safe from invasion by alien species and the other disturbances occurring on reefs adjacent to the larger Hawaiian Islands. Offshore islets can provide models that can be used in refining restoration techniques for rehabilitation of impacted reefs in more disturbed areas.

In order to address the need for coordinated, statewide program for islet conservation, the Offshore Islet Restoration Committee (OIRC) was formed in September 2002. The OIRC is a multi-agency group dedicated to conducting biological surveys and restoration on selected offshore islets in Hawaii. Members include the Hawaii Department of Land and Natural Resources' Division of Forestry and Wildlife (DOFAW), the U.S. Fish and Wildlife Service, the U.S. Coast Guard, the U.S. Geological Survey's Biological Resources Division, Wildlife Services from the U.S. Department of Agriculture, Bishop Museum, National Marine Fisheries Service, Pelea Pacifica, and the University of Hawaii. The objectives of the OIRC are to:

- Complete baseline biological inventories on selected islets
- Collect and conserve genetic material from rare plant species
- Eradicate alien mammals
- Assess efficacy of experimental eradication techniques
- Eradicate or control invasive weeds
- Control soil erosion through re-vegetation
- Re-plant native vegetation, including rare species, on selected islets
- Monitor and scientifically document results of restoration actions
- Educate the public on islet biota and conservation needs

Much of the focus of the OIRC has been on assessing, maintaining or restoring the terrestrial system and bird fauna of these offshore islets. Most offshore islet reef areas in the main Hawaiian Islands have not yet been assessed for the composition or abundance of the organisms that comprise their marine communities. Therefore, the present project was conceived and conducted to provide this information for selected offshore islets in the main Hawaiian chain where such information has been lacking, and to evaluate the status of these areas in terms of their assumed lack of anthropogenic disturbance and isolation from introduced invasive species.

II. METHODS

Site Selection

The islets surveyed were selected in consultation with OIRC to supplement previously available studies that had been conducted by researchers from the Hawai'i Division of Aquatic resources (DAR) and the National Oceanic and Atmospheric Administration (NOAA), which had mostly focused on windward O'ahu offshore islets off Kāne'ōhe and Kailua Bays. Further criteria in island selection was their accessibility under "normal" weather conditions, the variety of habitats they were likely to contain, and the logistic feasibility of travel to the sites on the small boats that were available for the project. The islet areas surveyed were:

Lāna'i

South Shore- Pu'u Pehe Island and Po'o Po'o Island

Maui:

North Shore – Kaemi and Hulu Islets

Molokini Crater, Outside Rim

Moloka'i:

North Shore – Mōkapu, 'Ōkala and Nāmoku Islets

O'ahu:

East Shore - Kāohikaipu Islet

Northeast Shore – Kāpapa Islet

These final selections were slightly different from those designated in the original HCRI proposal. Kāpapa Islet outside Kāne'ōhe bay was substituted for Wanapana Island off the O'ahu's north shore at the request of ORIC. Nāmoku Islet adjacent to the Kaulapapa National Historic park was substituted for Mokuho'oniki Islet off Moloka'i's east end because of weather-related inaccessibility of the latter site during the time of the Molokai surveys. Kaemi Islet was substituted for Mōke'ehia Islet off Maui's north shore because the latter is a peninsula rather than a true islet.

Field Techniques

The survey methods employed were adapted from rapid assessment techniques used by DAR and NOAA for surveying coral reefs at other locations in the main and Northwestern Hawaiian islands following guidelines established during the 2000 Northwestern Hawaiian Islands Expedition (Maragos and Gulko (2002) and later modified by Gulko (2005). Modifications of the assessment technique for the benthic community used by DAR and NOAA were necessary for the present surveys because the survey crew for the present study was limited to four because of personnel and boat space limitations, compared to crews of eight that normally conduct rapid assessments for DAR and NOAA surveys. However similar quantification of benthic organisms was achieved with greater precision in the present surveys by using photographic techniques that also provide permanent records of results.

The protocol followed for the surveys is described in detail in Appendix A. To summarize, two dives were made at each site: a preliminary reconnaissance survey lasting approximately one hour to record species occurrences, followed by second dive when quantitative measurements were made along transects to determine abundance of algae and fishes and size classes and abundance of reef corals. One dive team consisted of an algae (L. Giuseffi) and a coral specialist (S. L. Coles), and the other team of an invertebrate (M. Hutchinson) and a reef fish specialist (various DAR staff for Lānaʻi, Maui and Oʻahu; E. Brown of the U.S. National Park Service for Kaulapapa, Molokaʻi). On the reconnaissance surveys each specialist recorded the species that could be reliably identified in the field, photographed specimens using digital cameras, and collected algae and invertebrates for later identification in the laboratory. For the transect measurements, 3-25 m lines were deployed by the fish-invertebrate team, which made fish counts of species within size class ranges and invertebrate identifications and collections along all three transects. The coral-algal team followed and recorded algae and coral abundance and coral size class distributions along the first two transect lines using photo-quadrats. The coral specialist used a camera and platform with a frame area of 0.67 m² (Figure 1) to photograph 24 quadrats along each of two transects for a total area measured of 16 m² per transect or 32 m² per site. The algae specialist (Figure 1) used a smaller frame with an area of 0.16 m² to photograph 13 quadrats along each transect for a total sample area of 2.1 m² per transect and 4.2 m² per site. A rugosity chain 11.5 m long was also deployed on two transects and the resulting length of the chain on the bottom recorded for estimates of reef rugosity. Pelican buoys were deployed at the start and the end of each reconnaissance survey and set of transects, and the positions of these were recorded following the dives using a Garmin 12 GPS receiver. The locations of reconnaissance and transect start and end for each site is shown on maps for each survey in Figures 2 to 2 .

Analysis of Field Data and Treatment of Collected Samples

The quadrat photographs obtained for the coral and algae transects were analyzed using Coral Point Count with Excel extension (CPCe) software (Kohler and Gill 2006) available from the National Coral Reef Initiative headquarters at Nova University (<http://www.nova.edu/ocean/cpce/>). Coral quadrat photos were cropped to a consistent area of 0.67 m² and enhanced to an optimal image where needed. The outline of each coral within the photo was then traced with the computer cursor and its area determined by the CPCe area analysis program. This process was repeated for all corals on the 24 quadrats for each transect, and the areas generated in the Excel spreadsheet output were converted by formula to an estimated average diameter for each coral colony. The diameters were then grouped by size classes of 0-1 cm, 1.1-5 cm, 5.1-10 cm, 10.1-20 cm, 20.1-40 cm, 40.1-80 cm and 80.1-160 cm, similar to the size frequency analysis that has been undertaken by DAR and NOAA surveys based on visual estimates made in the field. In addition, the area measurement for each colony made in the present study allows estimates of total coral cover and percent cover of the available substratum. Corals that were recognizably fragments of larger colonies or that did not lie totally within the quadrat photograph were excluded from the diameter size class analysis, but were included in the area estimates of total and percent coverage for the quadrats.

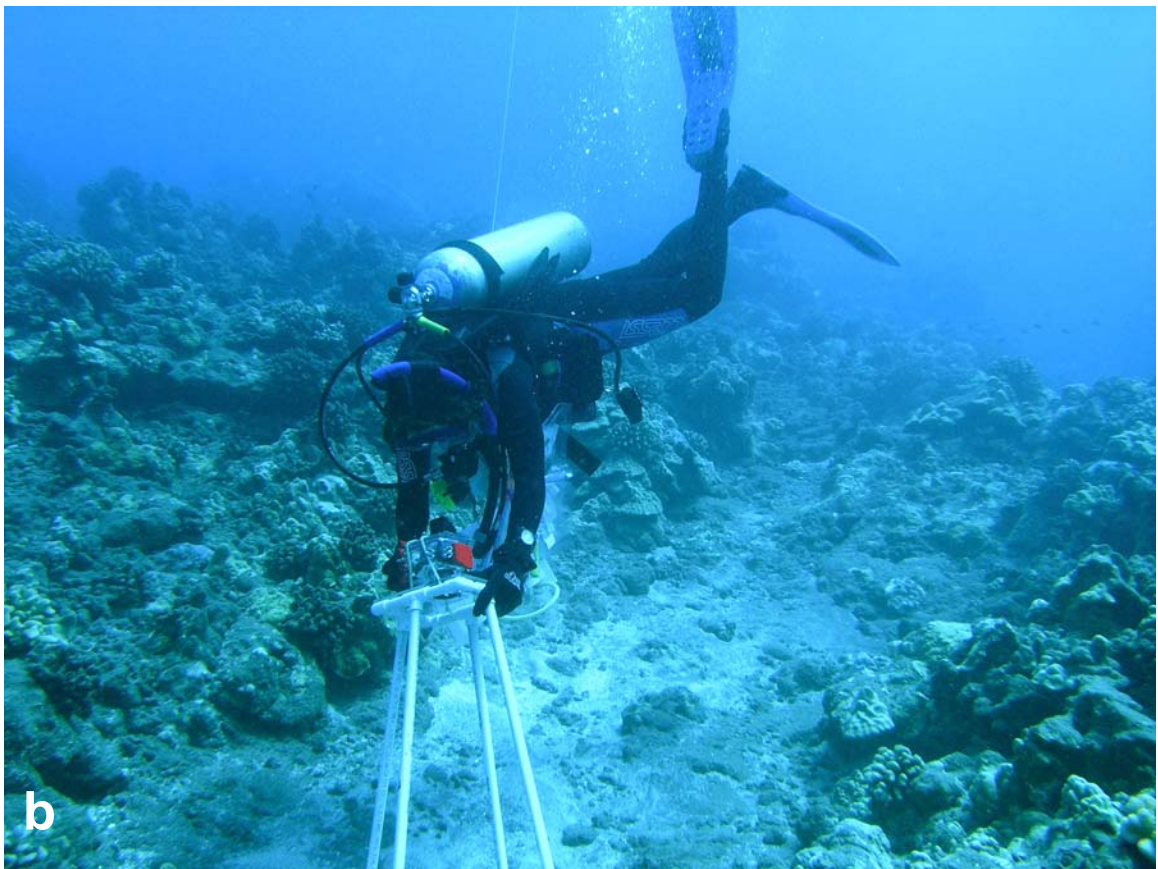
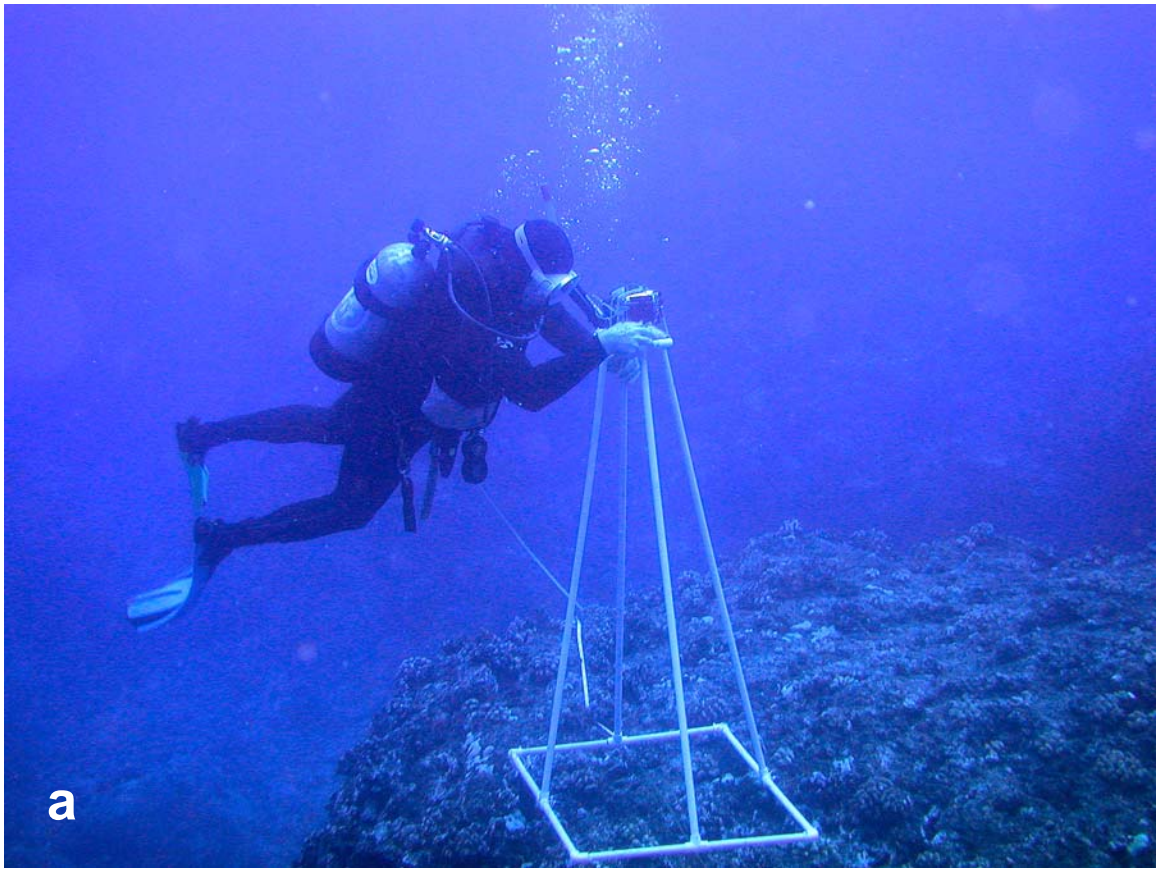


Figure 1. Coral specialist (a) and algal specialist (b) photographing bottom cover along transects.

CPCe point count analysis was also used to estimate percent coverage of algae within the 0.16 m² algae photo quadrats. Fifty-five points were randomly projected on each photo, and the species or higher taxonomic category of the alga underlying each point was recorded where an alga was present, otherwise the substratum composition was noted for the point. The results were averaged for the total number of quadrats on the transect and summarized on the Excel output.

The reef fish species observed on the reconnaissance surveys were recorded, and the sizes of fishes occurring on the fish transects were estimated according to lengths corresponding to 5 cm size classes up to 85 cm. The fish transect data were kindly analyzed and summarized by Ivor Williams of the DAR. Following collection, invertebrate specimens were relaxed in a saturated seawater solution of magnesium chloride followed by 10% formalin in seawater and preserved in 70% ethanol before identification in the laboratory. Algae samples were frozen before drying and pressing for fleshy species. Calcareous algae were dried and sent to Dr. Rafael Riosmena-Rodriguez of Programa de Investigacion en Botánica Marina in La Paz, Baha, Mexico for identification. Hydroids were sent to Dr. Dale Calder at the Royal Ontario Museum and sponges to Dr. Barbara Calcini at the Dipartimento di Scienze del Mare, Università Politecnica delle Marche. Invertebrate and algae specimens will be deposited in the Bishop Museum collections.

IV. RESULTS

Station Locations and Characteristics

The locations of the starts and ends of the reconnaissance surveys and transects at each site are shown in Figures 2 to 5, site descriptions are in Table 1 and a summary of site characteristics are in Table 2. The sites included a variety of environmental characteristics and levels of management protection. The Lāna'i sites at Pu'u Pehe and Po'o Po'o are in the lee of their respective islets and are in the relatively clam conditions that are normal for south Lāna'i. Pu'u Pehe is within a limited access Marine Life Conservation District (MLCD) and is closed to fishing other than by hook and line from the shore, while Po'o Po'o lies near this MLCD. However, both sites are only a short distance from Mānele Harbor and the Four Seasons Resort hotel. By contrast, the north Maui sites of Kaemi and Hulu are remote from population areas and are probably seldom visited or fished due to difficulty of access because of their exposure to strong winds and high wave turbulence under even normal weather conditions. The third Maui site on the outside of Molokini Crater lies within an MLCD, is closed to fishing and is moderately exposed to wind and waves. Although the inside of Molokini Crater is probably one of the most frequently visited and dived locations in Hawaii, the outer rim is relatively isolated and, requiring a special permit to dive, is relatively undisturbed by humans.

The Moloka'i sites at Mōkapu, 'Ōkala and Nāmoku Islets are within or just outside of the Kaulapapa National Historic Park (KNHP) and, similar to the North Maui sites, directly exposed to heavy trade winds and North Pacific Swells in the winter, which tend to reduce the frequency of access by non-KNHP personnel. However, these sites are open to fishing by all methods. The survey sites at these two islets are on their lee sides, but they are still subject to substantial wave turbulence, as is the Nāmoku site just outside of Kaulapapa Harbor. The Kāohikaipu and Kāpapa sites are both on the windward side of O'ahu and therefore exposed to considerable wave and wind disturbance, but they contrast in a number of

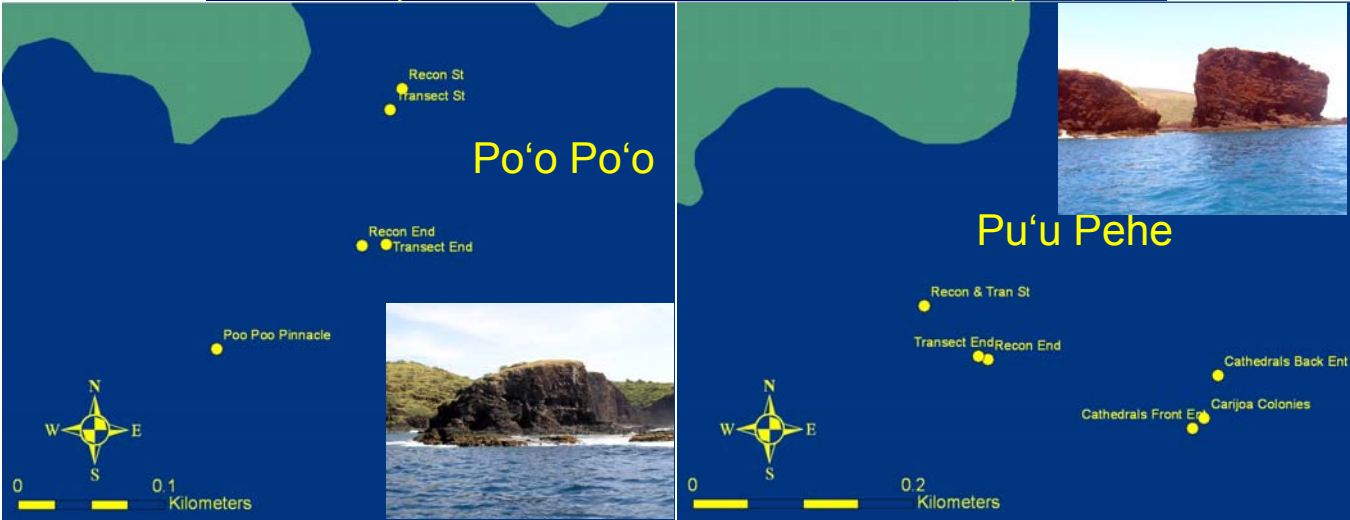
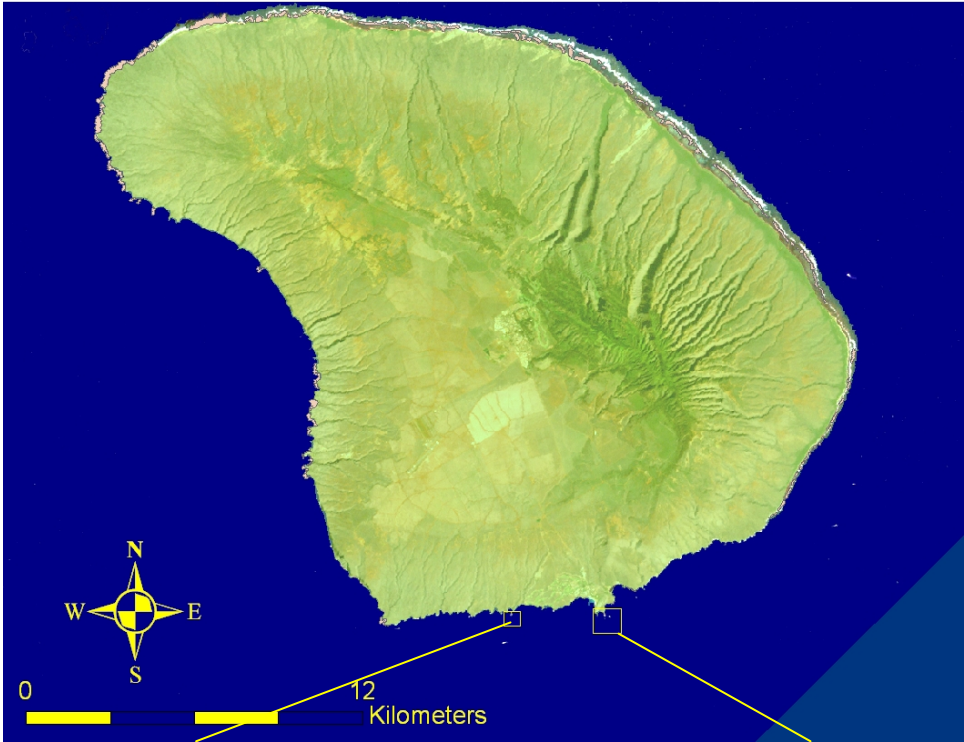


Figure 2. Lāna'i sampling sites at Pu'u Pehe and Po'opo'o.

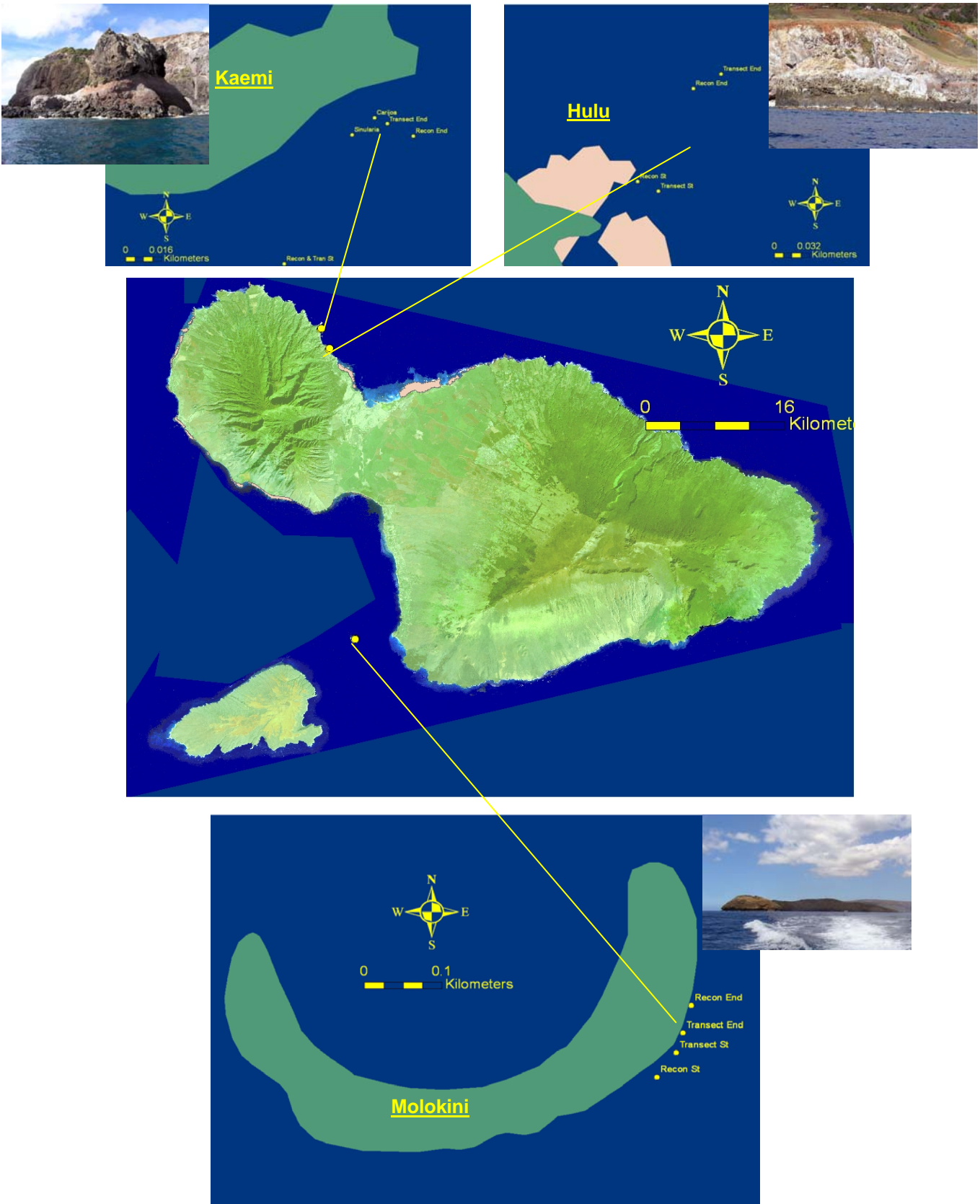


Figure 3. Maui sampling sites at Kaemi, Hulu and Molokini Rim.

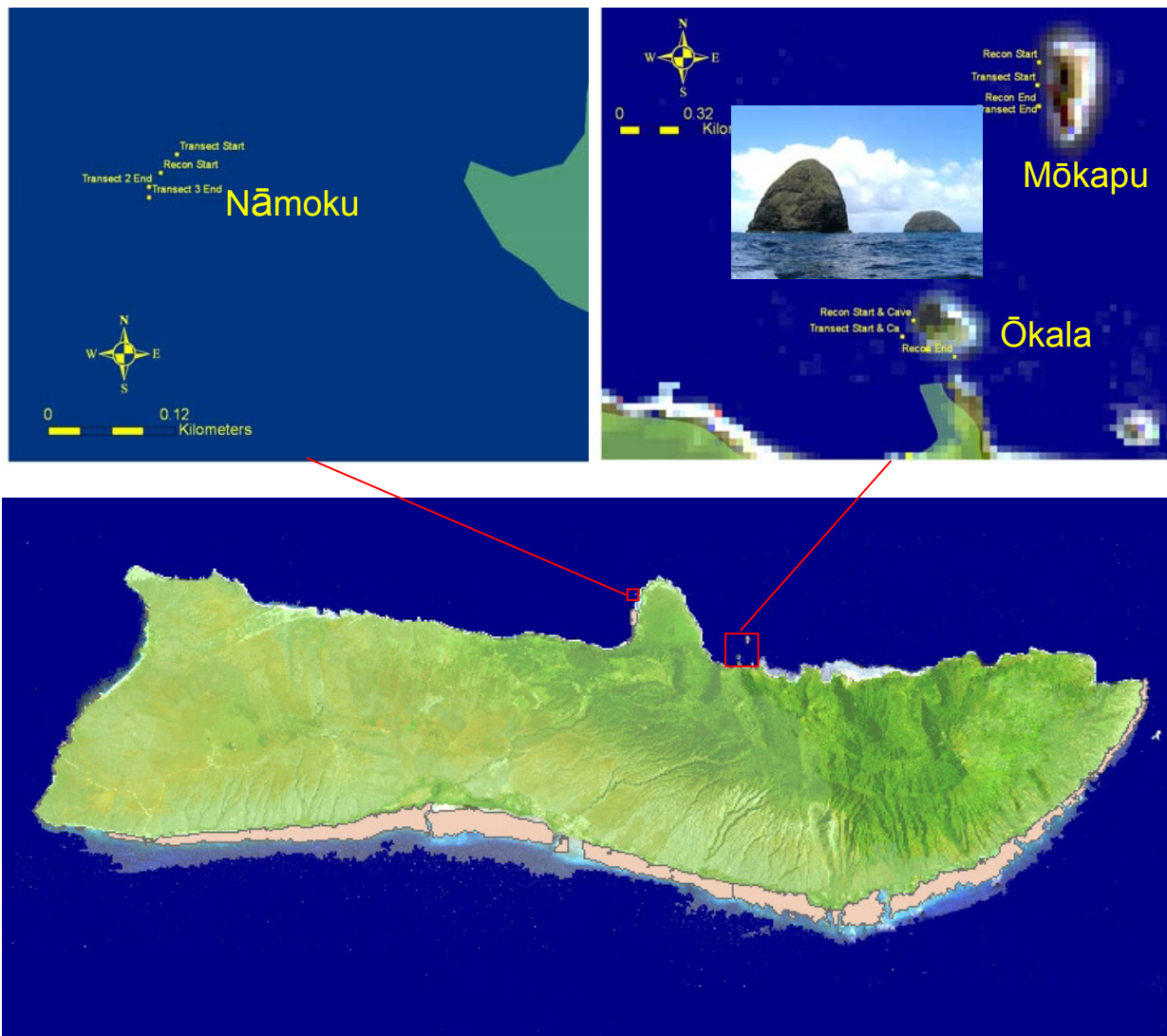


Figure 4. Moloka'i sampling sites at Nāmoku, Mōkapu and 'Ōkala Islets.

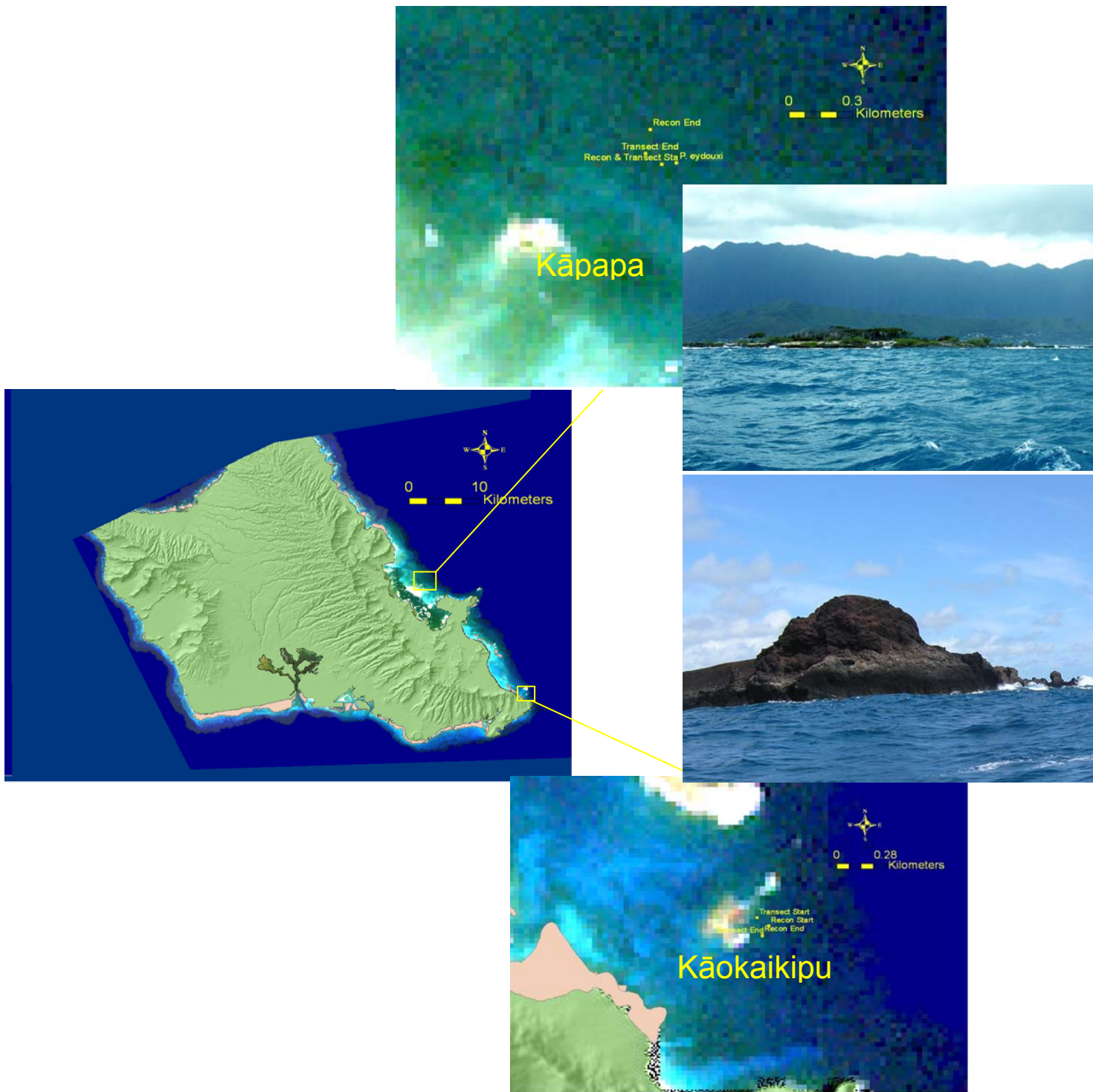


Figure 5. O'ahu sampling sites at Kāōkaikīpu and Kāpapa Islets.

Table 1. Station Location and Descriptions.

Lana'i

Station PUUPEH. Pu'u Pehe Reconnaissance and Transects. 02-Apr-07. (Latitude 20°44'01.7", Longitude 156°53'26.5"). Depth 8-11 m. Visibility excellent, ca 20-30m. Reef of medium relief along lee side of Pu'u Pehe Islet with abundant coral cover of ca. 30-50% on consolidated limestone and intermittent sand and rubble. Reef is bordered to the east by a wall extending from the islet that rises abruptly from 8 m depth and has many ledges and some caves with abundant sponges and occasional hydroids.

Station CATHED. Cathedrals, Near Pu'u Pehe. 04-Apr-07. (Latitude 20°43'57.9", Longitude 156°53'18.1). Depth 17-18m. Visibility excellent, ca 20-30 m. In and around a large cave formed by a lava tube open at both ends, with "rose window" at one end providing light from above. Abundant cup corals (*Tubastrea coccinea*) and diverse sponges on cavern roof. Two areas of introduced *Carijoa riisei* growing on side of reef along channel northeast of main cavern entrance.

Station POOPOO. Po'o Po'o Reconnaissance and Transects. 03-Apr-07 (Latitude 20°44'06.9", Longitude 156°55'20.3"). Depth 8-13 m. Visibility good (ca. 15-20 m). Reef with low coral cover and abundant algae along west side of wall extending south of Po'o Po'o Islet. Limestone substratum is coated with sand and silt and has abundant boulders and cobbles with ca. 5% coral cover, virtually all small colonies of *Porites lobata* and *Pocillopora meandrina*. The sponge *Spirastella vagabunda* is common in sandy areas. The vertical wall to the east supports moderate (10-20%) coral cover, increasing to ca 30% going seaward, and some sponges. Sand coverage increase on flat going seaward.

Station POOPIN. Po'o Po'o Pinnacle. 03-Apr-07. (Latitude 20°44'01.7", Longitude 156°55'24.5"). Depth 4-18 m. Steep pinnacle rising out of 20 m depth with high coral cover of ca. 60% and areas of abundant black hydroid *Lytocarpia niger*, two areas of abundant *Carijoa riisei*, and many Crown of Thorns starfish *Acanthaster planci*.

Maui

Station KAEMI. Kaemi Reconnaissance and Transects. 29-May-07. (Latitude 20°58'49.1", Longitude 156°31'32.4"). Depth 6-12 m. Visibility excellent, ca 20-30. Low relief reef on northeast side of Kaemi Islet. Bottom strewn with abundant boulders among intermittent sand patches, area obviously heavily impacted by North Pacific swells. Coral cover low at ca. 5%, abundant algae especially *Dictyopteris australis* and *Sargassum* sp., and encrusting calcareous forms. Wall of islet to west rises steeply to the surface and supports abundant *Sinularia* sp., *Carijoa riisei* and *Pennaria disticha*. The lacy bryozoan *Reteporellina denticulata* becomes abundant on flat bottom area near the outer end of the reconnaissance survey at ca. 12 m.

Station HULU. Hulu Reconnaissance and Transects 30 May-07. (Latitude 20°57'26.6", Longitude 156°31'00.9"). Depth 6-15 m. Visibility excellent, ca 20-30 m. High relief bottom with abundant basalt boulders and modest 5-10% coral cover heavily impacted by North Pacific swells. Rock sizes range from large boulders to cobbles with little sand present on the bottom. *Pocillopora meandrina* abundant in small size classes up to 5-10 cm diameter, algae common, especially *Sargassum* and *Dictyopteris*.

Station MOLOKI. Outer Molokini Rim Reconnaissance and Transects. 31 May-07. (Latitude 20°37'153.0", Longitude 156°29'36.0"). Depth 4-28 m. Visibility excellent, ca 30 m. Southeast side of outer Molokini Rim. Sheer basalt wall with narrow shelf at ca 15 m, then dropping to >60 m. Coral abundant (>50%) especially colonies of *Pocillopora meandrina* on cliff face and on cobble size rocks on shelf. Highly diverse invertebrate fauna, including rare *Vittaticella uberrima* (= *Savignyella lofonti*), macroalgae sparse.

Moloka'i

Station MOKAPU. Mōkapu Reconnaissance and Transects 18-Sep-07. (Latitude 21°11'00.8", Longitude 156°55'28.9"). Depth 13-22 m. Steep cliff on western/leeward side of Mōkapu Islet. Basalt substratum with moderate coral cover of ca. 15% dominated by *Pocillopora molokensis* and moderate coverage (ca. 5-10%) of red sponge *Clathria* sp.

Station OKALA. 'Ōkala Reconnaissance and Transects 19-Sep-07. (Latitude 21°10'28.1", Longitude 156°55'48.3"). Depth 14-19 m. Steep cliff on western side of 'Ōkala Islet similar in wave and wind exposure to Mōkapu site, but very different in benthic biotic composition. At the western end of islet the dominant feature is a large cave extending through the islet that has abundant red cup coral *Rhizopsammia verrilli* and abundant introduced and invasive snowflake coral *Carijoa* aff. *riisei*. The basalt substratum east of the cave is dominated by a high coverage (up to 75%/quadrat) of the soft coral *Sinularia densa* and lesser amounts of the zoanthid *Palythoa caesia*. Because of the high cover of these two species hard corals are in low abundance and are mostly *Pocillopora molokensis*.

Station NAMOKU. Nāmoku Reconnaissance and Transects 20-Sep-07. (Latitude 21°12'26.2", Longitude 156°59'02.2"). Depth 11-22 m. Western side of mostly submerged Nāmoku Islet, near Kaulapapa Harbor. Most of the area around the islet is a flat basalt bench with thin limestone veneer and many cracks supporting moderate hard coral cover of ca. 15%. Outside of this zone are numerous channels down to 22 m, with large basalt boulders supporting a sparse cover of corals, mostly *Pocillopora molokensis* and *P. meandrina*.

O'ahu

Station KAOHI. Kāohikaipu Reconnaissance and Transects 7-Aug-07. (Latitude 21°19'10.1", Longitude 157°39'14.8"). Depth 8-12 m, visibility good, but high ground surge and moderate wave action. On leeward side of Kāohikaipu Islet along basalt bench bordered by ledges and boulder and cobble-strewn depressions. Coral cover diverse and coverage moderate, ca. 20 species and 15% cover. Abundant and diverse fish.

Station KAPAPA. Kāpapa Reconnaissance and Transects 30-Aug-07. (Latitude 21°28'48.6", Longitude 157°47'32.9"). Depth 8-9 m Reef zone outside of Kāpapa Island with very gradual slope and generally low relief except for linear ridges formed primarily by dead and live *Pavona duerdeni*. Coral cover abundant dominated by encrusting *Montipora flabellata*, *M. patula* and *M. capitata*, and encrusting and lobate *Porites lobata* and *P. evermanni*, with occasional *Pocillopora meandrina*. A single very large *Pocillopora eydouxi* of ca 2 m long diameter was observed (Frontispiece). Total coral cover was estimated at >50%. The coral cover is surprisingly high given that the site is highly wave disturbed and water conditions are usually quite turbid, with lateral visibility at the time of the survey < 10 m.

Table 2. Summary of site characteristics.

Islet	Remoteness	Orientation	Wave Exposure	Protection Level	Relief	Dominant Substratum
Pu'u Pehe	Low	Leeward	Low	High	Medium	Limestone, moderate coral
Po'o Po'o	Low	Leeward	Low	Medium	Medium	Limestone, fine sediment
Kaemi	High	Windward	High	Low	Low	Basalt boulders, sand
Hulu	High	Windward	High	Low	High	Basalt boulders
Molokini Rim	Medium	Leeward	Medium	High	High	Basalt wall, abundant coral
Mōkapu	High	Leeward	Medium	Medium	High	Basalt wall, moderate coral
'Ōkala	High	Leeward	Medium	Medium	High	Basalt wall, soft coral & zoanthid
Nāmoku	Medium	Windward	Medium	Medium	Medium	Flat bench with cracks & grooves
Kāohikaipu	Medium	Leeward	Medium	Low	Medium	Bench with ledges & cobbles
Kāpapa	Low	Windward	High	Low	Low	Flat limestone, abundant coral

ways. The Kāohikaipu site is in the lee in the islet, has high relief and substantial rugosity, with numerous ledges cracks and shallow caves and probably subject to only moderate fishing pressure due to its distance from boat launching areas. The Kāpapa site is on the outer windward side of the islet outside of Kāne'ōhe Bay and has very low relief with a high cover of encrusting and lobate corals clearly adapted to substantial turbulence. Because of its close proximity outside of highly utilized Kāne'ōhe Bay, the Kāpapa site is probably subject to the most fishing pressure and other anthropogenic influences.

Reconnaissance Surveys

Macroalgae, invertebrate, and fish species or higher taxa identified in the field or in the laboratory from collected specimens are listed in Appendix B, and total numbers at each site are shown in Table 3 and Figure 6. A total of 1486 taxa were identified for all 10 sites, with a maximum of 181 determined at Po'o Po'o at Lāna'i and a minimum of 126 at Kāpapa. By reference to major taxonomic groups, the most algal taxa occurred at Kāpapa and Hulu and the fewest at 'Ōkala, the most invertebrates at Po'o Po'o and the fewest at Hulu, and the most fish at Nāmoku and the fewest at Kaemi followed by Kāpapa. The high numbers of taxa at Po'o Po'o are somewhat surprising, since most of the area surveyed was a low relief limestone reef with a largely covered with fine sediment, but the results do include the observations made at the nearby pinnacle area that had a more diverse invertebrate and fish fauna. The low total numbers for Kāpapa probably reflect the low relief of the flat bottom of the area that, although having a high coral cover and abundant algae, provided little habitat for other invertebrates and fish.

Table 3. Numbers of taxa observed or collected at reconnaissance survey sites.

	Lana'i		Maui			Moloka'i			O'ahu		Mean
	Po'o Po'o	Pu'u Pehe	Hulu	Kaemi	Molokini	Mōkapu	Nāmoku	'Ōkala	Kāohikaipu	Kāpapa	
Algae	30	16	40	30	15	24	29	8	18	40	25
Invertebrates	89	77	41	64	69	65	58	62	65	43	63.3
Fish	62	59	58	42	67	61	82	57	64	42	59.4
Total	181	152	139	136	151	150	169	127	147	125	147.7
Grand Total	1486										

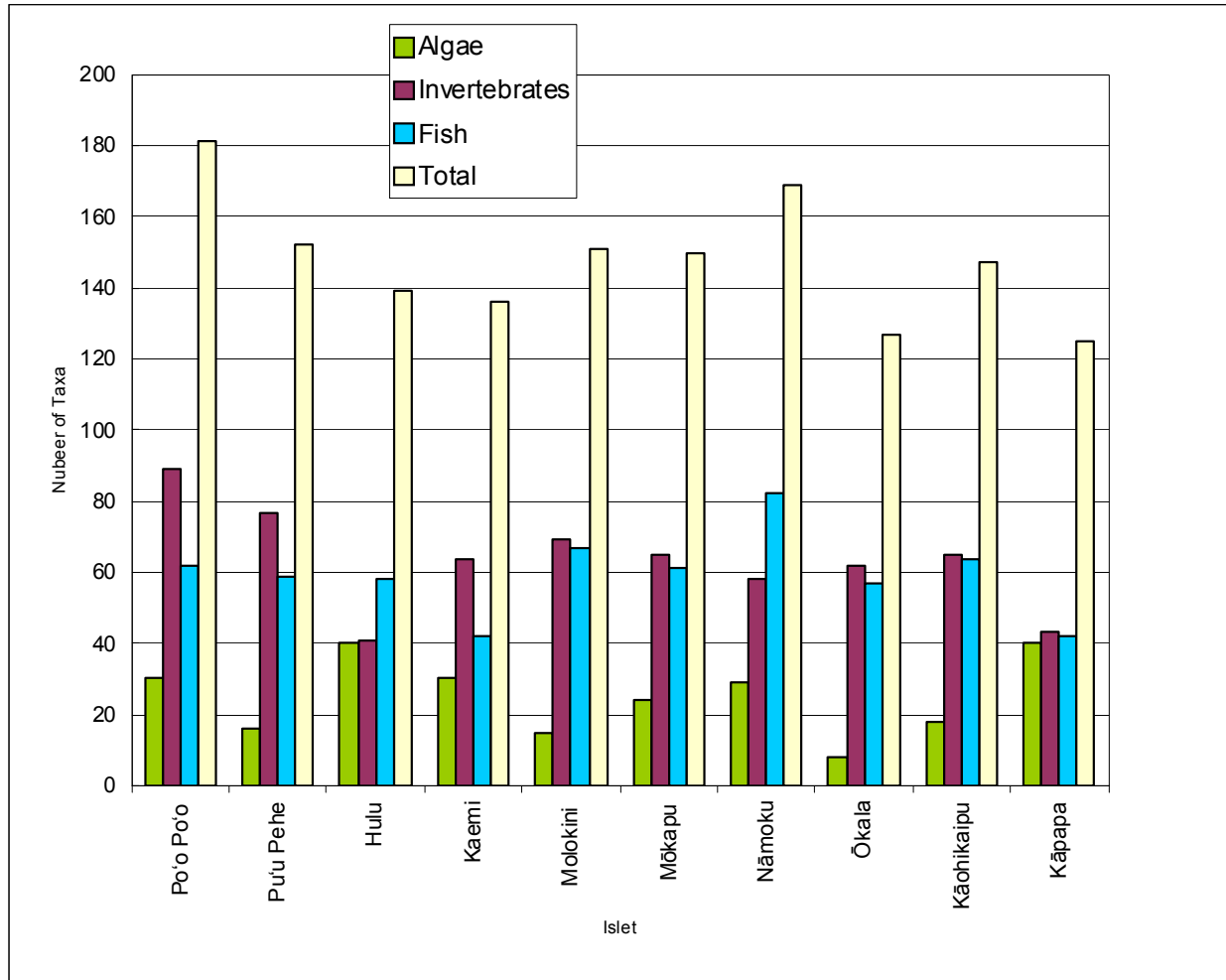


Figure 6. Numbers of taxa at reconnaissance survey sites.

A dendrograph of Sorensen coefficients for presence:absence of all taxa identified for the sites is shown in Figure 7. Three distinct clusters are indicated, with the third cluster subdivided into two sub-clusters. Cluster A consists of the two sites off south Lāna'i that had the highest total numbers of taxa and invertebrates and relatively high values for fish taxa. Cluster B has three sites, including the two off north Maui and outside Kāpapa Islet. These wave-disturbed sites had medium to high values for algae and low values for total taxa. The third cluster, composed of two sub-clusters is less definitive for common

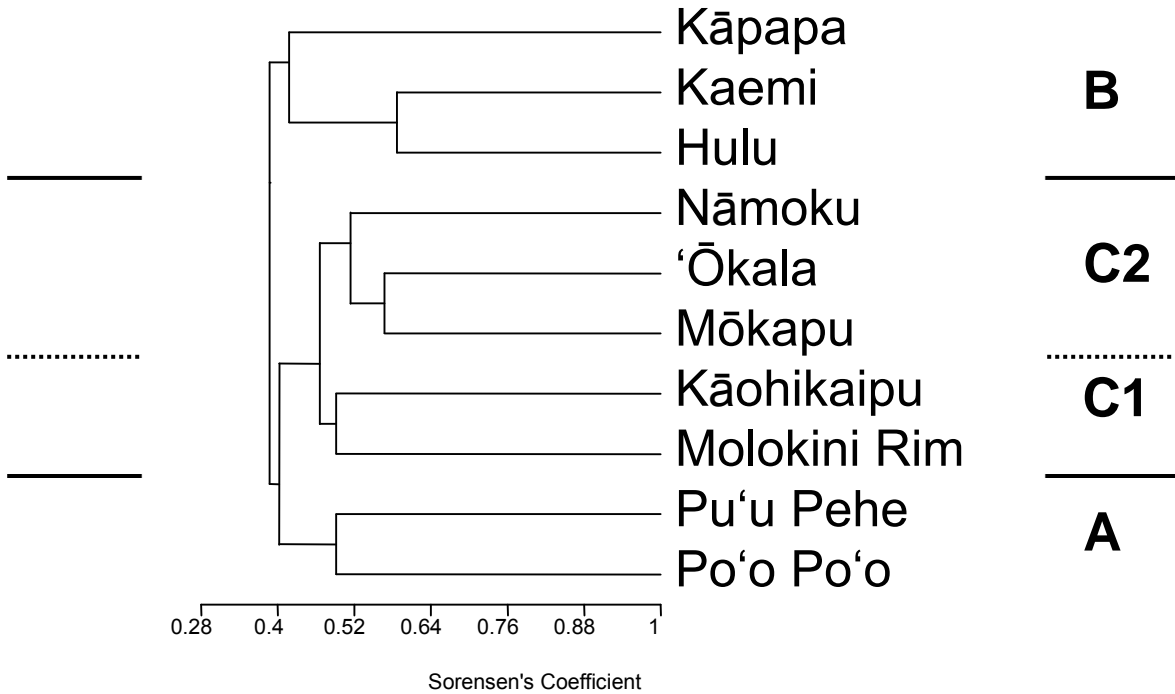


Figure 7. Dendrograph of Sorensen presence:absence similarity coefficients for all taxa on reconnaissance surveys.

characteristics by major taxonomic groups. Cluster C1 has two sites, Kāohikaipu and Molokini Rim that were high to medium relief areas with high numbers of total and fish taxa and among the lowest for algal taxa. Cluster C2 consists of the of the three sites off Kaulapapa NHP, which had low numbers of algal taxa and high numbers of fish taxa, including the highest overall number for any site, which occurred at Nāmoku, just outside of Kaulapapa Harbor.

Quantitative Transects

The results for various parameters for the two transects surveyed for coral and algae and the three transects for fish are shown in Table 4. A wide range of values for each parameter was found throughout the ten study sites. Maximum mean coral cover (32%) and number of colonies m^{-2} (41) occurred at Molokini, followed by second highest cover at Kāpapa (31%). However, because of substantial larger sizes of the colonies at Kāpapa, colony density was only fourth highest ($17.6 m^{-2}$) at that site. The lowest coral cover (1.8%) and colony density ($5.7 m^{-2}$) occurred at Kaemi, reflecting the highly turbulent and algal dominated substratum at that site.

Coral, Algae and Substrata

Mean percent cover for reef coral, various categories of algae, hard substratum and sand/silt are shown in Table 5 and Figure 8. Algae taxa large enough and sufficiently abundant to be identified in the photo quadrats are also listed in Table 5.

Table 4. Summary of results for algae, coral, and fish transects.

SITE		TRANSECT		CORAL		ALGAE				FISH TRANSECTS			
Island	Islet Area	Number	Rugosity	% Cover	Colonies/m ²	% Macro	% Coralline	% Turf	% Cyanobacteria	No. Species	No. Individ.	Mean Biomass	Recon Fish Species
Lāna'i	Pu'u Pehe	1	1.31	19.3	20.8	0.8	1.3	22.6	0.3	6	22		
		2	1.31	29.1	32.4	0.1	0.9	8.6	0.2	13	17		
		Mean	1.31	24.2	26.6	0.4	1.1	15.6	0.3	9.5	20	17.4	61
Lāna'i	Po'o Po'o	1	1.01	1.6	10.0	1.1	1.0	9.6	0.0	7	248		
		2	1.01	3.5	13.8	1.9	0.5	36.6	0.0	6	16		
		Mean	1.01	2.6	11.9	1.5	0.7	23.1	0.0	6.5	132	8.5	60
Maui	Kaemi	1	1.26	1.2	3.4	21.2	2.4	63.0	3.0	8	24		
		2	1.26	2.3	8.0	14.6	25.1	49.8	4.6	9	22		
		Mean	1.26	1.8	5.7	17.9	13.8	56.4	3.8	8.5	23	50.9	42
Maui	Hulu	1	1.45	3.5	11.5	1.4	12.4	72.2	1.9	9	11		
		2	1.45	6.5	13.6	2.7	11.6	66.2	1.6	18	33		
		Mean	1.45	5.0	12.6	2.1	12.0	69.2	1.7	13.5	22	13.7	58
Maui	Molokini	1	1.43	34.0	37.9	1.1	26.5	20.8	6.4	13	49		
		2	1.43	30.8	44.1	1.15	21.50	27.5	16.9	8	14		
		Mean	1.43	32.4	41.0	1.1	24.0	24.2	11.6	10.5	32	43.2	67
Moloka'i	Mōkapu	1	1.64	7.6	12.5	0.9	20.0	52.9	7.0	10	21		
		2	1.64	8.1	6.7	1.1	23.3	47.6	5.6	17	51		
		Mean	1.64	7.9	9.6	1.0	21.6	50.2	6.3	13.5	36	57.4	61
Moloka'i	'Ōkala	1	1.05	5.5	5.1	0.5	8.2	43.8	5.6	12	39		
		2	1.14	11.2	13.8	0.7	3.0	66.8	2.6	13	60		
		Mean	1.10	8.4	9.5	0.6	5.6	55.3	4.1	12.5	50	44.6	59
Moloka'i	Nāmoku	1	1.14	12.0	3.9	2.3	5.3	80.0	6.3	12	191		
		2	1.10	6.9	7.7	6.3	7.6	63.7	9.4	9	22		
		Mean	1.12	9.5	5.8	4.3	6.4	71.8	7.8	10.5	107	55.4	83
O'ahu	Kāohikaipu	1	1.23	8.1	24.5	2.5	11.7	66.4	6.0	14	90		
		2	1.35	6.7	17.3	3.4	12.3	63.1	8.4	20	100		
		Mean	1.29	7.4	20.9		12.0	64.8	7.2	17.0	95	62.9	63
O'ahu	Kāpapa	1	1.16	24.4	15.5	1.9	18.8	37.5	1.1	12	99		
		2	1.16	37.6	19.7	4.2	5.2	35.4	0.6	5	30		
		Mean	1.16	31.0	17.6	3.0	12.0	36.5	0.8	8.5	65	107.4	43

Table 5. Percent coverage of reef coral, algae and principal substrata at islet sites.

(% Cover)	Po'o Po'o		Pu'u Pehe		Hulu		Kaemi		Molokini		Mōkapu		Nāmoku		'Ōkala		Kāohikaipu		Kāpapa	
	Tr. 1	Tr. 2	Tr. 1	Tr. 2	Tr. 1	Tr. 2	Tr. 1	Tr. 2	Tr. 1	Tr. 2	Tr. 1	Tr. 2	Tr. 1	Tr. 2	Tr. 1	Tr. 2	Tr. 1	Tr. 2	Tr. 1	Tr. 2
CORAL	1.6	3.5	19.3	20.8	3.8	6.5	1.2	2.3	34.0	30.8	7.6	8.1	12.0	6.9	5.5	11.2	8.1	6.7	24.4	37.6
MACROALGAE	1.1	1.9	0.8	0.1	1.4	2.7	21.2	14.6	1.1	1.1	0.9	1.1	2.3	6.3	0.5	0.7	2.5	3.4	1.9	4.2
CORALLINE ALGAE	1.0	0.5	1.3	0.9	12.4	11.6	2.4	25.1	26.5	21.5	20.0	23.3	5.3	7.6	8.2	3.0	11.7	12.3	18.8	5.2
TURF ALGAE	9.6	36.6	22.6	8.6	72.2	66.2	63.0	49.8	20.8	27.6	52.9	47.6	80.0	63.7	43.8	66.8	66.4	63.1	37.5	35.4
CYANOBACTERIA	0.0	0.0	0.3	0.2	1.9	1.6	3.0	4.6	6.4	16.9	7.0	5.6	6.3	9.4	5.6	2.6	6.0	8.4	1.1	0.6
HARD SUBSTRATUM	0.1	0.4	11.7	28.0	0.9	0.3	2.3	0.5	2.0	1.5	1.8	0.5	0.1	0.1	0.3	1.8	0.2	0.5		
SAND/SILT	85.1	56.8	24.2	24.7	6.1	10.1	5.6	2.8	4.4	2.4	1.6	0.0	0.0	0.1	0.5	3.1	3.8	2.1	14.0	10.3
UNKNOWN	0.3	0.2	1.5	1.8	1.2	0.8	0.0	0.0	0.0	0.0	0.8	0.4	0.0	0.2	0.7	0.2	0.0	0.1	0.2	0.1
MACROALGAE TAXA																				
Family Corallinaceae					0.3	0.2	0.4	0.2					0.1							
Crustose Coralline	0.1	0.1	1.2	0.9							19.7	22.9	5.2	7.6	8.1	3.0	11.5	12.0	17.3	4.9
Family Galaxauraceae	0.2	0.2			0.2	0.2													0.1	0.2
Family Liagoraceae	0.1		0.1		0.3														0.1	0.1
<i>Acanthophora pacifica</i>		0.7									0.7	1.0	0.1	0.2	0.3	0.7				
<i>Amansia glomerata</i>																			0.5	1.6
<i>Asparagopsis taxiformis</i>	0.7		0.5																	
<i>Caulerpa</i> sp.																			0.2	
<i>Codium edule</i>																				0.1
<i>Dictyopteris australis</i>					0.1	0.1	19.0	11.4												
<i>Dictyota</i> spp.					0.3	1.0	0.1	0.1	1.0	0.9	0.3	0.1	2.1	6.0	0.1	0.1	2.5	3.4	0.4	0.2
<i>Gibsmithia hawaiiensis</i>																				0.1
<i>Halimeda</i> sp.	0.1	0.9	0.2	0.1																
<i>Jania</i> sp.	0.8	0.5	0.1		0.1	0.3	0.2	0.1	0.1		0.2	0.4			0.1		0.1	0.3	1.4	0.4
<i>Lobophora variegata</i>								0.1	0.1	0.2									0.2	
<i>Laurencia</i> sp.																				1.4
<i>Neomeris annulata</i>		0.1			0.1	0.1														
<i>Padina</i> spp.							1.8	1.2					0.1	0.1						
<i>Portieria hornemannii</i>																				0.3
<i>Sargassum</i> spp.					0.3		0.1													
<i>Styopodium flabelliforme</i>					0.4	1.0	0.3	1.6												
<i>Turbinaria ornata</i>								0.2												

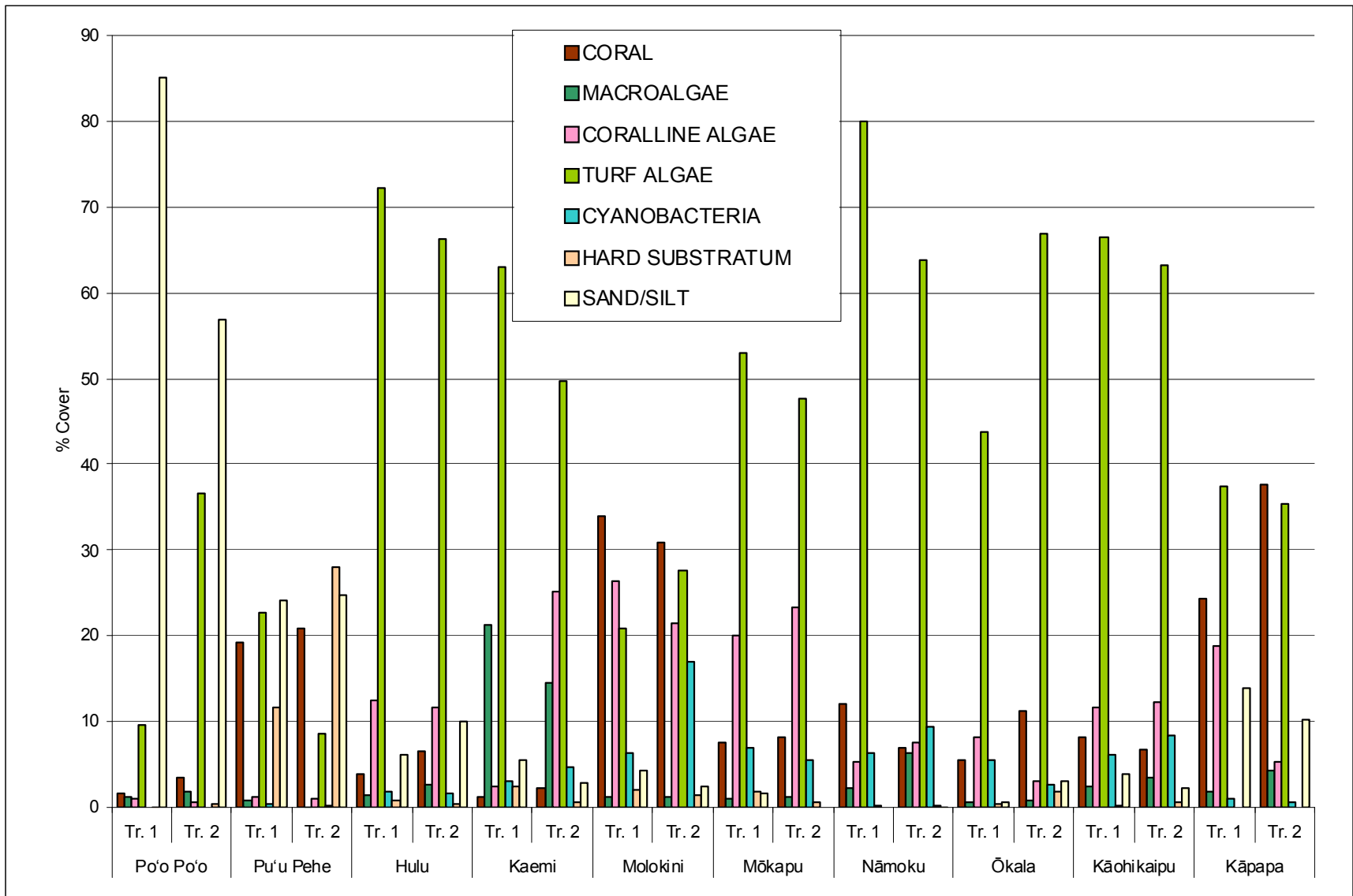


Figure 8. Percent coverage of reef coral, algae and principal substrata at islet sites.

Algal Abundance and Substrata Types

Table 5 and Figure 8 summarize the algal percent coverage and dominant substrata on each transect at each site determined from the 0.165 m² point intercept photo quadrats, along with coral percent coverage determined from the 0.66 m² coral photo quadrats. Coral coverage is discussed below along with colony size class analyses. Non-live substrata at most sites was most reef limestone or basalt boulders, except at Po'ō Po'ō where sand/silt averaged 71% of the bottom for the two transects, Pu'u Pehe where sand/silt averaged 24.4% and Kāpapa where the mean was 12.2%. Calcareous algae was a major benthic component at Molokini, Mōkapu and Kāohikaipu where cover averaged 25.8%, 12.0%, and 12.0% respectively, and high calcareous algal cover was also found on single transects at Kaemi (25.1%) and Kāpapa (18.8%). Macroalgal cover was low at all sites except Kaemi, where the average was 17.9% for the two transects. All but one of the transects at the other sites had less than 5% macroalgal cover and 12 of them had less than 2%. Cyanobacteria (blue-green algae) was also in low abundance at most sites with averages exceeding 5% at only four sites, Molokini (11.6%), Mōkapu (6.3%), Nāmoku (7.8%), and Kāohikaipu (7.2%). By far the most abundant algal component at all sites was minute unidentified turf algae, which averaged from 50.2% to 71.8% cover at six of the ten sites, i.e. Hulu, Kaemi, Mōkapu, Nāmoku, 'Ōkala and Kāohikaipu.

The algae that could be identified to genus or species and quantified from the photoquadrats are listed in Table 5, along with coverage of higher taxonomic categories. Most of the identifiable genera or species averaged less than 1% for the two transects at each site. The exceptions were *Dictyopteris australis*, which averaged 15.2% and was a dominant component of the benthos at Kaemi, *Dictyota* spp. that averaged 4.0% at Nāmoku and 3.0% at Kāohikaipu, and *Padina* spp. that averaged 1.6% at Kaemi. Crustose corallines are indicated to comprise nearly all of the total calcareous algae found at all sites.

Coral Abundance and Size Class Analysis

Size class distributions, a representative quadrat image and values for major parameters are shown for the two coral-algal transects at each site in Figures 9-18. Highly contrasting patterns were found for coral cover, species compositions and size distributions among the ten sites, and often for sites that were located near each other. For example, Pu'u Pehe and Po'ō Po'ō, both in the lee of islets on the south shore of Lāna'i, had very different coral coverages, composition and size distributions. Pu'u Pehe (Figure 9) was more typical of a thriving coral population, with nine hard and one soft coral species, total cover averaging 19-29% and diameters running up to 40 cm. Po'ō Po'ō (Figure 10), less than 5 km away and in a very similar physical environment in the lee of the islet, had a substratum largely covered by fine sediment, biota numerous sponges, only five species of coral with mean total cover of only 1.5-3.5%, and size class distributions largely in the 1-5 cm diameter range.

The Kaemi (Figure 11) and Hulu sites (Figure 12) on North Maui both had low coral cover of 1-2% and 3-6% respectively with size class distributions concentrated in the 1-5 cm diameter range, but they otherwise contrasted in their coral species compositions, with only five hard and one soft coral occurring at Kaemi, compared to seven hard and one soft at Hulu. However, the principal contrast between benthic organisms at the two sites was the 21-25% dominance of the substratum by macroalgae, mostly *Dictyopteris australis*, at Kaemi, compared to only 1-4% macroalgal cover at Hulu (Table 4). Again, these sites are in all respects similar in environmental characteristics and exposure to normally turbulent

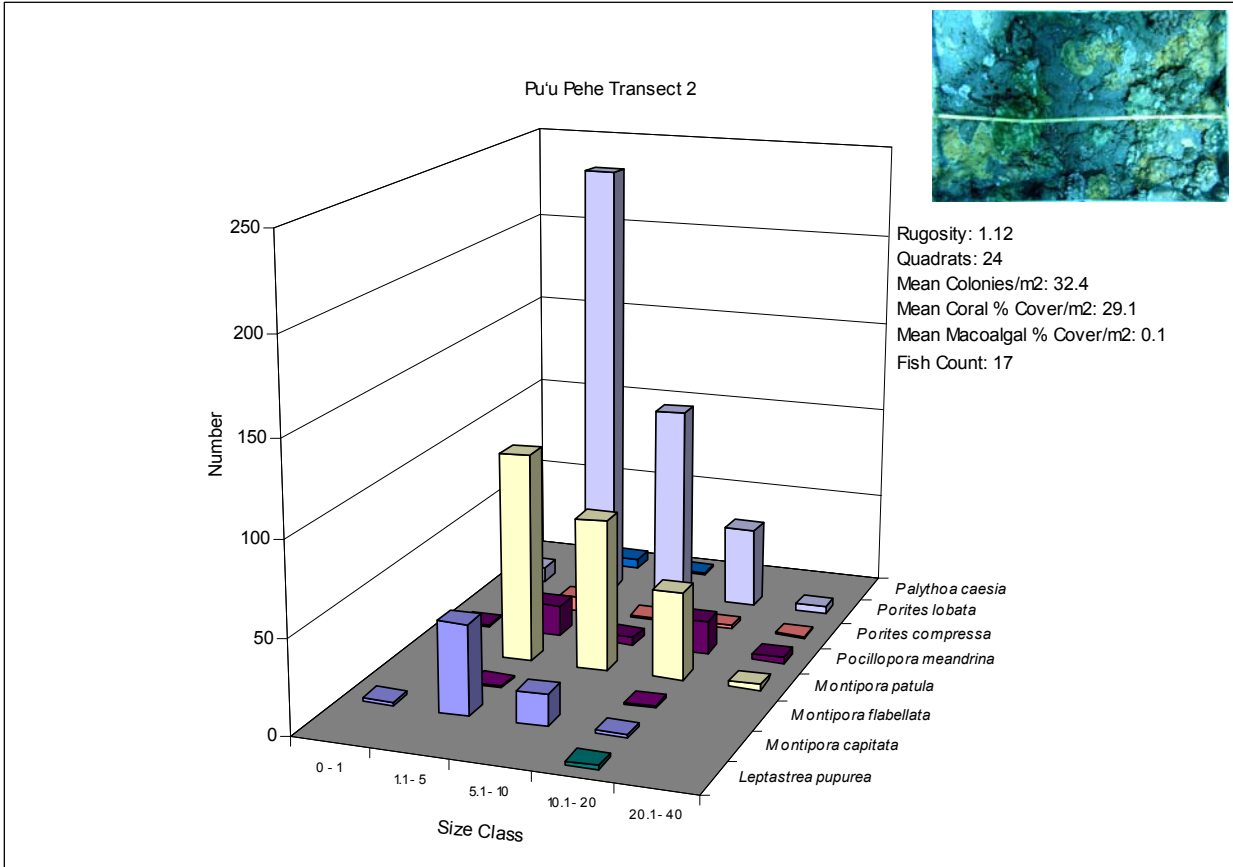
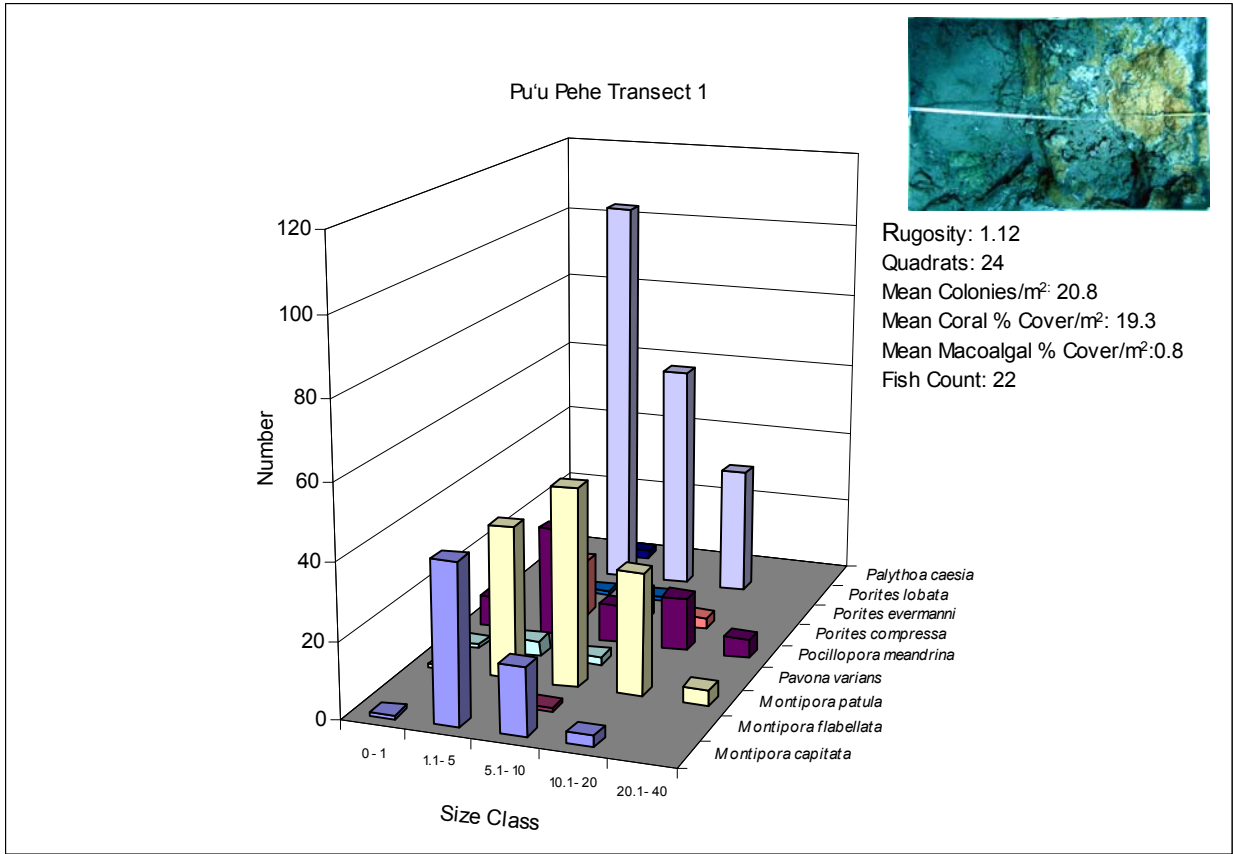


Figure 9. Size class analysis for corals on Pu'u Pehe transects.

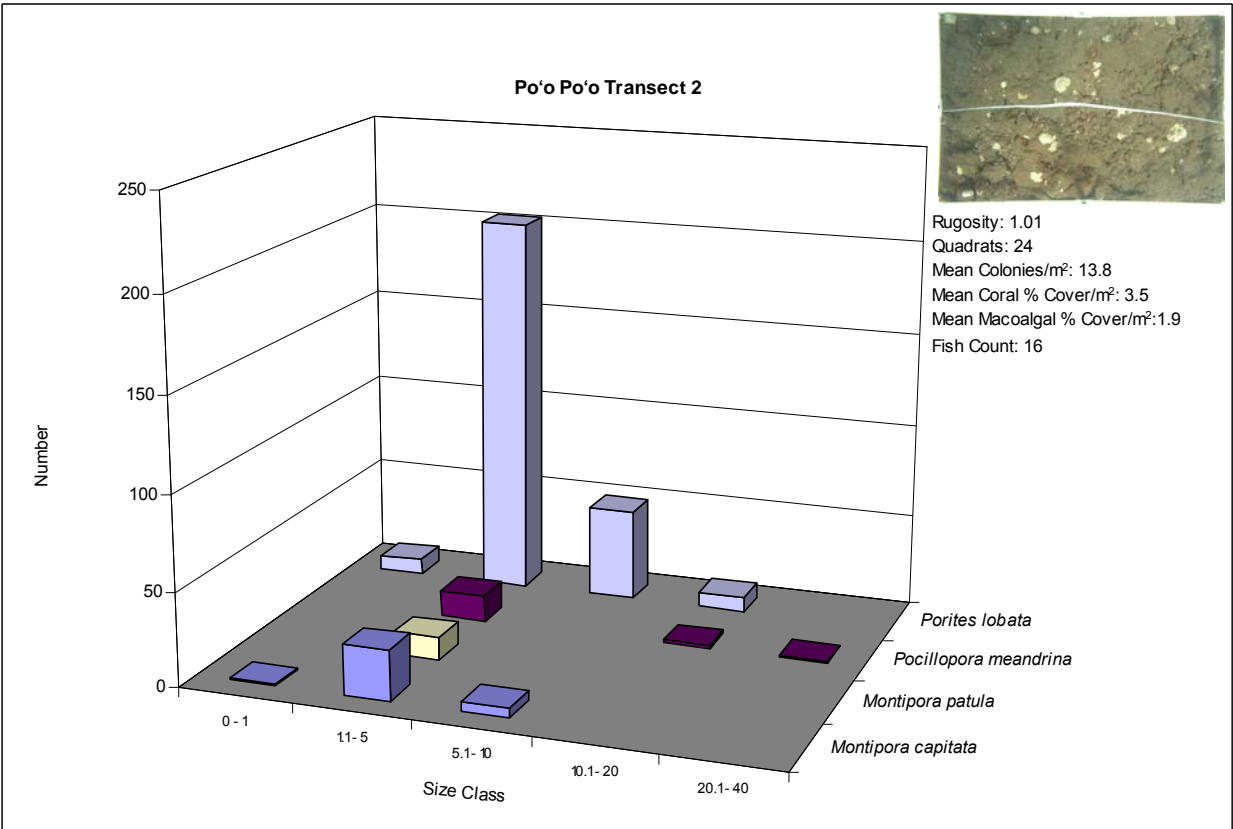
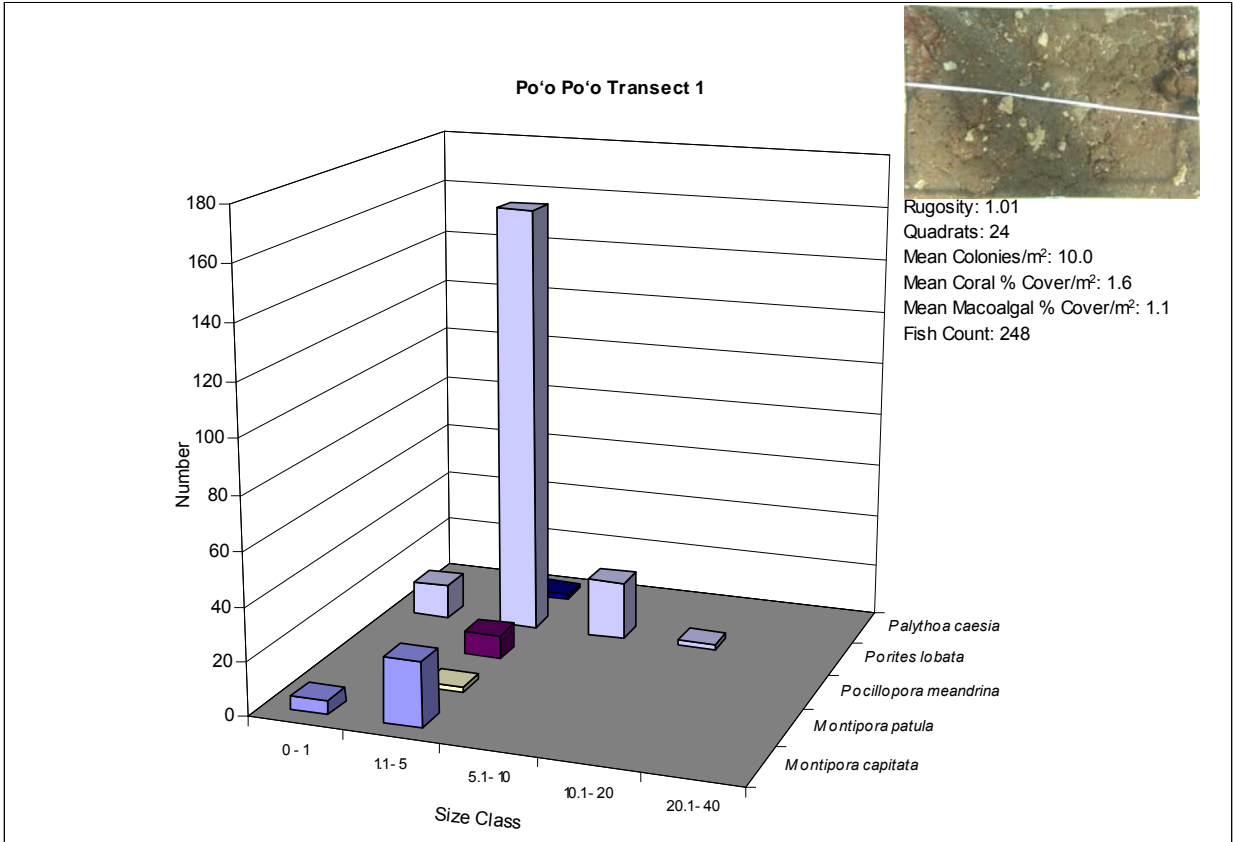


Figure 10. Size class analysis for corals on Po'o Po'o transects

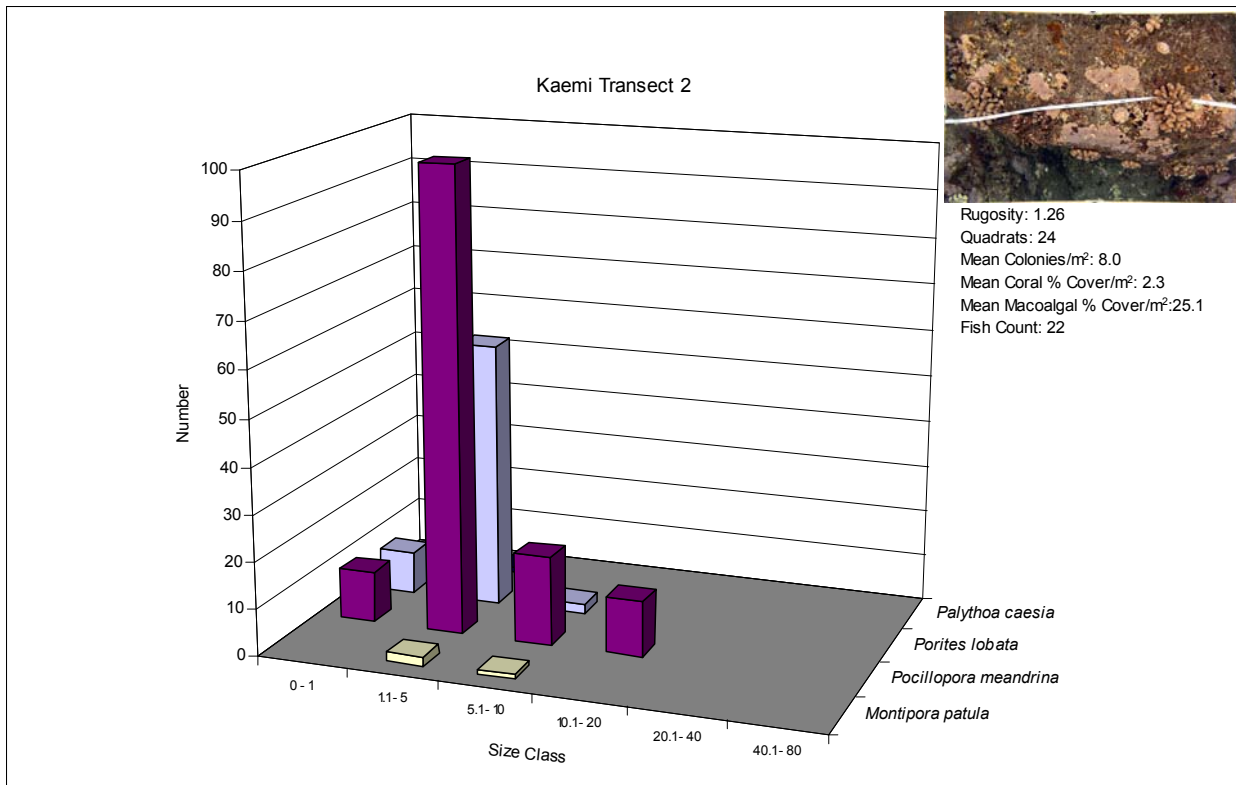
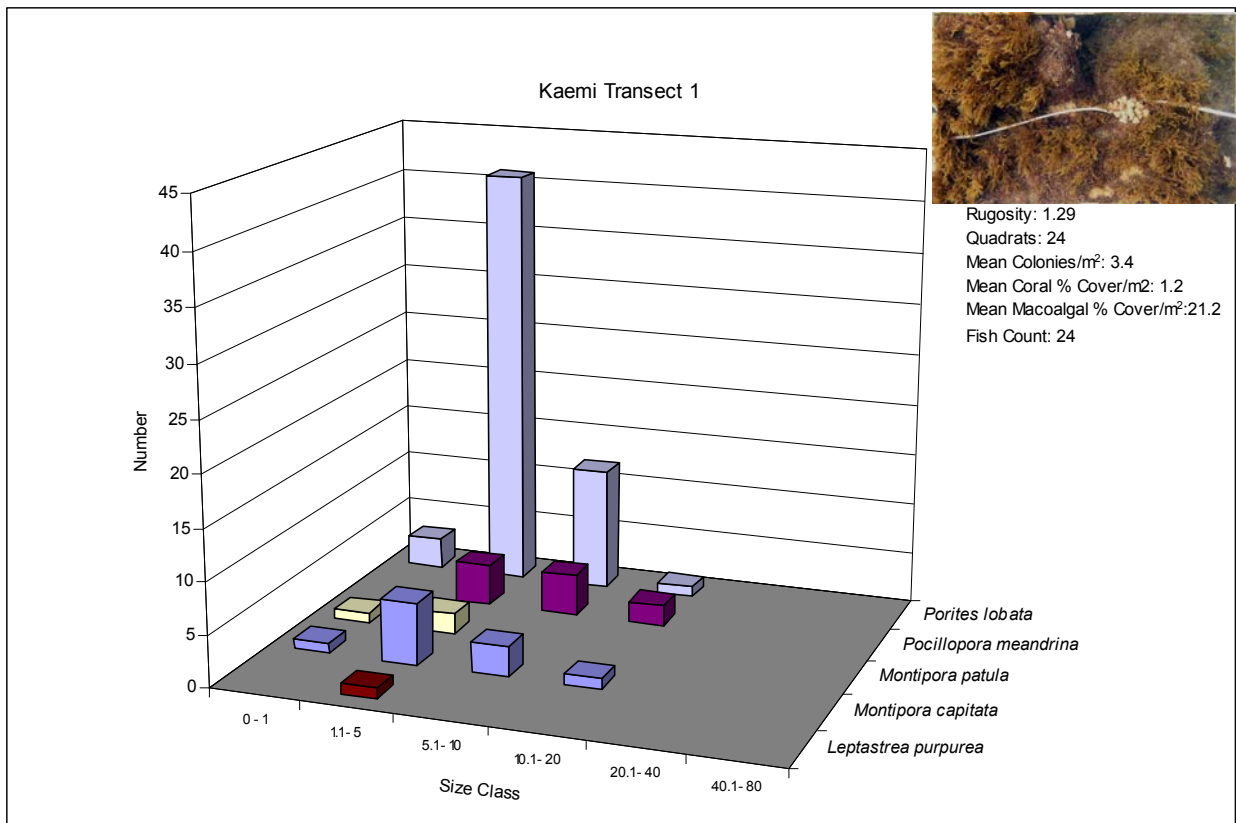


Figure 11. Size class analysis for corals on Kaemi transects.

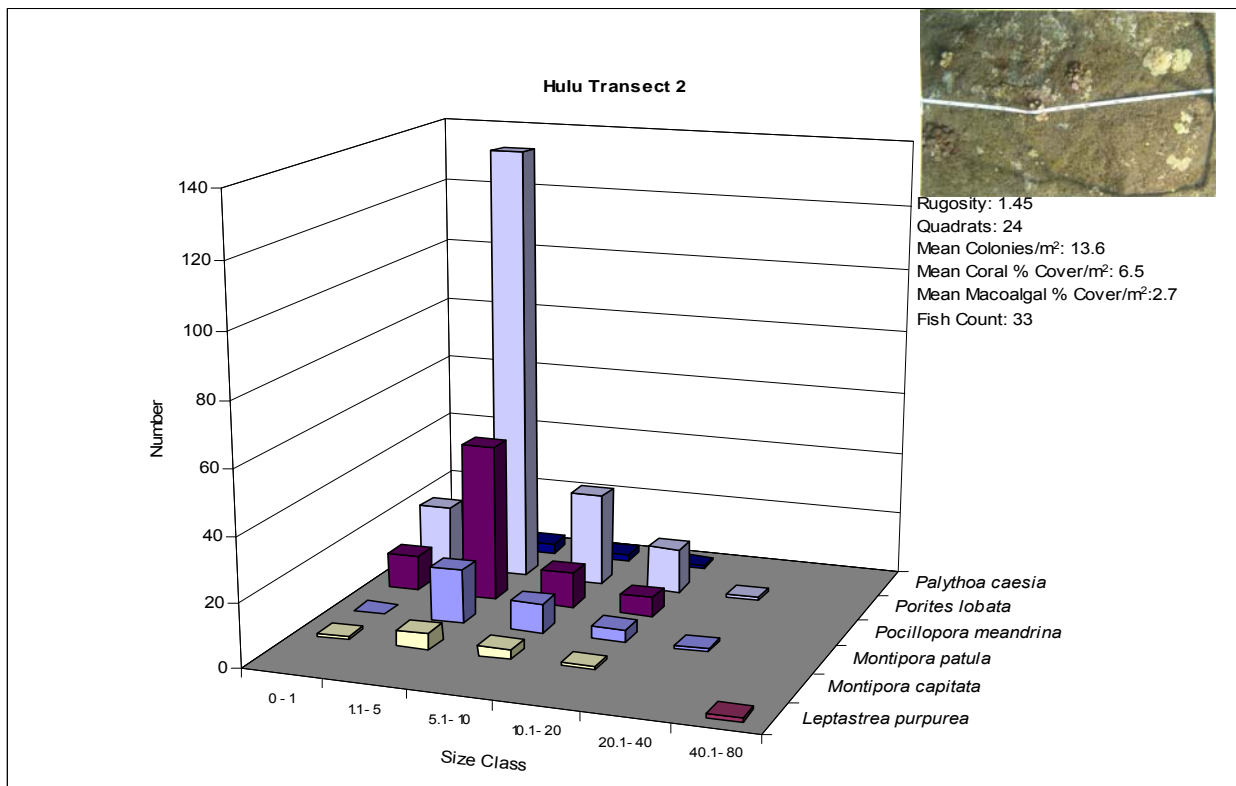
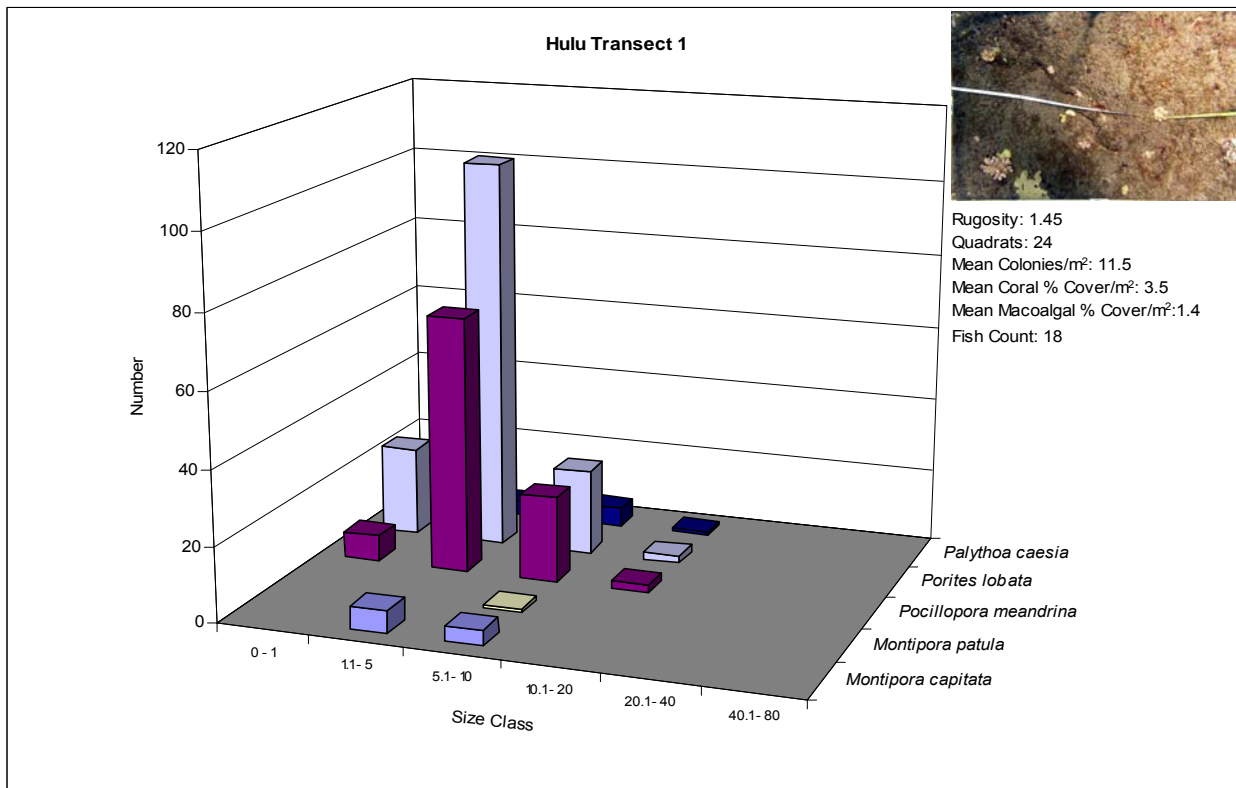


Figure 12. Size class analysis for corals on Hulu transects.

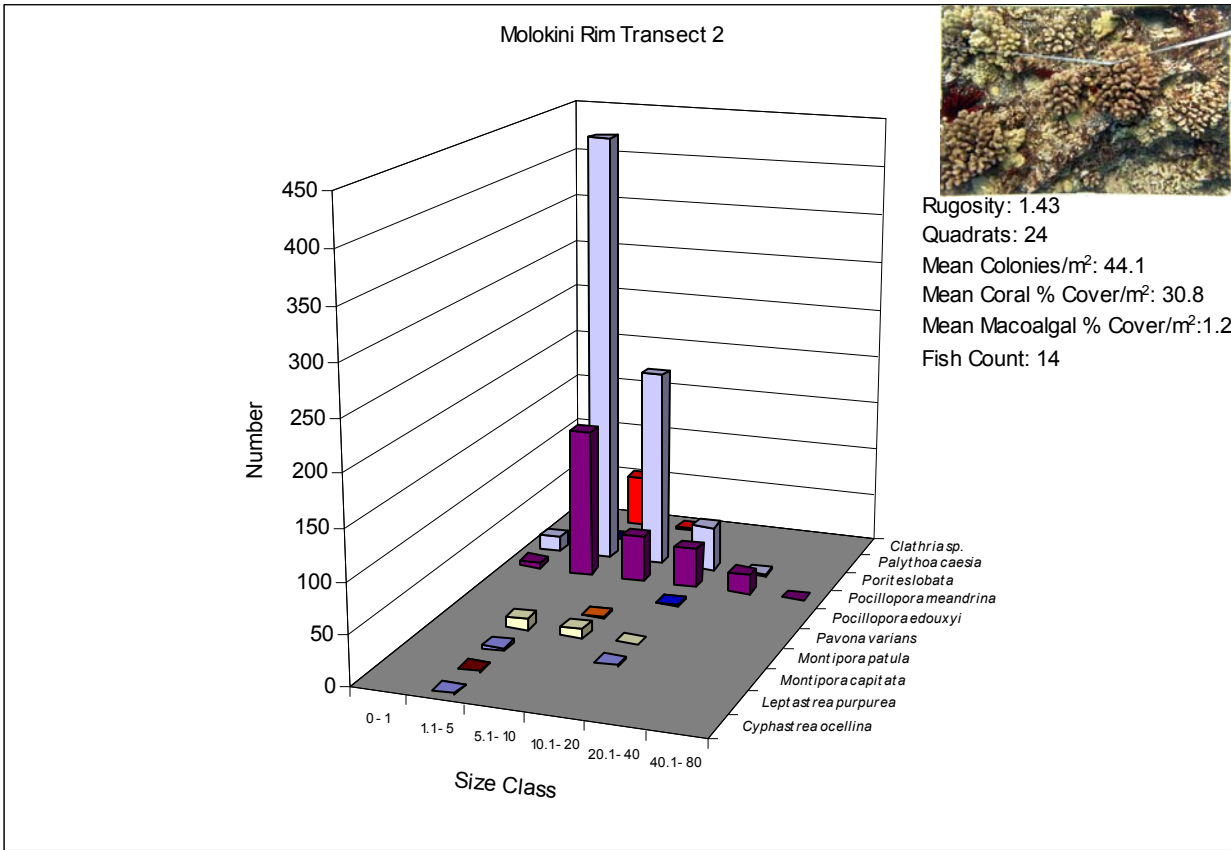
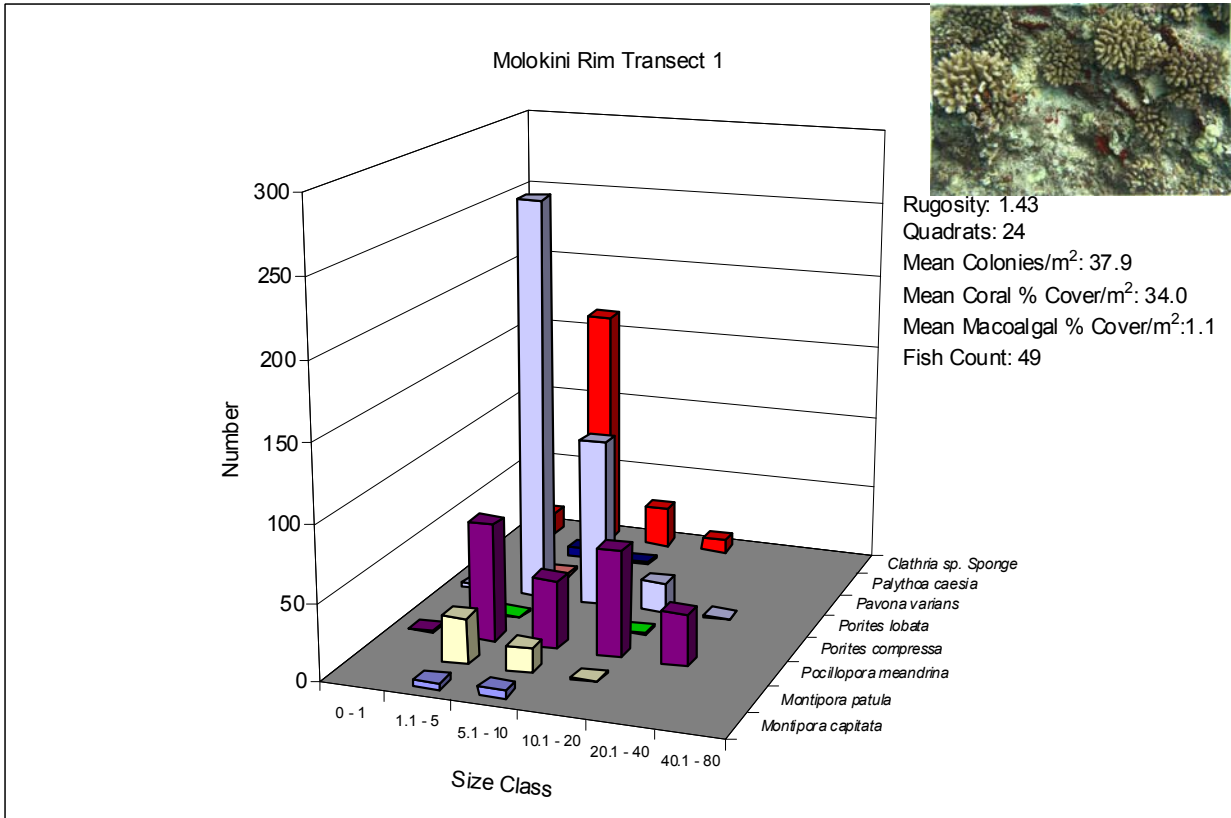


Figure 13. Size class analysis for corals on Molokini Rim transects.

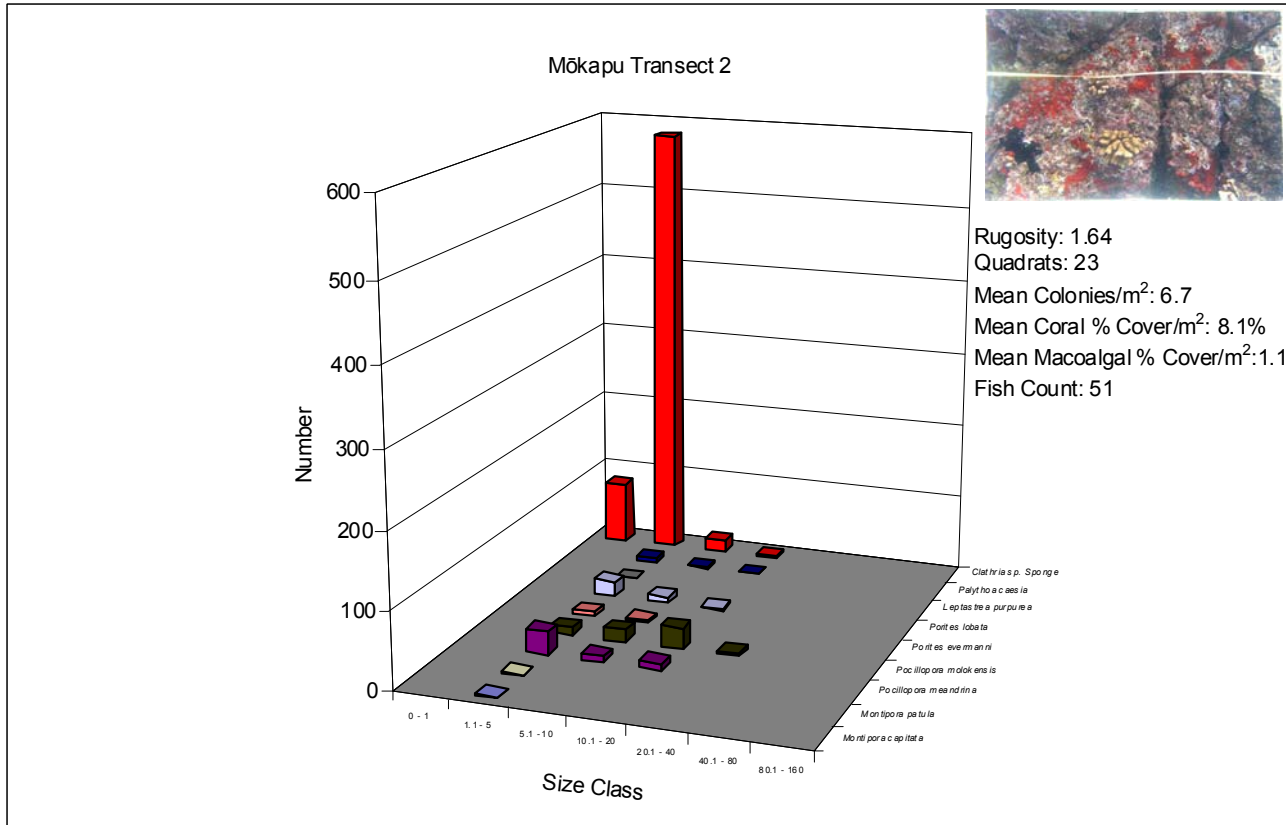
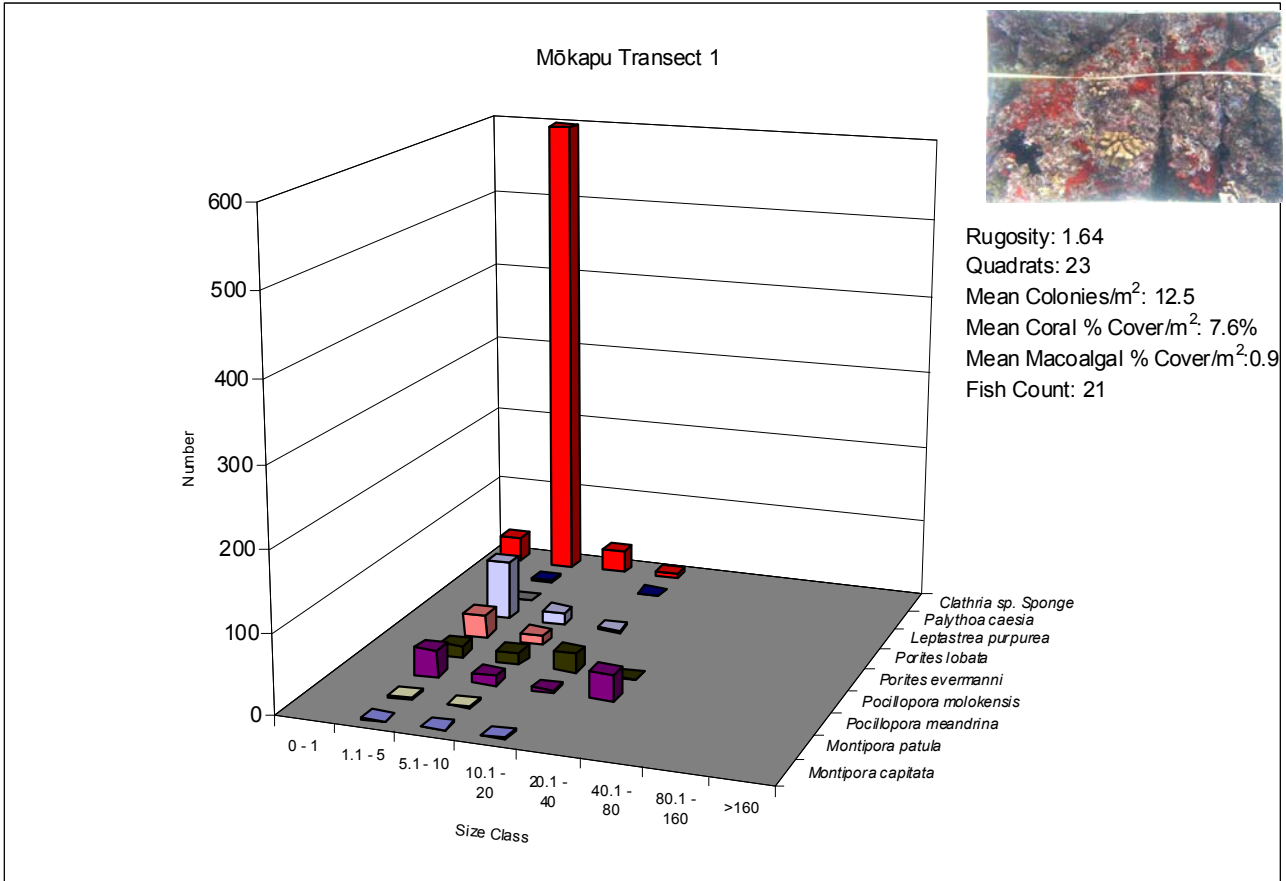


Figure 14. Size class analysis for corals on Mōkapu transects.

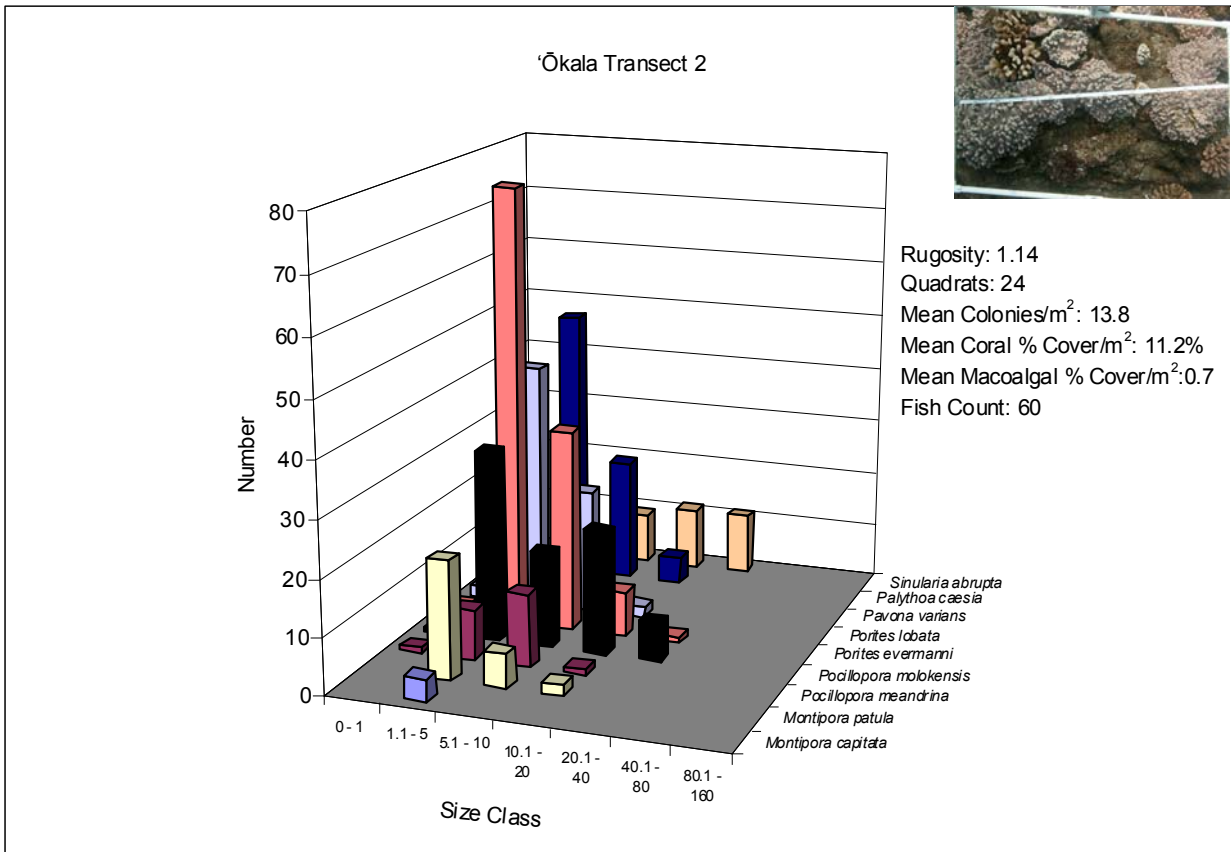
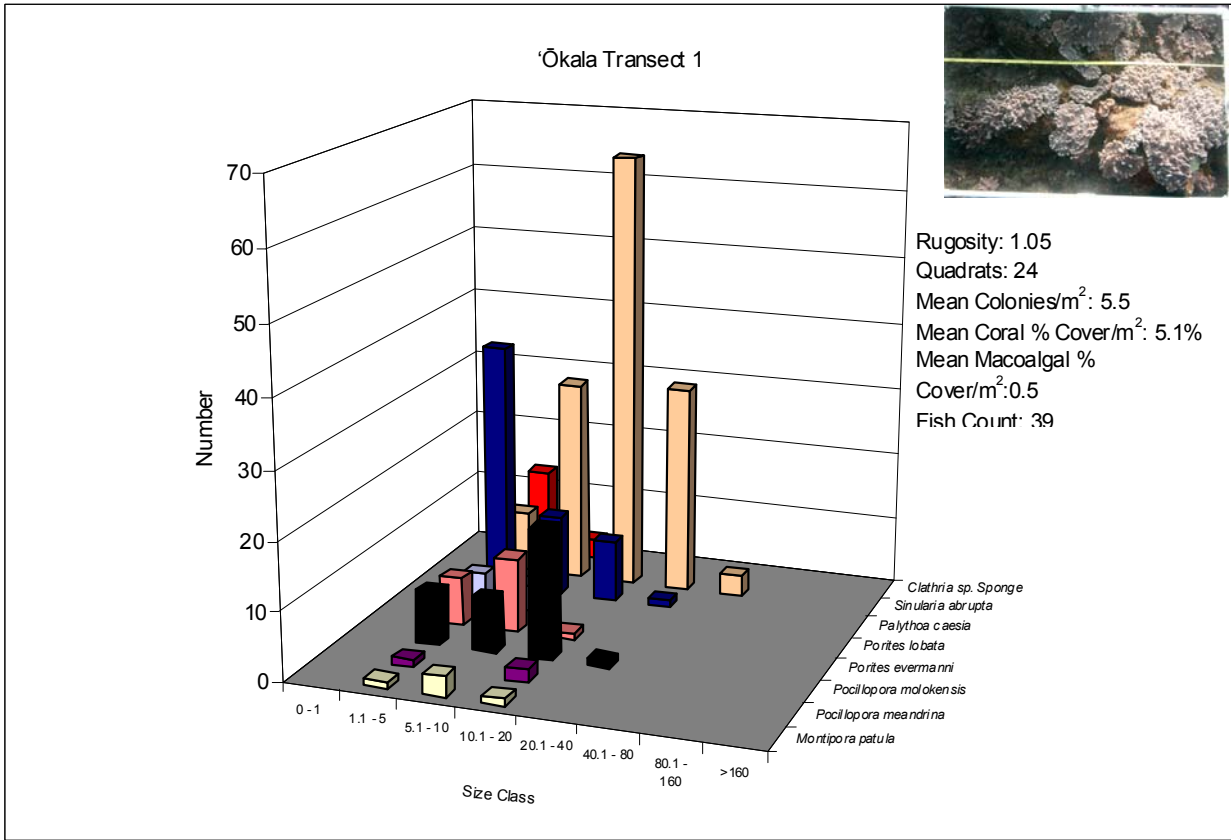


Figure 15. Size class analysis for corals on 'Ōkala transects.

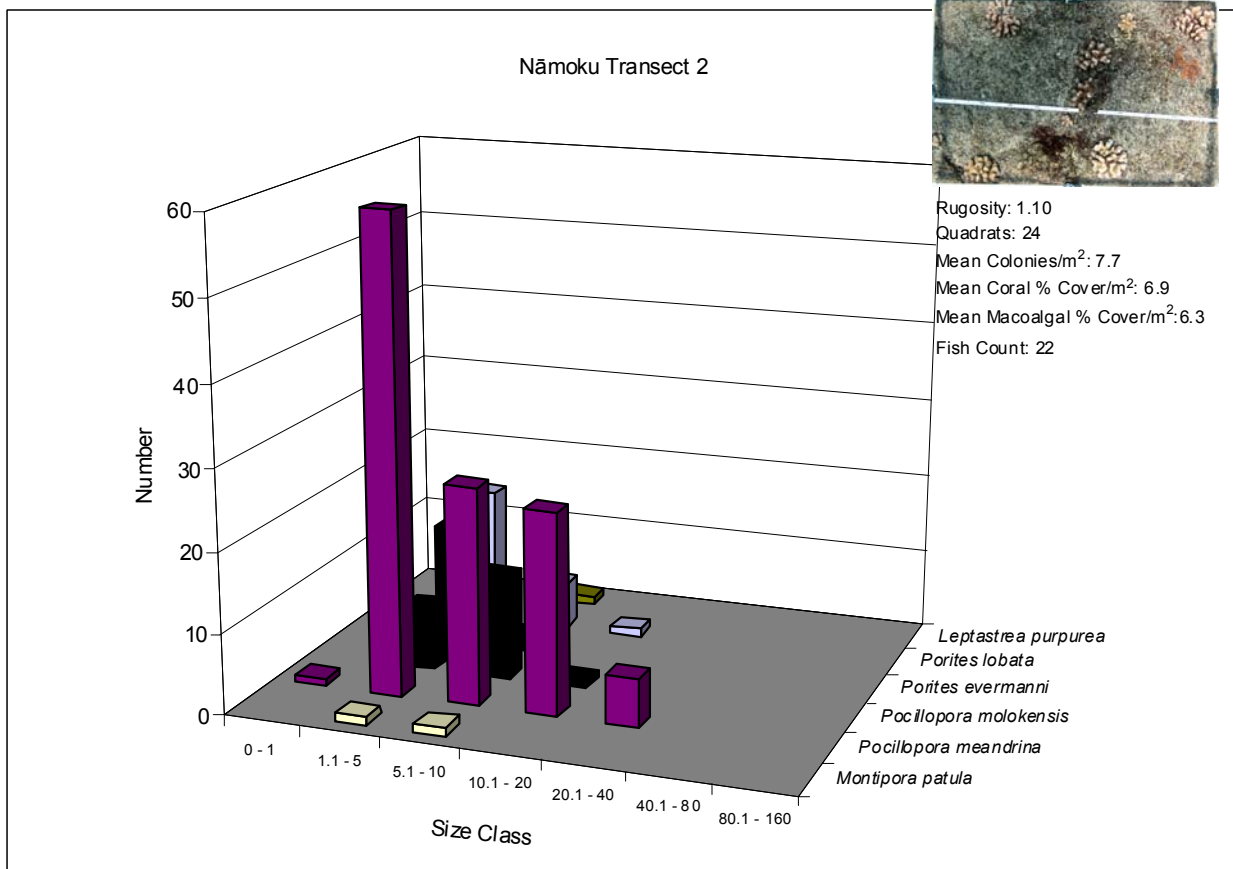
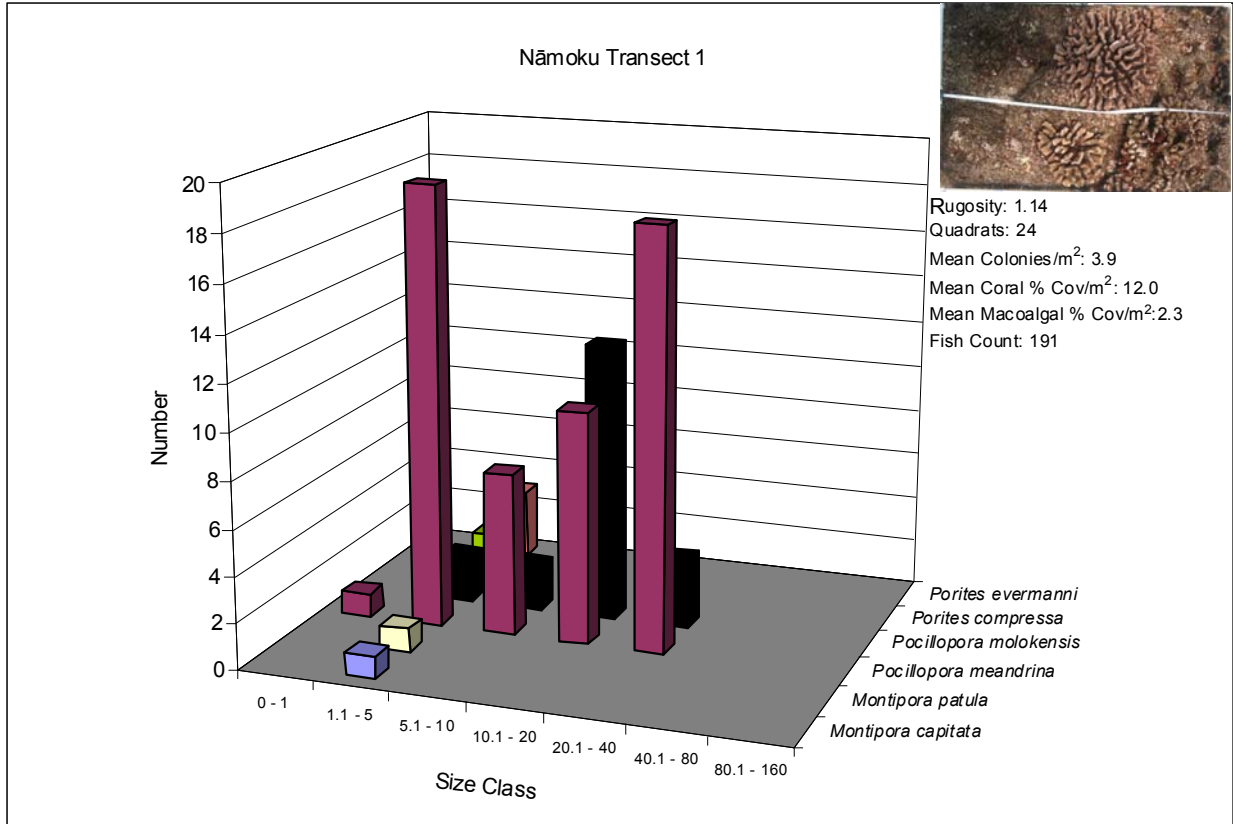


Figure 16. Size class analysis for corals on Nāmoku transects.

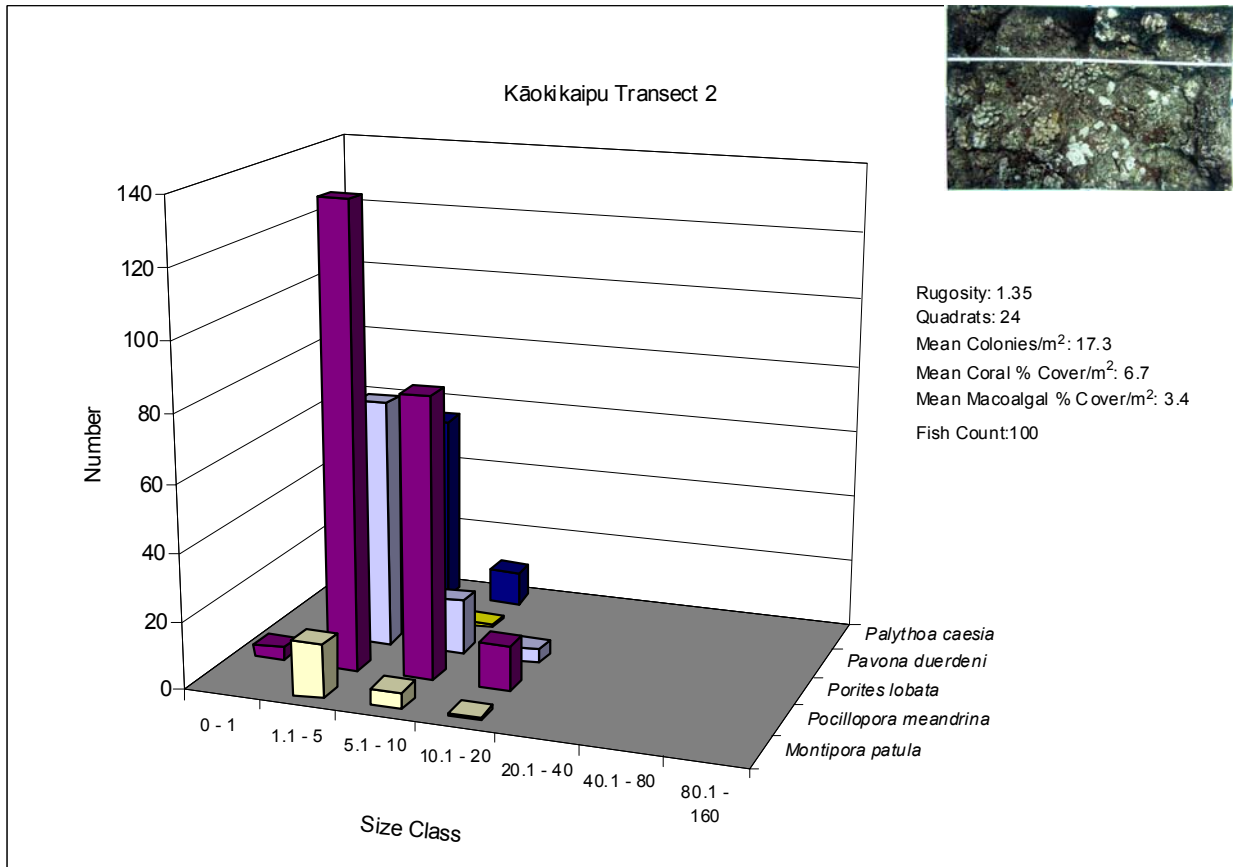
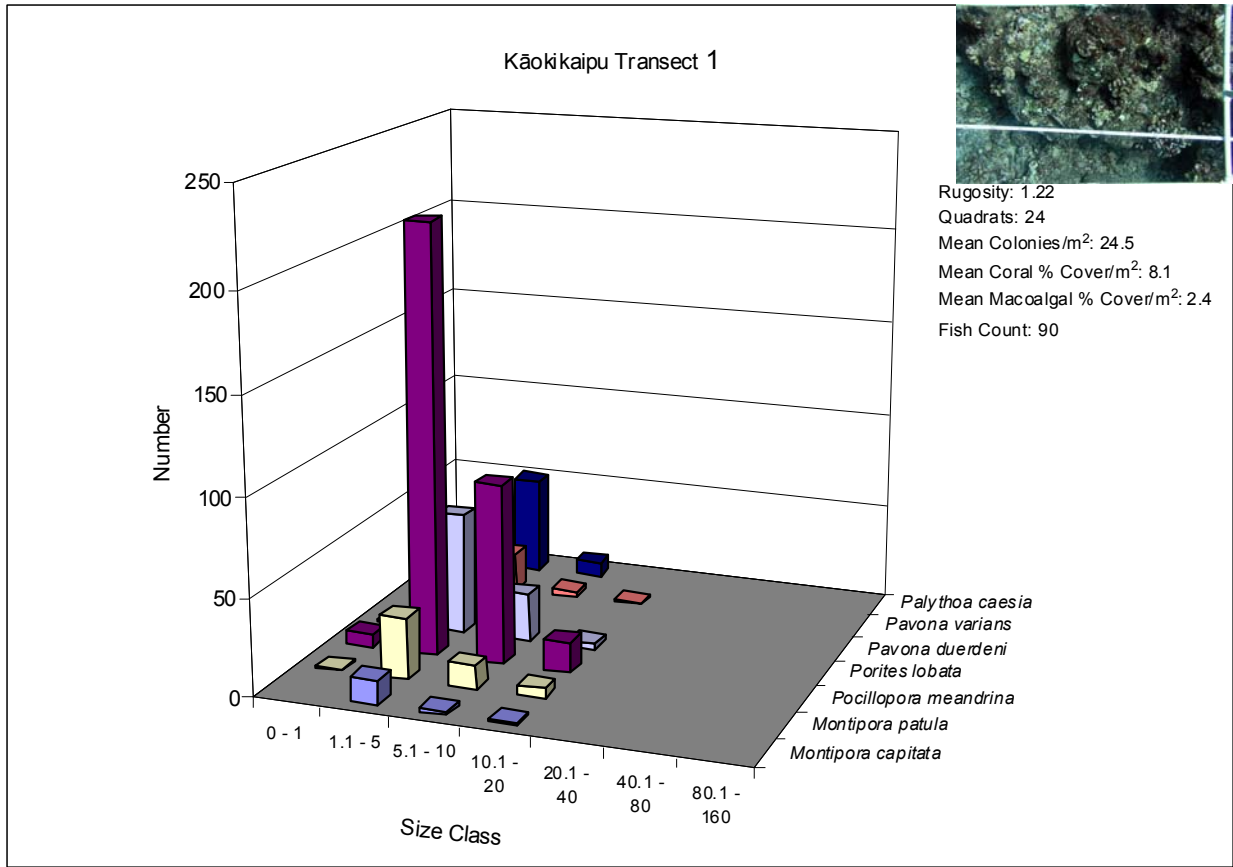


Figure 17. Size class analysis for corals on Kāōhikaipu transects.

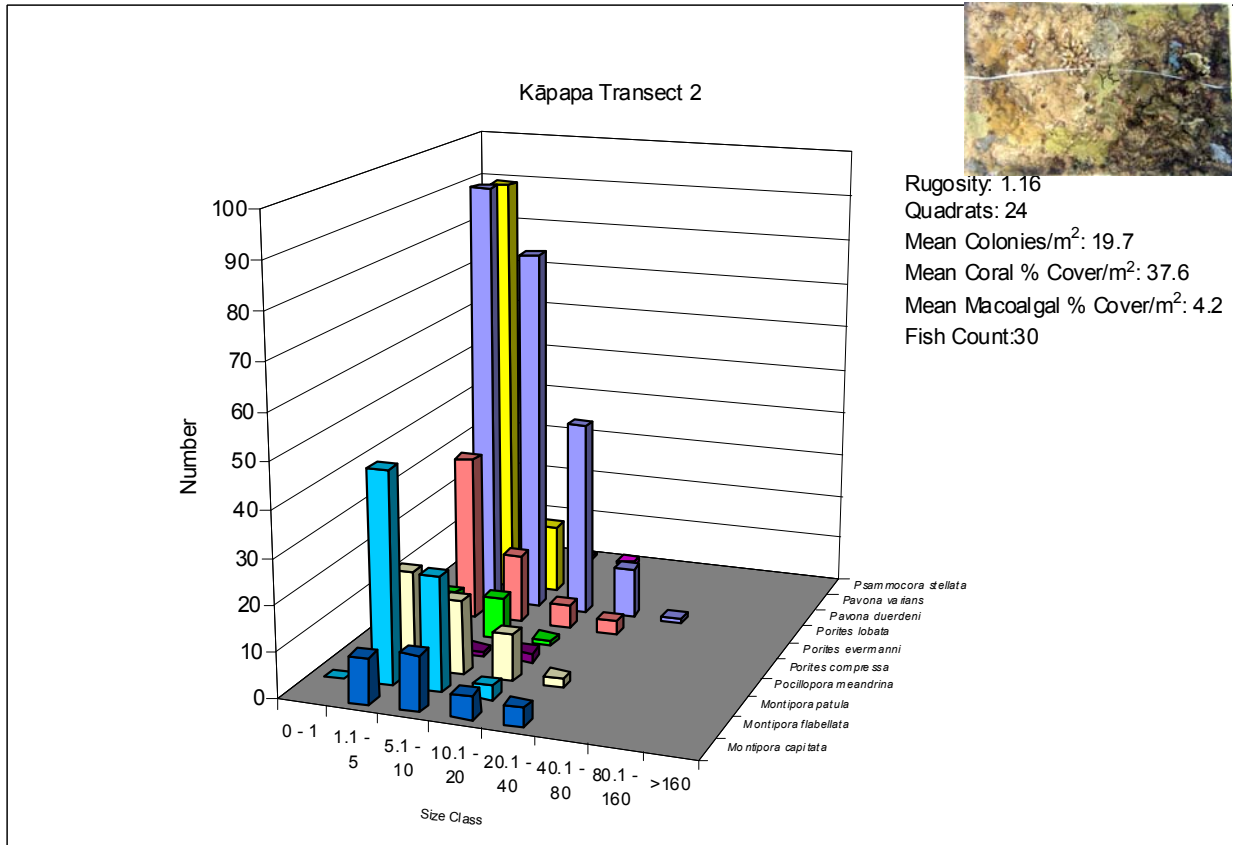
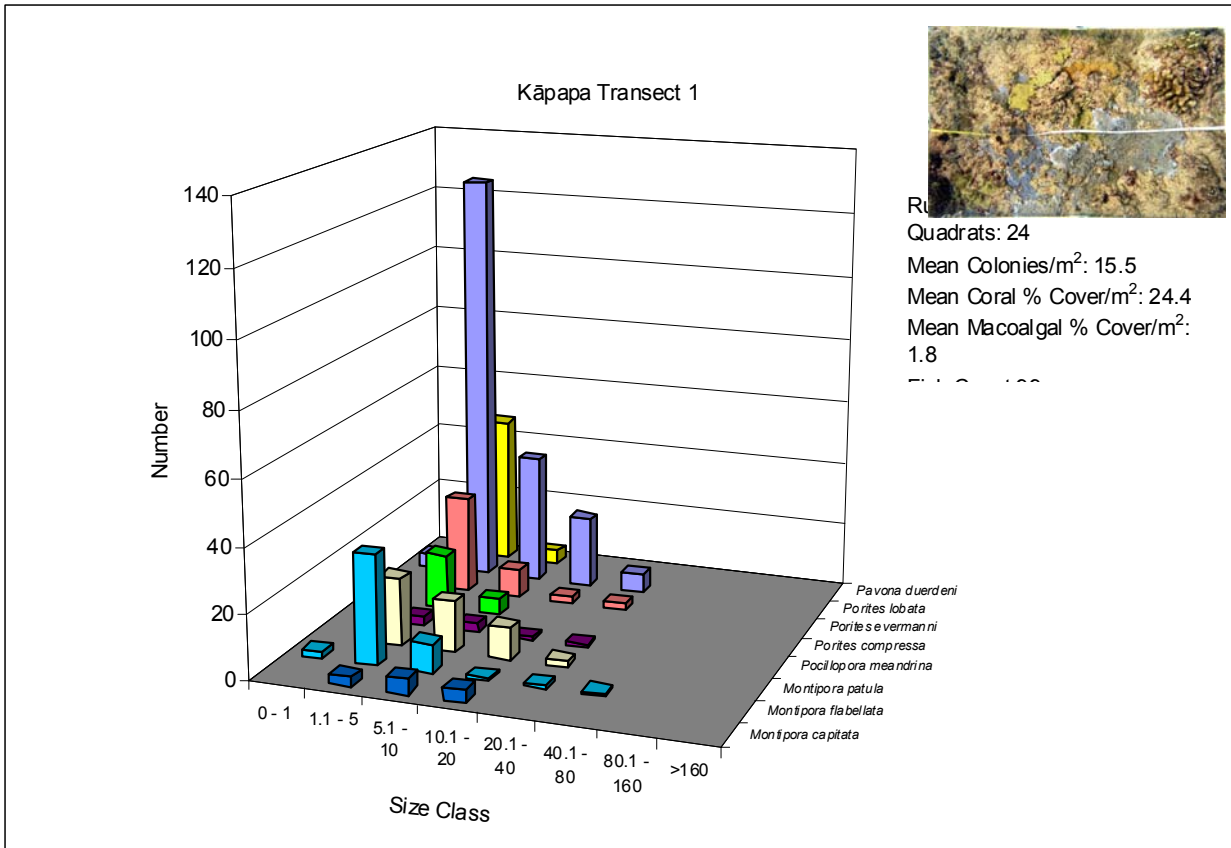


Figure 18. Size class analysis for corals on Kāpapa transects.

sea conditions. By contrast, the relatively sheltered conditions and high relief of the Molokini site (Figure 13) on the southeast side of the crater rim supported the highest mean coral cover (31-34%) and mean colony densities (38-38 m⁻²) of any site surveyed, eight hard and one soft coral species and size distributions ranging up to the 40-80 cm diameter. The Molokini site also had a minor presence of a red sponge, cf. *Clathria* sp., of 0.2-1.8%.

This red sponge was the dominant benthic species on the transects at Mōkapu (Figure 14), the furthest islet seaward surveyed at the Kaulapapa NHP on the north shore of Moloka'i. About 600 whole sponges or fragments were determined to be in the 1-5 cm diameter size class for each transect at this site, far more than any of the seven hard or one soft coral species. Most of the corals showed a fairly even distribution through the size classes, suggesting a robust and relatively diverse coral community. About 0.5 km further shoreward and in a similar leeward location relative to the islet, the macrobenthic epifauna at 'Ōkala contrasted greatly with that at Mōkapu. At 'Ōkala (Figure 15) the benthos was dominated by the soft coral *Sinularia densa* and the zoanthid *Palythoa caesia*, with most of the size distribution of *Sinularia* in the 10-40 cm diameter size classes and ranging up to 80 cm. The 'Ōkala hard coral community was diverse, with seven species with size classes of most ranging up to 20-40 cm diameter. The third Moloka'i site Nāmoku (Figure 16), in the relatively more sheltered area leeward of Kaulapapa Peninsula, had a less complex coral community with six species highly dominated by *Pocillopora meandrina* and *Pocillopora molokensis*. Colony sizes of these were distributed similarly to those at Molokini Rim, with much of the total number in the 10-40 cm diameter size ranges.

The two O'ahu sites showed substantial differences in coral parameters that were related to their contrasting environmental conditions and exposures to wave turbulence. The Kāohikaipu site (Figure 17), in the lee of the islet and in an area of high relief due to outcrops and ledges, had one of the highest mean colony densities (17-24) on the two transects of any site, but only moderate total coverage (7-8%) by six hard and one soft coral species dominated by *Pocillopora meandrina* and *Porites lobata* in the 1-10 cm diameter size classes. The Kāpapa site (Figure 18) was unique among all the areas surveyed, with greatest number of hard coral species (10), including *Pavona duerdeni* and *Psammocora stellata*, which did not occur on transects at any other site, and the largest colony of *Pocillopora eydouxi* (frontispiece) that the senior author has seen in 40 years of diving in Hawaiian waters. Although most of the colonies of all species present were in the 1-10 cm diameter size classes, a substantial number were larger and ranged up to 80 cm, resulting in the second highest mean coverage (24-38%), with intermediate colony density mean values of 17-24 m⁻².

Fish Biomass

Numbers of fish species and individuals for the first two fish transects at each site are shown in Table 3. Mean biomass estimates for total fishes, primary consumers (herbivores), secondary consumers (plankton and small fish feeders), apex predators and target species that are subject to fishing pressure are shown in for the three transects at each site in Table 6 and Figure 19. Order of magnitude or more differences in biomasses were found among some sites for each category. For example, mean total biomass and primary consumers on the Kāpapa transects were more than twelve times the mean values at the Po'o Po'o site. Total fish biomass was highly correlated with primary consumer biomass (Pearson product moment coefficient $r = 0.87$), secondary consumers ($r = 0.70$), and target species ($r = 0.93$)

Table 6. (Analysis by Ivor Williams).

Location	Total Fish	Consumer Level			Target Species
		Primary	Secondary	Apex	
Po'o Po'o	8.5	1.7	6.5	0.3	3.0
Hulu	13.7	7.5	6.2	0.0	4.7
Pu'u Pehe	17.4	12.9	3.9	0.6	8.8
Molokini	43.2	17.4	16.4	9.4	23.5
'Okala	44.6	32.0	12.5	0.0	39.4
Kaemi	50.9	42.8	8.1	0.0	46.2
Nāmoku	55.4	28.9	9.6	16.9	30.7
Mōkapu	57.4	38.5	18.9	0.0	31.3
Kāohikaipu	62.9	14.1	48.2	0.7	27.5
Kāpapa	107.4	73.3	34.1	0.0	80.0
All Main Hawaiian Islands	48.4	21.6	24.6	2.2	26.7

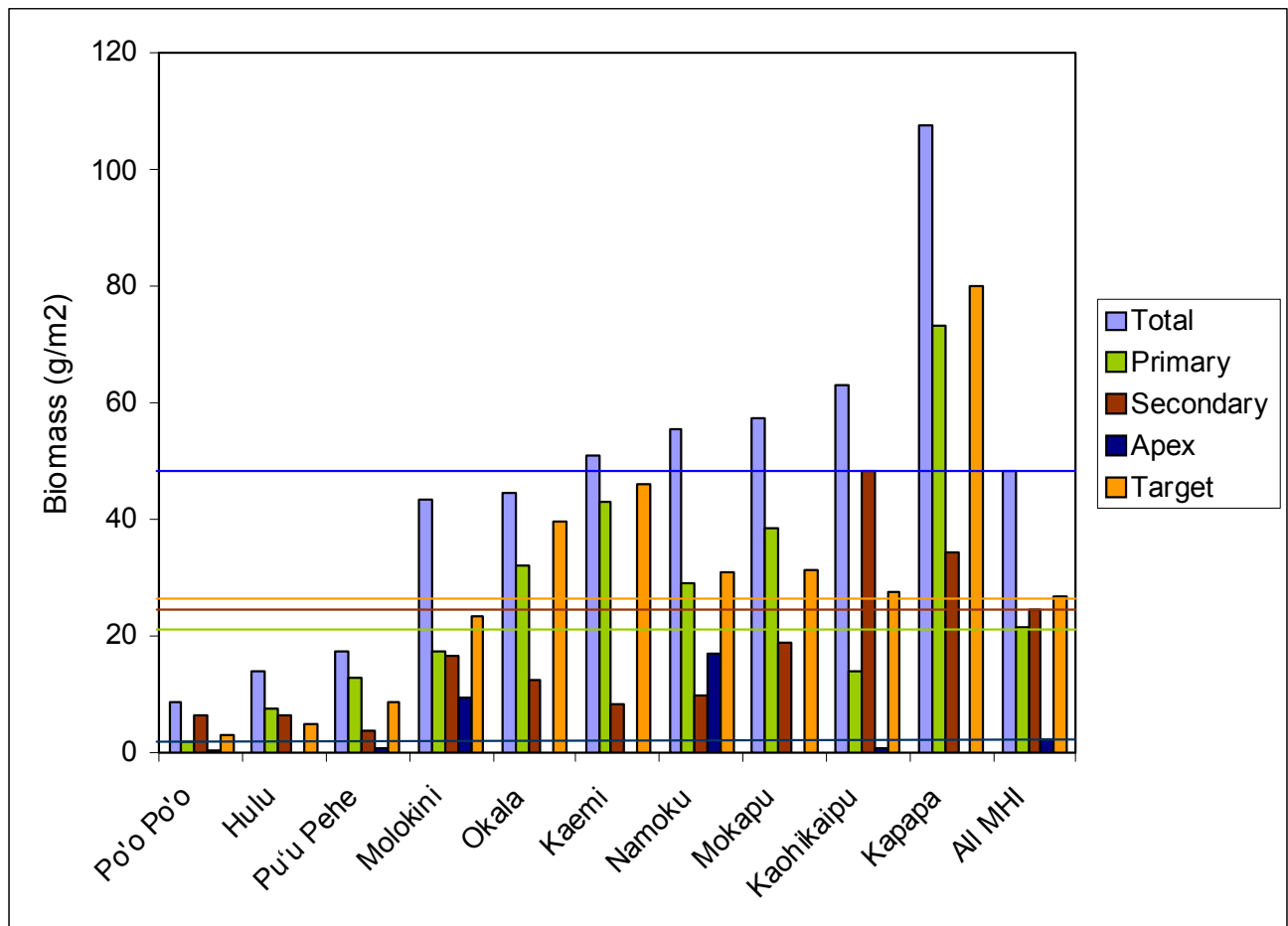


Figure 19. Mean biomass values for study sites compared with mean values for Main Hawaiian Islands.

throughout the sites, showing similar relationships trends among the sites for the two lower trophic levels and for fishes subject to fishing pressure. Few or no apex predators were counted at all sites except Molokini and Nāmoku, which both had *ulua* (*Caranx melampygus*) of 30-45 cm and, at Molokini, a single white tipped reef shark (*Trianodon obesus*).

The mean values at each site for various fish biomass categories are also compared in Table 6 and Figure 19 with mean values that have been determined by similar methods on NOAA/DAR surveys throughout the main Hawaiian Islands (MHI). MHI mean values were exceeded at five of the ten sites for total fish and primary consumers, six sites for target species and two sites for secondary consumers and apex predators. For all but apex predators and target species at Molokini, all sites exceeding MHI mean values were offshore of Moloka'i and O'ahu or at Kaemi, off the north coast of Maui. Surprisingly, the highest values for total fish, primary consumers and target species occurred at the site nearest a major population center, on the turbulent low relief reef at Kāpapa, just outside Kāne'ohe Bay. The highest value for secondary consumers occurred off O'ahu at Kāohikaipu, which also had the second highest total fish mean biomass, and the Nāmoku site just outside of Kaulapapa Harbor had the highest apex predator mean value. By contrast, the lowest mean values for all categories were at Pu'u Pehe off south Lāna'i or at Hulu off Maui's north shore.

Although three 25-m transects are probably insufficient to fully define fish composition and biomass for an area, the trends in mean biomass for these sites probably adequately represent the differences in the fish populations among the sites and indicate that substantial differences occurred. Much of the variation may be explained by differences in habitat and food availability to the various trophic levels. The high mean biomass at the Kāpapa site was primarily due to a large school of *pualu* (*Acanthurus blochii*) and abundant *kole* (*Ctenochaetus strigosus*), herbivores that can utilize the relatively abundant and diverse macroalgae and turf algae that grow in this wave-swept location. The high value of secondary consumers at Kāohikaipu are probably related to sheltering habitat provided by the outcrops and ledges in this area of high relief and rugosity. The relatively low mean values at Molokini and Pu'u Pehe for all categories except apex predators at Molokini are surprising, given the relatively high relief and rugosity and the high coral density and coverage at Molokini, and the fact that both sites are in MLCs with limited to no-take fishing restrictions. However, both areas are highly accessible, suggesting that poaching may be occurring. The low biomass values in all categories at Po'o Po'o are likely related to the limited habitat provided for fish in this low relief, low rugosity area, with little live coral and a substratum largely covered with fine sediment. The Hulu site ranked second lowest in all categories except apex predators, where it tied for lowest, and it is unclear why this was the case, since it has high relief and rugosity, and moderate coral cover (Table 4). It is in all respects similar to the Kaemi site, where all but the secondary consumer mean exceeded MHI mean values, except for low coral cover and a high abundance of macroalgae at Kaemi (Table 5). The latter may account for the highest mean biomass of herbivores having been found at the Kaemi site. The relatively high mean values found for the Kaulapapa NHP sites, which included the highest apex predator mean value at Nāmoku, third highest means for primary and secondary consumers at Mōkapu, and third highest target species mean at 'Ōkala may be related to their remoteness and resulting low fishing pressure, although some fishing does occur in this area during calm periods since they are not in an protected area, despite their location in the Kaulapapa NHP (E. Brown, pers. comm.).

Introduced Species

Table 7 lists the 22 recognized introduced or cryptogenic species per Carlton and Eldredge (in press) that were observed or collected at islet sites during reconnaissance or transect surveys. All but seven of these are listed as cryptogenic, i.e. neither demonstrably native nor introduced, but considered potentially introduced per criteria described in Chapman (1988) and Chapman and Carlton (1991). Ten of the cryptogenic species were hydroids, most of which have been rarely and recently first reported in the Hawaiian Islands. All of these were found in low abundance and were a minor component of the total benthos at the sites where they occurred. Six of them (*Eudendrium* sp., *Antennella secudaria*, *Plumularia strictocarpa*, *Sertularella tongensis*, *Tridentata humpferi* and *Tridentata ligulata*) have previously been reported from Bishop Museum introduced species surveys, mostly from O'ahu sites, especially off Waikīkī and Hawai'i Kai (Coles et al. 2002b).

No introduced or invasive algal species occurred at any of the sites, and the only invasive invertebrate found was the introduced snowflake octocoral *Carijoa* aff. *riisei*, which occurred at seven of the ten sites and was very abundant in caves at 'Ōkala in the Kaulapapa NHP and at a pinnacle near Po'ō Po'ō. At other sites *Carijoa* was present as relatively small patches, usually under ledges or in subdued light, but it was found at all Neighbor Island sites except Hulu on Maui. Interestingly it did not occur at either of the O'ahu sites surveyed, despite its known abundance on O'ahu reefs (Thomas 1979, Kahng 2006).

Of the remaining six recognized introduced species only three were invertebrates: the ubiquitous hydroid *Pennaria disticha*, which occurred at half the sites, the serpulid polychaete *Salmacina disticha*, which was a minor benthic component at the three Moloka'i sites, and the bryozoan *Bugula dentata*, also occurring sparsely at two of the sites. The remaining introduced species were fishes that are widely distributed throughout the main Hawaiian islands and, in the case of the blueline snapper, *Lutjanus kasmira*, even to the end of the Northwestern Hawaiian Island chain (DeFelice et al 1998). *L. kasmira* occurred at six of the ten sites, the peacock grouper *Cephalopholis argus* occurred at all three Kaulapapa NHP sites off Moloka'i and the Kāohikaipu site off O'ahu, and the blacktail snapper *Lutjanus fulvus* occurred at four widely distributed sites.

Uncommon, Unique or Endangered Species or Habitats

No recognized threatened or endangered species were observed or collected on these surveys. Sixteen species, five algae, five invertebrates and six fishes (Table 8) were found that are relatively uncommon or worthy of comment. *Padina melemele*, (Figure 20a) found at Pu'u Pehe, Po'ō Po'ō and Hulu, is a distinctive and rare species of algae found in deep or shaded locations and is recognizable by the bright golden color of its non-calcified outer surface (Huisman et al 2007). Other uncommon algae were *Halimeda distorta*, (Figure 20b) found at Pu'u Pehe and Po'ō Po'ō and *Caulerpa elongate* (Figure 20c) at Pu'u Pehe and Molokini. *Sporochnus dotyi*, found on these surveys only at Nāmoku is very rare. *Dictyopteris australis* is relative common on Hawaiian reefs but is worth noting for its very high abundance on rocks and hard surfaces at the Kaemi site (Figure 20d), the only location where it was found on these surveys.

Regarding invertebrates, *Solanderia secunda* is an uncommon, relatively large hydroid that resembles small pink sea fans and occurred under ledges at Po'ō Po'ō and Kāohikaipu. *Myriopathes ulex* (Figure

Table 7. Introduced or cryptogenic species observed or collected at islet sites.

Taxa 1	Family	Scientific name	Author Date	Origin	Lana'i		Maui		Moloka'i			O'ahu		
					Po'o Po'o	Pu'u Pehe	Hulu	Kaemi	Molokini	Mōkapu	Nāmoku	Ōkala	Kāohikaipu	Kāpapa
HYDROZOA	AGLAOPHENIIDAE	<i>Lytocarpia phyteuma</i>	(Kirchenpauer, 1876);	Cryptogenic	x	x								
	CAMPANULARIIDAE	<i>Campanularia sp.</i>		Cryptogenic		x								
	EUDENDRIIDAE	<i>Eudendrium sp.</i>		Cryptogenic	x	x								
	HALOPTERIDIDAE	<i>Antennella secundaria</i>	(Gmelin, 1791)	Cryptogenic								x		
	PLUMULARIIDAE	<i>Plumularia strictocarpa</i>	Pictet, 1893	Cryptogenic						x	x			
	SERTULARIIDAE	<i>Sertularella diaphana</i>	(Allman, 1885)	Cryptogenic								x		
		<i>Sertularella tongensis</i>	Stechow, 1919	Cryptogenic							x			
		<i>Tridentata borneensis</i>	(Billard, 1925)	Cryptogenic	x				x					
		<i>Tridentata humpferi</i>	Broch, 1914	Cryptogenic		x								
		<i>Tridentata ligulata</i>	(Thornely, 1904).	Cryptogenic						x				
	HALOCORDYLIDAE	<i>Pennaria disticha</i>	(Goldfuss, 1820)	Introduced		x	x	x	x				x	
ANTHOZOA	RHIZANGIIDAE	<i>Culicia rachelfizhardingeae</i>	Cairns 2006	Cryptogenic	x									
	TELESTIDAE	<i>Carijoa aff. riisei</i>	(Duchassaing & Michelotti, 1860)	Introduced	x	x		x	x	x	x	x		
POLYCHAETA	CHAETOPTERIDAE	? <i>Chaetopterus sp.</i>		Cryptogenic	x	x		x					x	
	SERPULIDAE	<i>Salmacina dysteri</i>	(Huxley, 1855)	Introduced						x	x	x		
GASTROPODA	HIPPONICIDAE	<i>Hipponix australis</i>	(Lamarck, 1819)	Cryptogenic	x	x							x	
NUDIBRANCHIA	FACELINIDAE	<i>Caloria indica</i>	(Berg, 1896)	Cryptogenic									x	
ECTOPROCTA	BUGULIDAE	<i>Bugula dentata</i>	(Lamouroux, 1816)	Introduced	x								x	
				Invertebrates	8	8	1	3	3	4	4	5	4	0
OSTEICHTHYES	POMACENTRIDAE	<i>Abudefduf vaigiensis</i>	(Quoy and Gaimard, 1825)	Cryptogenic	x	x				x	x			
	LUTJANIDAE	<i>Lutjanus fulvus</i>	(Forster, 1801)	Introduced	x				x		x		x	
		<i>Lutjanus kasmira</i>	(Forsskal, 1775)	Introduced	x	x	x		x	x	x			
	SERRANIDAE	<i>Cephalopholis argus</i>	Bloch and Schneider 1801	Introduced						x		x	x	
				Fish	3	2	1	0	2	2	4	1	2	1
				Cryptogenic	7	7	0	1	1	3	3	2	3	0
				Introduced	4	3	2	2	4	4	5	4	3	1
				Total Species	11	10	2	3	5	6	8	6	6	1

Table 8. Uncommon or notable species observed or collected at islet sites.

Taxa 1	Family	Scientific name	Author_Date	Lana'i		Maui		Moloka'i		O'ahu		
				Po'o	Pu'u	Pehe	Hulu	Kaemi	Molokini	Mōkapu	Nāmoku	'Ōkala
PHAEOPHYTA	DICTYOTACEAE	<i>Padina melemele</i>	Magruder & Abbott	x	x	x						
		<i>Dictyopteris australis</i>	(Sonder) Askenasy				x					
	SPOROCHNACEAE	<i>Sporochnus dotyi</i>	Brostoff						x			
CHLOROPHYTA	HALIMEDACEAE	<i>Halimeda distorta</i>	(Yamada) Hillis-Colinvaux	x	x							
	CAULERPACEAE	<i>Caulerpa elongata</i>	Weber-van Bosse		x		x					
			Total Algae	2	3	1	1	0	1	0	0	0
HYDROZOA	SOLANDERIIDAE	<i>Solanderia secunda</i>	Inaba, 1892	x							x	
ANTHOZOA	ANTIPATHIDAE	<i>Myriopathes ulex</i>	Ellis & Solander, 1786	x						x		
	DENDROPHYLLIIDAE	<i>Rhizopsammia verrilli</i>	Horst, 1926		x					x		
	ALCYONIIDAE	<i>Sinularia densa</i>	Whitelegge, 1897						x	x		x
ECTOPROCTA	VITTATICELLIDAE	<i>Vittaticella uberrima</i>	Harmer, 1957					x	x			
			Total Invertebrates	2	1	0	0	1	1	1	3	1
OSTEICHTHYES	LETHRINIDAE	<i>Monotaxis grandoculis</i>	(Forsskål, 1775)					x		x		
	MULLIDAE	<i>Parupeneus cyclostomus</i>	(Lacepède, 1801)	x	x	x			x	x	x	
	POMACANTHIDAE	<i>Desmoholacanthus arcuatus</i>	(Gray, 1831)					x		x		
	CHAETODONTIDAE	<i>Chaetodon ephippium</i>	Cuvier 1831								x	
	LABRIDAE	<i>Cirrhilabrus jordani</i>	Snyder 1904	x								
		<i>Coris flavovittata</i>	(Bennett, 1829)								x	
			Total Fishes	2	1	1	1	1	2	2	4	0
			Total Species	6	5	2	1	3	2	4	5	1

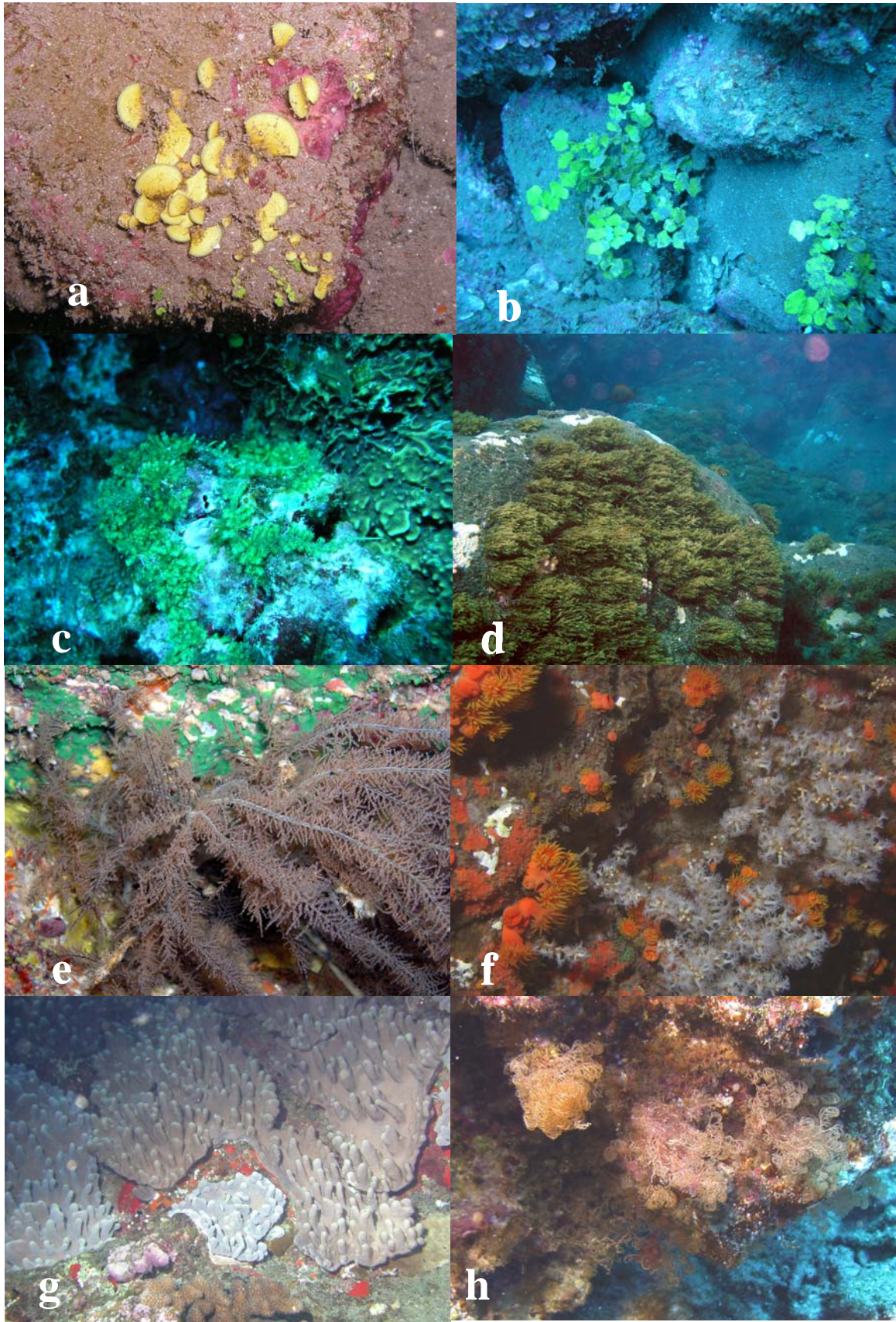


Figure 20. a: *Padina melemele*; b: *Halimeda distorta*; c: *Caulerpa elongata*; d: *Dictyopteris australis*; e: *Myriopathes ulex*; f: *Rhizopsammia verrilli* with *Carijoa riisei* (right); g: *Sinularia densa*; h: *Vittaticella uberrima*.

20e) is one of Hawai'i's commercially valuable black corals, and small colonies were found at Po' o Po' o and ' Ōkala. *Rhizopsammia verrilli* (Figure 20f) is a rare azooxanthellate cup coral that grows in subdued light and occurred in caves at "Cathedrals" at Pu' u Pehe and at ' Ōkala. *Sinularia densa* (= *Sinularia abrubta*) (Figure 20g) is one of only two alcyonid soft corals that occur in Hawai'i, and although it is not rare, it is seldom found in the abundance that it showed at ' Ōkala, where it was the dominant benthic organism and had a percent cover averaging 36% on Transect 1. *Vittaticella uberrima* (= *Savignyella lofonti*) (Figure 20h) is an unusual and distinctive bryozoan that is relatively common at the Molokini outer rim site, but seldom seen elsewhere, and it was observed at Mōkapu, off Kaulapapa NHP.

None of the fishes observed are rare but some are considered worth noting (Ivor Williams, pers. comm.). *Monotaxis grandoculis* (*mu*), which occurred at Molokini, Nāmoku, and Kāohikaipu is the only lethriniid species found in Hawaii and is prized as a food fish, but also one of the species most implicated in ciguatera fish poisoning (Randall 1998). *Parupeneus cyclostomus* (*moano kea*) is one of the less common Hawaiian goatfishes and was sighted at six of the ten locations surveyed. The bandit angelfish *Desmoholacanthus arcuatus* is usually seen at depths greater than 30 m (Randall 1998), but was seen at less than 25 m at Mōkapu and ' Ōkala off Kaulapapa NHP. The saddleback butterflyfish *Chaetodon ephippium* (*kikākapu*) is not common in Hawai'i and was found with a variety of other butterflyfishes at Kāohikaipu off east O'ahu. The distinctive flame wrasse *Cirrhilabrus jordani* was seen only at Po' o Po' o, and the yellowstriped wrasse *Coris flavovittata* (*hilu*) only Kāohikaipu.

V. DISCUSSION and MANAGEMENT CONSIDERATIONS

The ten islet sites surveyed included two MLCD's and encompassed a variety of reef conditions and environmental attributes regarding physical relief and rugosity, exposure to ocean turbulence, proximity to population centers, and possible human impacts such as fishing pressure and exposure to introduced species. Overall, the reefs at all sites appeared to be quite undisturbed and as yet mostly unaffected by anthropogenic influences, with the possible exception of fishing-related impacts. However, there were distinct differences among the various sites that are probably mostly related to ocean turbulence, and there were a few differences that could not be explained by any observable influences. For example, Pu' u Pehe, in the Mānele MLCD showed a robust coral community with relatively high cover and colony density and the third highest number of taxa of any site. By contrast, the Po' o Po' o site, only 5 km away, had coral cover about one tenth that of Pu' u Pehe with fine sand/silt and numerous sponges. However, the total number of taxa determined at Po' o Po' o was the highest of any site surveyed. Likewise, the Kaemi and Hulu sites were near each other on the northeast shore of West Maui and their sites were similarly exposed to high ocean turbulence. Despite this similarity, the coral cover and colony density at Hulu was 2-3 times that at Kaemi, where the mean macroalgal cover for the two transects, mostly of *Dictyopteria australis*, was 44 times that at Hulu.

Other unexpected results were revealed by this study. The highest coral cover on any transect occurred on the low relief, gradually sloping, wave impacted reef outside Kāpapa Island, and mean percent cover at this site was only slightly less than the highest mean, which occurred at the Molokini outer rim site. This is even more remarkable, given the high turbidity and ground swell turbulence at the Kāpapa site in addition to the high human impact at the highly used "Sandbar" area, which is inshore of Kāpapa Island.

Size class distributions also show that the size and frequency of largest corals of any site occurred at Kāpapa.

With the exception of the snowflake coral *Carijoa riisei*, there were no invasive species in abundance at any site, and most introduced or potentially introduced species found were infrequent and minute cryptogenic hydroids. Interestingly, there were no introduced species other than the ubiquitous fishes *Lutjanus kasmira* (*taape*) and *Cephalopholis argus* (*roi*) found at either O'ahu site, and only one introduced or cryptogenic species was found at Kāpapa, just outside Kāne'ohe Bay, where 166 introduced or cryptogenic species were found at 25 sites in 1999-200 surveys (Coles et al. 2000a). This finding agrees with the conclusion derived from previous surveys at reef sites throughout the MHI which determined that occurrence of introduced species was inversely related with exposure to open ocean conditions (Coles et al 2004, 2006).

Although it is not feasible to differentiate the influences of fishing pressure versus habitat variability in determining fish densities and biomass, the low values determined for the south Lāna'i sites of Po'o Po'o and Pu'u Pehe suggest that substantial fishing may be going on these sites beyond the shore-based pole and line method that is allowed in the Mānele Pu'u Pehe MLC. Enforcement to prevent any poaching that may be going on in this area should therefore be strengthened, and consideration made to extending the boundary to include Po'o Po'o. Conversely, the surprisingly high fish biomass values at Kāpapa and Kāohikaipu are "a world of difference from typical O'ahu sites" (I. Williams, pers. comm.), and these populations should be protected and preserved. The existing conditions may be a de facto result of these sites being relatively hard to exploit due to distance from boat launching areas and/or normally turbulent conditions, but restricting fishing by regulation and implementing diligent enforcement would help to assure preservation of the high fish biomass found at these sites and would possibly have the additional benefit of a spillover effect to nearby areas.

We strongly recommend that the 'Ōkala, Huelo and Nāmoku islets that are in the Kaulapapa NHP boundary, along with Mōkapu Islet which is just outside its boundary, be designated a restricted take MPA with consumption of any fish harvested to be done within the Park itself. This is the wish of the remaining Kaulapapa patients and is supported by Park staff and administrators. Presently the islets are designated Hawai'i State seabird sanctuaries with access to them limited by permit, but no special restrictions apply below the intertidal zone. Under calm conditions the islets are easily accessible from O'ahu and substantial fishing using scuba does occur (E. Brown, pers. comm.). The three islets surveyed at Kaulapapa comprised a variety of unique habitats otherwise unseen elsewhere on our surveys, e.g. the *Sinularia/Palythoa* dominated benthos at 'Ōkala, had high values for species richness, and the highest value for fish apex predators determined for any of our sites. This area should therefore be considered a prime candidate for a special management MPA. Moreover, the close proximity of Kaulapapa NHP staff, marine ecologists and enforcement rangers would assure that regulations and restricted activities would be enforced without additional staffing or funding being required from the state of Hawai'i. Currently discussions are in progress for a cooperative agreement between Kaulapapa NHP and Hawai'i State DAR and DOCARE representatives that would define jurisdiction over these islet areas and could enable enforcement of fishing and access regulations by Park officials. We would encourage that this agreement

be formalized and implemented to replace the current cooperative agreement that expires in August 2009.

VI. ACKNOWLEDGEMENTS

This project could not have been conducted without the assistance of many individuals from the Hawai'i State Division of Aquatic Resources (DAR) and the Kaulapapa National Historical Park. David Gulko of DAR was instrumental in developing the proposal, project objectives and survey protocols. Paul Murakawa coordinated DAR activities, provided boat logistic support and conducted fish surveys on O'ahu. Boat logistics on Lāna'i and Maui were provided through the Maui DAR office by Russell Sparks and John Mitchell, fish surveys at the Lāna'i sites were conducted by Kristy Wong and on Maui by Skippy Hau. On Moloka'i, Eric Brown arranged for accommodations and logistic support and conducted the fish surveys at the Kaulapapa NHP sites, and Randall Watanuki piloted the KHNP boat safely through difficult conditions. Ivor Williams of DAR analyzed and summarized fish transect results, and DAR director Dan Polhemis provided encouragement and support for the project that helped it to receive funding. Funding was provided by NOAA grant NOA06NOS4260200 through the Hawai'i Coral Reef Initiative, and by National Fish and Wildlife Foundation Award No 2006-0078-00 as part of the Hawaiian Offshore Islet Restoration Project. Dale Calder at the Royal Ontario Museum identified hydrozoans. We gratefully thank all of these individuals for making the project possible.

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APPENDIX A

Survey Protocol Used on HCRI Offshore Islet Surveys

OFFSHORE ISLETS SURVEY PROTOCOL

A modification of the Hawai'i Rapid Ecological Assessment (REA) protocols developed by the Hawai'i Division of Aquatic Resources (after Maragos & Gulko, 2002), used by the NOAA Coral Reef Ecosystem Division for coral reef monitoring, and later modified by DAR, USFWS & NOAA's Pacific Island Regional Office for use in active marine investigations:

Team Composition:

- Fish/Invertebrate Team – 2 divers
- Invertebrate/Algae Team – 2 divers
- Surface Support Team (1 vessel operator)

Recommended REA Equipment:

- 2 30m transect lines marked to cm on both sides
- 1 Reef SCUBA Accessories Inc. Cave Reel with 25+ m of yellow line marked off every 1 m and every 1/2 m differently.
- 1 1-m archeological meter scale marked every 10 cm in black and white bars (available from Forestry Suppliers; www.forestry-suppliers.com); used by the benthic team.
- 1 Cave Reel (Reef SCUBA Accessories Inc.) with 10 m of #3 stainless or brass chain for measuring rugosity used by the benthic team.
- Specific data sheets for each specialty that includes dive number and GPS info
- 2 PAM floats with dive flags and 200 m Manta reels
- GPS in waterproof housing
- 4 – 6 Numbered Pelican Floats for establishing impact perimeter and for identifying key points for GPS.
- Handheld waterproof sonar to measure depth from surface.
- Handheld waterproof laser rangefinder (monocular or similar device) to measure surface distances.
- 0.25 m quadrat for measuring community assemblage and conducting algal assessment.
- 2 underwater digital cameras (minimum 4 mpeg) with close-up and macro features. Used by benthic team (it's advisable to also have a camera with the fish team)
- Sealable Sample Buckets with lids labeled: Algal; Coral; Invert.
- 0.66 and 0.165 collapsible camera stands for epibenthic photography

Survey Protocol:

General Reconnaissance

- On arrival at a site, the two diver teams conduct an exploratory dive to delineate the area of focus for the quantitative surveys. The area evaluated can be based upon existing knowledge from previous investigations, public reports, or other available information, but will be sufficiently broad in scope to define the general characteristics of the location in terms of its physical structure, environmental conditions and special sub-habitats such as caves and ledges, or areas of massive or high coverage coral.

- Each diver team carries a surface safety float so that their locations can be monitored by the boat operator, and numbered pelican floats that can be surface-deployed at points of specific interest or the furthest extent of the reconnaissance. If a benthic diver spots a unique sub-habitat the diver releases the pelican float and records characteristics of the sub-habitat along with the number of the diver's Pelican float, the GPS location of which is recorded by surface support personnel. Photo-documentation of the sub-habitat should be done with the digital photographs.
- Comprehensive notes are taken on algae, invertebrates and fish that can be identified on site, and samples will be taken of algae and invertebrates that cannot be identified on site for preservation and laboratory identification, along with records of the specific habitat type from which the organisms were collected. The conditions of abnormal corals and other benthos in the area is assessed and photographed, including the extent of bleaching, apparent diseases, *Acanthaster* predation, alien species competition, entanglement in fishing gear, evident ship grounding, anchor damage, or destructive fishing.
- All members of the benthic team record presence and relative amounts of known alien and invasive benthic species (algal and invertebrate) and fish occurring within the survey area.

Quantitative measurements of benthic coverage and fish assemblages

Fish/Invertebrate Team General Protocol

- Each dive team consists of two divers swimming 25 m belt transects towing a PAM float that serves as surface marker throughout the dive and can provide a safety stop line during strong current conditions while still allowing the surface boat operator to follow the divers as the current moves them away during their safety stops. Use of PAM floats and marking of the transects is done as follows:
- The fish team enters the water with a PAM float and begins the first transect, marking the spot with a pelican buoy. The fish team also records a compass bearing for each transect to assist with later mapping efforts.
- The movement of the float away from the pelican buoy on the second pass by the fish observer provides an signal for the benthic team to enter the water and descend to the start of the first transect line, such that the benthic team does not interfere with the data collection of the fish team by causing additional disturbance to fish populations during the counts. At the end of the third transect the fish tem deploys a second pelican float to mark the end of the three transects and rolls up the third transect line.
- After the fish team has completed the first transect, the benthic team enters the water, and swims to the pelican buoy, towing the second PAM float throughout their dive to mark their continuing position. They then proceed to survey and photograph along the first two transect lines and roll up these lines when they are finished.
- Surface GPS waypoints are taken for the two pelican floats when they are retrieved, which mark the end points of the three transect series

Fish Transect Protocol (Modified after DAR WHAP & NOWRAMP 2000 protocols)

- The fish specialist sets three 25 m transect lines (two of which are also used by the benthic REA team). The fish observer is accompanied by the invertebrate specialist, who follows closely

behind the fish specialist through all three legs of each transect and records all macroinvertebrates occurring within 0.5 m of either side of the transect line.

- During the deployment leg of the transect, the diver records size-class-specific (Total Length, TL) counts of all fishes greater than 20 cm within visually estimated but defined belt widths 2 m on each side of the line), while small and cryptic fish (i.e. less than 20 cm) are counted on a belt width 1 m on each side of the line during the “swim-back” leg.
- Each fish is identified to species. The result is a density estimate of all fishes > 20 cm Total Length (TL) within a 25-m long x 4-m wide (100-m²) area on an initial (“swim-out”) leg, followed by a density estimate of fishes ≤ 20 cm TL within a 25-m long x 2-m wide (50-m² area) on the subsequent (“swim back”) leg, on each of 3 transects, at each dive-station, conditions permitting. Three transects worth of data provided totals of 600 m² searched for large, relatively vagile fish and 300 m² for small, site-attached reef fishes, respectively.
- For cave and vertical wall habitats, the “swim-back” leg is combined with the out-going leg, with the divers proceeding at half the normal speed; this is necessary because, due to specific habitat constraints associated with vertical walls and caves, the fish move away from the divers such that they would not be counted on the return leg.
- All fish transects record rare species and unusual fish habitats during the dive. Upon completion of transects, the fish/invertebrate transect divers retrieve the third transect line and ascend the safety float.
- The data are used both to estimate numerical (and biomass) densities and to describe relative abundance (post-classified sensu DACOR: [Dominant, Abundant, Common, Occasional, Rare] used to qualitatively describe relative abundance.) of the fish assemblage.
- Additional recording of species presence off transects during the reconnaissance dive are used to generate a parent species list for biodiversity and rare species.

Invertebrate Transect Protocol

- Following closely behind the fish transect specialist, the invertebrate specialist makes site-specific identifications of both epibenthic and cryptic macro-invertebrates along a 0.5 m band on either side of both benthic transect lines and takes samples of specimens to be preserved and identified later. The first time that a diver encounters an unknown invertebrate on the transect line the specimen is collected and placed in a bag with as much collection information as possible. For all subsequent encounters the diver notes on his/her data sheet that the invert was seen again. Unknown species are photographed and/or collected for later identification and analysis, and specimens eventually deposited as vouchers in the Bishop Museum's invertebrate collection. Target species include: cnidarians (zoanths, anemones, and hydrocorals), echinoderms (sea urchins, sea cucumbers, and sea stars), mollusks (bivalves, nudibranchs, gastropods and cephalopods), and crustacea (hermit crabs, lobsters, large crabs and shrimp)
- At the end of the transects the invertebrate specialist collects a dead coral head ca. 10 cm in diameter or a similar quantity of loose coral rubble into a sturdy plastic bag for preservation and later identification of invertebrates. Cryptic species are assessed and identified through post-dive examination and sorting from the dead coral or rubble.

Invertebrate (Coral)/Algae Team General Protocol

- Two 25 m transects are conducted per dive. After a wait of 10 to 15 minutes (using the position of the two surface floats as a guide to when the fish team is beginning the second transect), the benthic team enters the water and begins taking data on the first 25 m transect line previously laid and left behind by the fish team. The delay by the benthic team is required in order to minimize disturbance of fish populations being censused by the fish team.
- At the beginning of each transect one of the divers lays a 10 m rugosity and records the length of the chain as it lies on the transect. All members of the benthic team record presence and relative amounts of known alien and invasive benthic species (algal and invertebrate) as they occurred on the transect lines and elsewhere in the survey area

Coral Transect Protocol

- The coral specialist photographs bottom coverage along the entire length of the line at 1.2 m above the center of the line. Photographs are taken using a camera platform which gives a consistent image size throughout the transects of ca. 0.67 m² at the cameras maximum wide angle setting.
- Photographs are taken along the transect line at 1.0 m intervals with the transect line centered in each photograph using line marks as locators.
- Transect photographs are later analyzed using Coral Point Point with Excel (CPCe) software. Each coral colony is coded by its quadrat location and number, outlined using CPCe and its area calculated. This data is used to calculate total areas and size class distribution by species, as well as percent coverage, on the transects. The digital photos also provide a permanent record for future reference. Corals showing signs of disease, predation, abnormal growth, bleaching or direct human impact can be noted.

Algal Transect Protocol:

- The algal specialist uses a camera platform to photograph quadrats with an 0.165 m² image size along the two 25 m transects and collects samples of macroalgal species as possible from a 0.5 m band on either side of the transect line. Photographs are taken every two meters along each transect for a total of 25 images per site.
- The first time that a diver encounters a rare or unidentifiable alga on a transect line it is collected and placed in a bag along with as much collection information as possible. Turf algae are collected by chiseling small randomly selected pieces of dead coral/limestone substrate from the bottom that appear to support dense filamentous algae. Crustose coralline algae are collected by chiseling or breaking off pieces of the benthos where this algae occurs.
- Collected macro-algae or turf algae specimens are either frozen or preserved in 4% formalin in seawater until they can be sorted and identified using a microscope. Specimens are either dried or stored in 4% Formalin. All samples collected in these surveys will be deposited as voucher specimens at the Bishop Museum's phycological collection.
- Images from the transects are analyzed using CPCe point intercept with 55 random points per image and percent frequency by species and of various algal functional forms and dominant or

keystone algae categories are determined from the total 2750 points analyzed per site. The algal specialist will also differentiate community cover (algal/coral/rock/sand/etc.) within the transects..

Upon completion of the coral/algal transect measurements one of the divers retrieves the two transect lines and both divers returns with these and the quadrat frames to the boat.

APPENDIX B

Organisms observed or collected at Lānaʻi Sites: Puʻu Pehe and Poʻo Poʻo

Organism	Taxa	Scientific name	Author Date	Common name	Po'o Po'o Pu'u Pehe	
Algae	CHLOROPHYTA	<i>Caulerpa elongata</i>	Weber-van Bosse		x	
		<i>Cladophora</i> sp.			x	
		<i>Dictyosphaeria cavernosa</i>	(Forssk.) Børgesen		x	
		<i>Halimeda discoidea</i>	Decne.		x	
		<i>Halimeda distorta</i>			x	
		<i>Halimeda opuntia</i>	(L.) J.V.Lamour.		x	
		<i>Microdictyon umbilicatum</i>	Decaisne		x	
		<i>Neomeris annulata</i>	Dickie		x x	
		<i>Parvocaulis parvula</i>	(Solms-Laubach) Berger et al.		x	
	<i>Ventricaria ventricosa</i>	(J.Agardh) Olsen & West		x		
	CYANOBACTERIA	<i>Hormothamnion enteromorphioides</i>	Grunow ex Bornet & Flahault		x	
		<i>Lyngbya confervoides</i>	C.Agardh Ex Gomont		x	
		<i>Microcystis</i> sp.			x	
		<i>Schizothrix calcicola</i>	Kutzing Ex Gomont		x	
		Unid. Cynaobacteria sp. 1			x	
		Unid. Cynaobacteria sp. 2			x	
	PHAEOPHYTA	<i>Dictyota bartayresiana</i>	Lamouroux		x	
		<i>Dictyota ceylanica</i>	Kutzing		x	
		<i>Padina melemele</i>	Magruder & I.A.Abbott		x x	
		<i>Symploca hydroides</i>	(Harvey) Kutzing		x	
	RHODOPHYTA	<i>Acanthophora pacifica</i>	(Setchell) Kraft		x	
		<i>Actinotrichia fragilis</i>	(Forssk.) Børgesen		x	
		<i>Amansia glomerata</i>	C.Agardh		x	
		<i>Asparagopsis taxiformis</i>	(Delile) Trevisan		x x	
		<i>Corallophila</i> sp.			x	
		<i>Dasya iridescens</i>	(Schlech) A.Millar & I.A.Abbott		x	
		<i>Dichotomaria marginata</i>	(Ellis & Sol.) Lamarck		x	
		<i>Dichotomaria obtusata</i>	(Ellis & Sol.) Lamarck		x	
		<i>Gibsmithia hawaiiensis</i>	Doty		x x	
		<i>Haloplegma duperryi</i>	Mont.		x	
		<i>Jania pumila</i>	J.V.Lamour.		x	
		<i>Jania</i> sp.			x	
		<i>Laurencia</i> sp.			x x	
		<i>Portieria hornemannii</i>	(Lyngb.) P.C.Silva		x x	
		<i>Scinaia furcata</i>	Zablackis		x	
		<i>Scinaia hormoides</i>	Setch.		x	
		<i>Tricleocarpa fragilis</i>	(Linneaus) Huisman & Townsend		x	
		Unid. Rhodophyta sp. 32			x	
		Unid. Rhodophyta sp. 33			x	
		Unid. Rhodophyta sp. 34			x	
	Algae Total					30 16
Invertebrates	AMPHIPODA	Unid. amphilocid amphipod		Amphipod	x	
		Unid. caprellid amphipod		Amphipod	x	
		Unid. gamarid amphipod		Amphipod	x	
	ANASPIDEA	Unid. Aplysiidae		Sea Hare	x	
	ANTHOZOA	<i>Aiptasia pulchella</i>	CarlGren, 1943		Glass Anemone	x
		<i>Anthelia edmondsoni</i>	(Verrill, 1928)		Blue Octocoral	x
		<i>Antipathes ulex</i>	Ellis and Solander, 1786		Feathery Black Coral	x
		<i>Carijoa aff. riisei</i>	(Duchassaing & Michelotti, 1860)		Snowflake Coral	x x
		<i>Cirripathes anguina</i>	Dana, 1846		Common Wire Coral	x x
		<i>Culicia rachelfizhardingeae</i>	Cairns 2006			x
		<i>Fungia scutaria</i>	Lamarck, 1801		Mushroom Coral	x

Organism	Taxa	Scientific name	Author Date	Common name	Po'o	Po'o	Pu'u	Pehe
		<i>Leptastrea bewickensis</i>	(Veron et al., 1977)	Bewick's Coral	x		x	
		<i>Leptoseris incrustans</i>	(Quelch, 1886)	Swelling Coral				x
		<i>Montipora capitata</i>	(Dana, 1846)	Rice Coral	x			x
		<i>Montipora flabellata</i>	Studer, 1901	Blue Rice Coral				x
		<i>Montipora patula</i>	Verrill, 1864	Sandpaper Rice Coral	x			x
		<i>Palythoa caesia</i>	Dana, 1848	Blue-Gray Zoanthid	x			x
		<i>Pavona duerdeni</i>	Vaughan, 1907	Duerden's Coral				x
		<i>Pavona varians</i>	Verrill, 1864	Corrugated Coral				x
		<i>Pocillopora eydouxi</i>	Milne Edwards & Haime, 1860	Antler Coral	x			
		<i>Pocillopora meandrina</i>	Dana, 1846	Cauliflower Coral	x			x
		<i>Porites compressa</i>	Dana, 1846	Finger Coral	x			x
		<i>Porites lobata</i>	Dana, 1846	Lobe Coral	x			x
		<i>Protopalythoa</i> sp.		Colonial Anemone	x			
		<i>Rhizopsammia verrilli</i>	Horst, 1926	Verrill's Cup Coral				x
		<i>Sarcothelia edmondsoni</i>	(Verrill, 1928)	Blue Octocoral				x
		<i>Tubastraea coccinea</i>	Lesson, 1829	Orange Cup Coral	x			x
	ASCIDIACEA	<i>Aplidium</i> sp. A		Ivory Tunicate	x			
		<i>Aplidium</i> sp. B		Gold Ring Aplidium				x
		<i>Didemnum</i> sp.		White Didemnid				x
	ASTEROIDEA	<i>Acanthaster planci</i>	Linnaeus, 1758	Crown-of-thorns Starfish				x
		<i>Linckia multifora</i>	(Lamarck, 1816)	Spotted Linckia	x			
	BIVALVIA	<i>Arca</i> sp.		Ark Shell				x
		<i>Arca ventricosa</i>	Lamarck, 1819	Ventricose Ark Shell	x			
		<i>Barbatia divaricata</i>	Sowerby, 1833	Hawaiian Ark	x			
		<i>Kellia rosea</i>	(Dall, Bartsch, & Rehder, 1938)		x			
		<i>Periglypta reticulata?</i>	(Linnaeus, 1758)	Reticulated Venus Shell	x			
		<i>Spondylus violacescens</i>	Lamarck, 1819	Variable Worm Snail				x
	DECAPODA	<i>Calcinus argus?</i>	Wooster, 1982					x
		<i>Calcinus laurentae</i>	Haig & McLaughlin, 1984	Laurent's Hermit Crab	x			
		<i>Calcinus</i> sp.		Hermit Crab				x
		<i>Dardanus sanguinocarpus</i>	Degener, in Edmondson, 1925	Bloody Hermit Crab				x
		<i>Exopalicus maculatus?</i>	(Edmondson, 1930)	Button Crab				x
		<i>Panulirus penicillatus</i>	(Oliver, 1791)	Tufted Spiny Lobster				x
		<i>Schizophorida hilensis</i>	Rathbun, 1906	Hilo Collector Crab	x			
		<i>Simocarinus simplex?</i>	(Dana, 1852)	Simple Collector Crab				x
		<i>Trapezia bidentata</i>	(Forsskal, 1775)	Rusty Guard Crab				x
		<i>Trapezia</i> sp.		Coral Guard Crab	x			
		Unid. Callappidae						x
		Unid. Grapsidae						x
		Unid. Majidae						x
		Unid. Palicidae		Button Crab	x			
		Unid. Pilumnidae						x
		Unid. xanthid						x
		Unid. Xanthidae						x

Organism	Taxa	Scientific name	Author_Date	Common name	Po'o Po'o Pu'u Pehe
Invertebrate	ECHINODERMATA	<i>Acanthaster planci</i>	Linnaeus, 1758	Crown-of-thorns Starfish	x
		<i>Echinothrix calamaris</i>	(Pallas, 1774)	Banded Urchin	x
		<i>Polypectana kefersteinii</i>	(Selenka, 1867)	Keferstein's Sea Cucumber	x
		<i>Triploneustes gratilla</i>	(Linnaeus, 1758)	Collector Urchin	x
	ECHINOIDEA	<i>Diadema paucispinum</i>	(Agassiz, 1863)	Long-Spined Urchin	x
		<i>Echinometra mathaei</i>	(Blainville, 1825)	Rock-Boring Urchin	x x
		<i>Echinostrephus aciculatus</i>	Agassiz, 1863	Needle-spined Urchin	x x
		<i>Echinothrix calamaris</i>	(Pallas, 1774)	Banded Urchin	x
		<i>Echinothrix diadema</i>	(Linnaeus, 1758)	Blue-black Urchin	x
		<i>Eucidaris metularia</i>	Lamarck, 1816	Ten-lined Urchin	x x
	ECTOPROCTA	<i>Bugula dentata</i>	(Lamouroux, 1816)	Blue Fan Bryozoan	x
		<i>Reteporellina denticulata</i>	(Busk, 1884)	Lace Bryozoan	x
		<i>Triphylozoon</i> sp.		Chech Bryozoan	x
	GASTROPODA	<i>Conus miles</i>	Linnaeus, 1758	Soldier Cone	x
		<i>Conus rattus</i>	Hwass in Bruguière, 1792	Rat Cone	x
		<i>Cypraea</i> sp.		Cowry	x
		<i>Cypraea isabella</i>	Linnaeus, 1758	Isabella Cowry	x
		<i>Cypraea maculifera</i>	Schilder, 1932	Reticulated Cowry	x
		<i>Cypraea tigris</i>	Linnaeus, 1758	Tiger Cowry	x
		<i>Drupa ricina</i>	(Linnaeus, 1758)	Spotted Drupe	x
		<i>Drupa rupusidaeus</i>	Roding, 1798	Brilliant Drupe	x
		<i>Hipponix australis</i>	(Lamarck, 1819)	Conical Hoof Shell	x x
		<i>Serpulorbis variabilis</i>	Hadfield & Kay, 1972	Variable Worm Snail	x
		<i>Terebra guttata</i>	(Röding, 1798)	White-spotted Auger	x
		Unid. <i>Bullidae</i>		Bubble Shell	x
		Unid. <i>Columbellidae</i>		Dove Shell	x
		Unid. <i>Costellariidae</i>		Ribbed Miters	x
	Unid. <i>Triphoridae</i>		Triphorid	x	
	HYDROZOA	<i>Eudendrium</i> sp.			x
		<i>Gymnangium hians</i>	(Busk, 1852)	Feather Hydroid	x
		<i>Halecium</i> sp.			x
		<i>Lytocarpia niger</i>	(Nutting, 1905)	Black Hydroid	x
<i>Lytocarpia phyteuma</i>		(Kirchenpauer, 1876)	Feather Hydroid	x x	
<i>Pennaria disticha</i>		Goldfuss, 1820	Christmas Tree Hydroid	x	
<i>Sertularella diaphana</i>		(Allman, 1885)	Diaphanous Hydroid	x x	
<i>Solanderia secunda</i>		(Inaba, 1892)	Sea Fan Hydroid	x	
<i>Tridentata borneensis</i>		(Billard, 1925)		x	
ISOPODA	<i>Colidotea edmondsoni</i>	Miller, 1940	Isopod	x	
	<i>Munna acarina?</i>	Miller, 1941	Isopod	x	
	Unid. janirid isopod		Isopod	x	
	Unid. Joeropsid isopod		Isopod	x	
	Unid. munnid iopod		Isopod	x	
NUDIBRANCHIA	<i>Dendrodoris ?nigra</i>	(Stimpson, 1856)	Black Dendrodoris	x	
	<i>Halgerda terramtuentis</i>	Bertsch & Johnson, 1982	Gold Lace Nudibranch	x x	
	<i>Hexabranchus sanguineus</i>	(Ruppell & Leuckart, 1831)	Spanish Dancer	x	

Organism	Taxa	Scientific name	Author Date	Common name	Po'o Po'o Pu'u Pehe	
Invertebrate	NUDIBRANCHIA	<i>Phyllidia pustulosa</i>	(Cuvier, 1804)	Pustulose Phyllidia	x	
		<i>Phyllidia varicosa</i>	Lamarck, 1801	Varicose Phyllidia	x	
		<i>Tambja morosa</i>	(Bergh, 1877)	Gloomy Nudibranch	x	
	OHIUROIDEA	<i>Ophiocoma</i> sp.		Brittle Star	x	
		<i>Unid. ophiuroid</i>		Brittle Star	x	
	OPHIUROIDEA	<i>Ophiactis modesta?</i>	Brock, 1888	Spiny Brittle Star	x	
		<i>Ophiactis savignyi?</i>	(Muller & Troschel, 1842)	Spiny Brittle Star	x	
		<i>Ophiocoma erinaceus</i>	Muller & Troschel, 1842	Spiny Brittle Star	x	
	POLYCHAETA	<i>?Chaetopterus</i> sp.		Parchment Worm	x	x
		<i>Loimia medusa</i>	(Savigny, 1818)	Medusa Spaghetti Worm		x
		<i>Pherecardia striata</i>	(Kinberg, 1857)	Lined Fireworm	x	x
		<i>Spirobranchus giganteus</i>	(Grube, 1862)	Christmas-tree Worm	x	x
		Unid. <i>Glyceridae</i>			x	x
		Unid. <i>Amphinomid</i>				x
		Unid. <i>Aphroditidae</i>			x	
		Unid. <i>Chaetopteridae</i>			x	
		Unid. <i>Dorvilleidae</i>			x	
		Unid. <i>Nereidae</i>			x	x
		Unid. <i>Phyllodocidae</i>			x	x
		Unid. <i>Polynoidae</i>			x	x
		Unid. <i>Sigalionidae</i>			x	
		Unid. <i>Spintheridae</i>			x	x
		Unid. <i>Spionidae</i>			x	
	Unid. <i>Syllidae</i>			x	x	
	PORIFERA	<i>?Dactylospongia</i> sp.		Yellow Dactylospongia	x	x
		<i>Batzella</i> sp.		Green Batzella	x	x
		<i>Clathria</i> sp.		Vermilion Clathria		x
		<i>Hyrtios</i> sp.	(de Laubenfels, 1954)	Yellow Hyrtios	x	
		<i>Leucetta</i> sp.		White Leucetta		x
		<i>Mycale</i> sp.		Red Mycale	x	
		<i>Spheciospongia vagabunda</i>	(Ridley, 1884)	Vagabond Boring Sponge	x	x
		<i>Stylinos</i> sp.		Orange Stylinos	x	
<i>Timea</i> sp.			Polyp-bearing sponge		x	
SIPUNCULA	<i>Aspidosiphon</i> sp.		Sipunculid	x		
TANAIDACEA	<i>Anatanais insularis?</i>	Miller, 1940	Tanaeid		x	
	Unid. tanaid		Tanaeid		x	
TURBELLARIA	<i>Pseudoceros ferrugineus</i>	Hyman, 1959	Fuchsia Flatworm		x	
Invertebrates Total					89	77
Marine Fish	OSTEICHTHYES	<i>Abudefduf abdominalis</i>	(Quoy & Gaimard, 1824)	Hawaiian Sergeant	x	x
		<i>Abudefduf vaigiensis</i>	(Quoy & Gaimard, 1825)	Indo-pacific Sergeant	x	x
		<i>Acanthurus achilles</i>	Shaw, 1803	Achilles Tang		x
		<i>Acanthurus blochii</i>	Valenciennes, 1835	Ringtail Surgeonfish	x	x
		<i>Acanthurus dussumieri</i>	Valenciennes, 1835	Eyestripe Surgeonfish	x	
		<i>Acanthurus guttatus</i>	(Bloch & Schneider, 1801)	Whitespotted Surgeonfish		x
		<i>Acanthurus leucopareius</i>	(Jenkins, 1903)	Whitebar Surgeonfish	x	x
		<i>Acanthurus nigrofuscus</i>	(Forsskål, 1775)	Lavender Tang	x	x

Organism	Taxa	Scientific name	Author Date	Common name	Po'o	Po'o	Pu'u	Pehe
Marine Fish	OSTEICHTHYES	<i>Acanthurus olivaceus</i>	Bloch & Schneider, 1801	Orangeband Surgeonfish	x		x	
		<i>Acanthurus triostegus</i>	Streets, 1877	Convict Tang	x		x	
		<i>Aphareus furca</i>	(Lacepède, 1802)	Smalltooth Jawfish	x		x	
		<i>Arothron meleagris</i>	(Lacepède, 1798)	Spotted Puffer				x
		<i>Aulostomus chinensis</i>	(Linnaeus, 1766)	Trumpetfish	x		x	
		<i>Bodianus bilunulatus</i>	(Lacepède, 1802)	Hawaiian Hogfish	x		x	
		<i>Calotomus carolinus</i>	(Valenciennes, 1839)	Stareye Parrotfish	x		x	
		<i>Cantherhines dumerilii</i>	(Hollard, 1854)	Barred Filefish				x
		<i>Canthigaster jactator</i>	(Jenkins, 1901)	Whitespotted Toby	x		x	
		<i>Caranx melampygus</i>	Cuvier, 1833	Bluefin Trevally				x
		<i>Centropyge potteri</i>	Jordan & Metz, 1912	Potter's Angelfish	x			
		<i>Cephalopholis argus</i>	Bloch & Schneider, 1801	Peacock Grouper	x		x	
		<i>Chaetodon auriga</i>	Forsskål 1775	Threadfin Butterflyfish	x			
		<i>Chaetodon kleinii</i>	Bloch, 1790	Bluehead Butterflyfish	x			
		<i>Chaetodon lunula</i>	(Lacepède, 1803)	Raccoon Butterflyfish	x		x	
		<i>Chaetodon multicinctus</i>	Garrett, 1863	Pebbled Butterflyfish	x		x	
		<i>Chaetodon ornatissimus</i>	Solander in Cuvier, 1831	Ornate Butterflyfish	x		x	
		<i>Chaetodon quadrimaculatus</i>	Gray, 1831	Fourspot Butterflyfish				x
		<i>Chaetodon unimaculatus</i>	Bloch, 1787	Teardrop Butterflyfish				x
		<i>Chlorurus sordidus</i>	(Forsskål, 1775)	Bullethead Parrotfish	x		x	
		<i>Chromis agilis</i>	Smith, 1960	Agile Chromis	x		x	
		<i>Chromis hanui</i>	Randall & Swerdloff, 1973	Chocolate Dip Chromis	x			
		<i>Chromis vanderbilti</i>	(Fowler, 1941)	Blackfin Chromis	x		x	
		<i>Chromis verater</i>	Jordan & Metz, 1912	Threespot Chromis	x			
		<i>Cirrhilabrus jordani</i>	Snyder, 1904	Flame Wrasse	x			
		<i>Cirrhilabrus fasciatus</i>	(Bennett, 1828)	Redbarred Hawkfish	x			
		<i>Coris gaimard</i>	(Quoy & Gaimard, 1824)	Yellowtail Coris	x		x	
		<i>Coris venusta</i>	Vaillant & Sauvage, 1875	Elegant Coris	x		x	
		<i>Forcipiger flavissimus</i>	Jordan & McGregor, 1898	Forcepsfish	x		x	
		<i>Forcipiger longirostris</i>	(Broussonet, 1782)	Longnose Butterflyfish	x		x	
		<i>Gomphosus varius</i>	Lacepède 1801	Bird Wrasse	x		x	
		<i>Halichoeres ornatissimus</i>	(Garrett, 1863)	Ornate Wrasse	x		x	
		<i>Hemitaurichthys polylepis</i>	(Bleeker, 1857)	Pyamid Butterflyfish	x			
		<i>Kuhlia sandvicensis</i>	(Steindachner, 1876)	Hawaiian Flagtail	x		x	
		<i>Kyphosus bigibbus</i>	Lacepède, 1801	Brown Chub	x			
		<i>Labroides phthiophagus</i>	Randall, 1958	Cleaner Wrasse	x		x	
		<i>Lutjanus fulvus</i>	(Forster in Bloch & Schneider, 1801)	Blacktail Snapper	x			
		<i>Lutjanus kasmira</i>	(Forsskål, 1775)	Blueline Snapper	x		x	
		<i>Melichthys niger</i>	(Bloch, 1786)	Black Triggerfish				x
		<i>Melichthys vidua</i>	(Solander, 1844)	Pinktail Triggerfish	x		x	
		<i>Mulloidichthys flavolineatus</i>	(Lacepède, 1801)	Yellowstripe Goatfish				x
		<i>Mulloidichthys vanicolensis</i>	(Valenciennes, 1831)	Yellowfin Goatfish	x			

Organism	Taxa x	Scientific name	Author_Date	Common name	Po'o Po'o Pu'u Pehe
		<i>Myripristis berndti</i>	Jordan & Evermann, 1903	Bigscale Soldierfish	x
		<i>Naso hexacanthus</i>	(Bleeker, 1855)	Sleek Unicornfish	x
		<i>Naso lituratus</i>	(Forster & Schneider, 1801)	Orangespine Unicornfish	x x
		<i>Naso unicornis</i>	(Forsskål, 1775)	Bluespine Unicornfish	x x
		<i>Ostracion meleagris</i>	(Shaw & Nodder, 1796)	Spotted Boxfish	x
		<i>Oxycheilinus unifasciatus</i>	(Streets, 1877)	Ringtail Wrasse	x
		<i>Paracirrhites arcatus</i>	(Cuvier, 1829)	Arc-eyed Hawkfish	x x
		<i>Paracirrhites forsteri</i>	(Bloch & Schneider, 1801)	Blackside Hawkfish	x x
		<i>Parupeneus bifasciatus</i>	(Lacepède, 1802)	Doublebar Goatfish	x x
		<i>Parupeneus cyclostomus</i>	(Lacepède, 1801)	Blue Goatfish	x x
		<i>Parupeneus multifasciatus</i>	(Quoy & Gaimard, 1825)	Manybar Goatfish	x x
		<i>Plectroglyphidodon johnstonianus</i>	Fowler & Ball, 1924	Blue-eye Damselfish	x x
		<i>Priacanthus meeki</i>	Jenkins, 1904	Hawaiian Bigeye	x
		<i>Pseudocheilinus octotaenia</i>	Jenkins, 1901	Eightstripe Wrasse	x x
		<i>Pseudocheilinus tetrataenia</i>	Schultz, 1960	Fourstripe Wrasse	x
		<i>Rhinecanthus rectangulus</i>	(Bloch & Schneider, 1801)	Reef Triggerfish	x
		<i>Scarus dubius</i>	Bennett, 1828	Regal Parrotfish	x
		<i>Scarus psittacus</i>	Forsskål 1775	Palenose Parrotfish	x
			Forsskål, 1775	Palenose Parrotfish	x
		<i>Scarus rubroviolaceus</i>	Bleeker, 1849	Redlip Parrotfish	x x
		<i>Selar crumenophthalmus</i>	(Bloch, 1793)	Bigeye Scad	x
		<i>Stegastes fasciolatus</i>	(Ogilby, 1889)	Pacific Gregory	x x
		<i>Stethojulis balteata</i>	(Quoy & Gaimard, 1824)	Belted Wrasse	x
		<i>Sufflamen bursa</i>	(Bloch & Schneider, 1801)	Lei triggefish	x
			(Bloch and Schneider, 1801)	Lei triggefish	x
		<i>Sufflamen fraenatus</i>	(Latrielle, 1804)	Bridled Triggerfish	x
		<i>Thalassoma duperrey</i>	(Quoy & Gaimard, 1824)	Saddle Wrasse	x
		<i>Thalassoma lutescens</i>	(Lay & Bennett, 1839)	Sunset Wrasse	x
		<i>Zanclus cornutus</i>	(Linnaeus, 1758)	Moorish Idol	x x
		<i>Zebrasoma flavescens</i>	(Bennett, 1828)	Yellow Tang	x
Marine Fish Total					62 59
Grand Total					181 152

APPENDIX C

Organisms observed or collected at Maui Sites: Kaemi, Hulu and Molokini Outer Rim

Organism	Taxa	Scientific name	Author Date	Common name	HuluKaemiMolokini	
Algae	CHLOROPHYTA	<i>Caulerpa elongata</i>	Weber-van Bosse		x	
		<i>Caulerpa racemosa</i>	(Forsskal) J. Agardh		x	
		<i>Caulerpa taxifolia</i>	(Vahl) C. Agardh		x	
		<i>Chlorodesmis caespitosa</i>	J. Agardh		x	
		<i>Cladophora</i> sp.			x	
		<i>Codium edule</i>	Silva		x	
		<i>Derbesia fastigiata</i>	Taylor		x	
		<i>Halimeda copiosa</i>	Goreau et Graham		x x	
		<i>Halimeda</i> sp.			x	
		<i>Microdictyon setchellianum</i>	Howe		x x x	
		<i>Microdictyon umbilicatum</i>	(Velley) Zanardini		x	
		<i>Neomeris annulata</i>	Dickie		x	
		<i>Neomeris</i> sp.			x	
		<i>Neomeris vanbosseae</i>	Howe		x x	
		<i>Parvocaulis parvula</i>	(Solms-Laubach) Berger et al.		x	
		<i>Ventricaria ventricosa</i>	(J. Agardh) Olsen & West		x	
		CYANOBACTERIA	<i>Lyngbya majuscula</i>	(Dillwyn) Harvey		x
			<i>Lyngbya</i> sp.			x
			<i>Microcystis</i> sp.			x x
	<i>Schizothrix calcicola</i>		Kutzing Ex Gomont		x	
	Unid. Cyanobacteria sp. 62				x	
	PHAEOPHYTA	<i>Dictyopteris australis</i>	(Sonder) Askenasy		x	
		<i>Dictyota bartayresiana</i>	Lamouroux		x	
		<i>Dictyota ceylanica</i>	Kutzing		x	
		<i>Dictyota friabilis</i>	Setchell		x	
		<i>Lobophora variegata</i>	Wormersley ex Oliviera		x	
		<i>Padina boryana</i>	Thivy		x x	
		<i>Padina melemele</i>	Magruder & I.A.Abbott		x	
		<i>Padina</i> sp.			x	
		<i>Padina thivyae</i>	Doty et Newhouse		x	
		<i>Sargassum echinocarpum</i>	J. Agardh		x	
		<i>Sargassum obtusifolium</i>	J. Agardh		x	
		<i>Styopodium flabelliforme</i>	Weber-van Bosse		x x	
		<i>Turbinaria ornata</i>	(Turner) J. Agardh		x x	
		RHODOPHYTA	<i>Acanthophora pacifica</i>	(Setchell) Kraft		x
			<i>Actinotrichia fragilis</i>	(Forssk.) Børgesen		x
	<i>Akalaphycus setchelliae</i>		(Yamada) Huisman et al.		x	
	<i>Asparagopsis taxiformis</i>		(Delile) Trevisan		x x x	
	<i>Ceramium dumosertum</i>		R. E. Norris et Abbott		x	
	<i>Ceramium fimbriatum</i>		Setchell & Gardner		x	
	<i>Ceramium flaccidum</i>		(Kutzing) Ardissonne		x	
	<i>Ceramium</i> sp.				x	
	<i>Dasya iridescens</i>		(Schlech) A. Millar & I.A.Abbott		x	
	<i>Dichotomaria marginata</i>		(Ellis & Solander) Lamarck		x x	
	<i>Dichotomaria obtusata</i>		(Ellis & Solander) Lamarck		x	
	<i>Dotyella hawaiiensis</i>		(Doty & Wainwright) Wormersley & Shepley		x x	
	<i>Galaxaura obtusata</i>		(Ellis & Solander) Lamouroux		x x	
<i>Galaxaura rugosa</i>	(Ellis & Solander) Lamouroux			x		
<i>Gibsmithia hawaiiensis</i>	Doty			x		
<i>Haloplegma duperreyi</i>	Montagne			x		
<i>Herposiphonia parca</i>	Hollenberg			x		

Organism	Taxa	Scientific name	Author Date	Common name	HuluKaemiMolokini
		<i>Herposiphonia</i> sp.			x
		<i>Hypoglossum barbatum</i>	Okamura		x
		<i>Hypoglossum</i> sp.			x
		<i>Jania pumila</i>	Lamouroux		x
		<i>Jania</i> sp.			x x
		<i>Laurencia</i> sp.			x
		<i>Liagora</i> sp. 46			x
		<i>Liagora</i> sp. 47			x
		<i>Liagora</i> sp. 48			x
		<i>Polysiphonia</i> sp.			x x
		<i>Rhodymenia leptophylla</i>	J. Agardh		x
		<i>Scinaia furcata</i>	Zablackis		x
		<i>Stenopeltis gracilis</i>	(Yamada & Tanaka) Itono & Yoshizaki		x
		<i>Tolypocladia glomerulata</i>	(C. Agardh) F. Schmitz		x x
		<i>Tricleocarpa fragilis</i>	(Linnaeus) Huisman & Townsend		x x
		Unid.Rhodophyta sp. #76			x
		Unid.Rhodophyta sp. 68			x
Algae Total					40 30 15
Invertebrates	ALCYONACEA	<i>Sinularia</i> sp.		Leather Coral	x x
	ANTHOZOA	<i>Anthelia edmondsoni</i>	(Verrill, 1928)	Blue Octocoral	x x
		<i>Antipathes</i> sp.		Branching Black Coral	x
		<i>Carijoa</i> aff. <i>riisei</i>	(Duchassaing & Michelotti, 1860)	Snowflake Coral	x x
		<i>Cirripathes anguina</i>	Dana, 1846	Common Wire Coral	x
		<i>Cyphastrea ocellina</i>	(Dana, 1846)	Ocellated Coral	x
		<i>Leptastrea bewickensis</i>	(Veron et al., 1977)	Bewick's Coral	x
		<i>Leptastrea transversa</i>	Klunzinger, 1879	Transverse Coral	x
		<i>Leptoseris incrustans</i>	(Quelch, 1886)	Swelling Coral	x
		<i>Leptoseris</i> sp.			x x
		<i>Leptoseris tubulifera</i>	Vaughan, 1907	Tube Coral	x
		<i>Montipora capitata</i>	(Dana, 1846)	Rice Coral	x x x
		<i>Montipora flabellata</i>	Studer, 1901	Blue Rice Coral	x x
		<i>Montipora patula</i>	Verrill, 1864	Sandpaper Rice Coral	x x x
		<i>Palythoa caesia</i>	Dana, 1848	Blue-Gray Zoanthid	x x
		<i>Palythoa ceasia</i>	Dana, 1848	Blue-Gray Zoanthid	x
		<i>Parazoanthus</i> sp.			x x
		<i>Pavona duerdeni</i>	Vaughan, 1907	Duerden's Coral	x
		<i>Pavona varians</i>	Verrill, 1864	Corrugated Coral	x x x
		<i>Pocillopora eydouxi</i>	Milne Edwards & Haime , 1860	Antler Coral	x x x
		<i>Pocillopora meandrina</i>	Dana, 1846	Cauliflower Coral	x x x
		<i>Porites lobata</i>	Dana, 1846	Lobe Coral	x x x
		<i>Porites lutea</i>	Milne Edwards & Haime , 1851	Mound Coral	x x
		<i>Psammocora</i> sp.			x
		<i>Zoanthus</i> sp. B		Pink Zoanthus	x
	ASCIDIACEA	<i>Aplidium</i> sp. B		Gold Ring Aplidium	x
		<i>Herdmania momus</i>	(Savigny, 1816)	Herdman's Sea Squirt	x
	ASTEROIDEA	<i>Acanthaster planci</i>	Linnaeus, 1758	Crown-of-thorns Starfish	x
	BIVALVIA	<i>Isognomon perna?</i>	(Linnaeus, 1767)	Brown Purse Shell	x
		<i>Spondylus violacescens</i>	Lamarck, 1819	Cliff Oyster	x
	BIVAVIA	<i>Pinctada margaritifera</i>	(Linnaeus, 1758)	Black-Lipped Pearl Oyster	x
	CALCAREA	<i>Leucetta solida</i>	Schmidt, 1862	White Leucetta	x

Organism	Taxa	Scientific name	Author Date	Common name	HuluKaemiMolokini
Invertebrate	CEPHALOPODA	<i>Octopus cyanea</i>	Gray, 1849	Day Octopus	x
	DECAPODA	<i>Alpheus brevipes</i>	Stimpson, 1860	snapping shrimp	x
		<i>Alpheus</i> spp.			x x x
		<i>Calcinus elegans</i>	Milne Edwards, 1836	Hawaiian Elegant Hermit Crab	x
		<i>Ciliopagurus strigatus?</i>	(Herbst, 1804)	Cone Shell Hermit Crab	x
		<i>Dardanus sanguinocarpus</i>	Degener, in Edmondson, 1925	Bloody Hermit Crab	x
		<i>Dynomene</i> sp.			x x
		<i>Echinoecus pentagonus</i>	(A. Milne Edwards, 1879)	Sea Urchin Crab	x
		<i>Metalpheus paragracilis</i>	Coutiere, 1897	snapping shrimp	x
		<i>Panulirus marginatus</i>	(Quoy & Gaimard, 1825)	Banded Spiny Lobster	x
		<i>Percnon planissimum</i>	(Herbst, 1904)	Flat Rock Crab	x x
		<i>Perinea tumida</i>	Dana, 1852		x x x
		<i>Synalpheus paraneomeris</i>	Coutiere, 1905	snapping shrimp	x
		<i>Trapezia</i> sp.		Coral Guard Crab	x
		Unid. Diogenidae sp.			x x x
		Unid. Galatheididae			x
		Unid. Paleamonidae sp. 1			x x x
		Unid. Paleamonidae sp. 2			x
		Unid. Paleamonidae sp. 3			x
		Unid. Xanthidae sp.			x x x
	ECHINODERMATA	<i>Actinopyga mauritiana</i>	(Quoy & Gaimard, 1833)	White-Spotted Sea Cucumber	x
		<i>Echinometra mathaei</i>	(Blainville, 1825)	Rock-Boring Urchin	x
		<i>Echinothrix calamaris</i>	(Pallas, 1774)	Banded Urchin	x
		<i>Echinothrix diadema</i>	(Linnaeus, 1758)	Blue-Black Urchin	x
		<i>Holothuria (Halodeima) atra</i>	Jaeger, 1833	Black Sea Cucumber	x
		<i>Tripeustes gratilla</i>	(Linnaeus, 1758)	Collector Urchin	x x
	ECHINOIDEA	<i>Actinopyga obesa</i>	(Selenka, 1867)	Plump Sea Cucumber	x
		<i>Echinometra mathaei</i>	(Blainville, 1825)	Rock-Boring Urchin	x x
		<i>Echinostrephus aciculatus</i>	Agassiz, 1863	Needle-Spined Urchin	x
		<i>Echinothrix diadema</i>	(Linnaeus, 1758)	Blue-Black Urchin	x x
		<i>Heterocentrotus mammillatus</i>	(Linnaeus, 1758)	Red Pencil Urchin	x
		<i>Tripeustes gratilla</i>	(Linnaeus, 1758)	Collector Urchin	x
	ECTOPROCTA	<i>Crisina radians</i>	(Lamarck, 1816)	Tuning Fork Bryozoan	x
		<i>Parasmittina</i> sp.		Yellow Crust Bryozoan	x x x
		<i>Reteporellina denticulata</i>	(Busk, 1884)	Lace Bryozoan	x x
		<i>Vittaticella uberrima</i>	Harmer, 1957	Lafont's Bryozoan	x
	GASTROPODA	<i>Conus flavidus</i>	Linnaeus, 1758	Yellow Cone	x x
		<i>Cypraea tigris</i>	Linnaeus, 1758	Tiger Cowry	x x
		<i>Drupa (Ricinella) rubusidaeus</i>	Röding, 1798	Brilliant Drupe	x x
		<i>Drupa ricina</i>	(Linnaeus, 1758)	Spotted Drupe	x
		<i>Engina</i> sp?			x
		<i>Latirus nodatus</i>	(Gmelin, 1791)	Knobby Spindle	x x
		<i>Morula uva</i>	(Röding, 1798)	Grape Morula	x
		<i>Serpulorbis variabilis</i>	Hadfield & Kay, 1972	Variable Worm Snail	x x
		<i>Tricolia variabilis</i>	(Pease, 1861)	Variable Pheasant Shell	x x x
		Unid. Hipponicidae			x
		Unid. Turridae			x
		<i>Vexillum (Pusia) piceum</i>	(Pease, 1860)	Ribbed Miter	x
	HOLOTHUROIDEA	<i>Actinopyga mauritiana</i>	(Quoy & Gaimard, 1833)	White-Spotted Sea Cucumber	x
	HYDROZOA	<i>Aglaophenia</i> sp.			x
		<i>Dynamena moluccana</i>		Green Hydroid	x

Organism	Taxa	Scientific name	Author Date	Common name	HuluKaemiMolokini	
Invertebrates	HYDROZOA	<i>Eudendrium</i> sp.	Cryptogenic		x	
		<i>Gymnangium hians</i>	(Busk, 1852)	Feather Hydroid	x x	
		<i>Lytocarpia niger</i>	(Nutting, 1905)	Black Hydroid	x	
		<i>Macrorhynchia philippina</i>	Kirchenpauer, 1872	Phillipine Hydroid	x	
		<i>Pennaria disticha</i>	(Goldfuss, 1820)	Christmas Tree Hydroid	x x x	
		<i>Tridentata borneensis</i>	(Billard, 1925)	Green Hydroid	x	
	NUDIBRANCHIA	<i>Glossodoris rufomarginata</i>	(Bergh, 1890)	White-Margin Nudibranch	x x	
		<i>Phyllidia varicosa</i>	Lamarck, 1801	Varicose Phyllidia	x	
		<i>Pteraeolidia ianthina</i>	(Angas, 1864)	Blue Dragon Nudibranch	x	
	OPHIUROIDEA	<i>Ophiocoma erinaceus</i>	Muller & Troschel, 1842	Spiny Brittle Star	x	
		<i>Ophiocoma pica</i>	Muller & Troschel, 1842	Pied Brittle Star	x	
	OPISTHOBRANCHIA	<i>Stylocheilus striatus</i>	(Quoy & Gaimard, 1824)	Lined Sea Hare	x	
	POLYCHAETA	<i>Chaetopterus</i> sp.		Parchment Worm	x	
		<i>Glycera tessellata</i>	Grube, 1863		x x	
		<i>Loimia medusa</i>	(Savigny, 1818)	Medusa Spaghetti Worm	x	
		<i>Notopygos albiseta</i>	Holly, 1939		x	
		<i>Opisthosyllis brunnea?</i>	Langerhans, 1879		x	
		<i>Pherecardia striata</i>	(Kinberg, 1857)	Lined Fireworm	x x x	
		<i>Phyllochaetopterus socialis</i>	(Claparede, 1870)		x	
		<i>Phyllodoce (Anaitides) madeirensis?</i>	(Langerhans, 1880)		x	
		<i>Phyllodoce (Phyllodoce) hiatti?</i>	Hartman, 1966		x	
		<i>Polyopthalmus pictus</i>	Dujardin, 1839		x	
		<i>Pseudovermilia occidentalis</i>	McIntosh, 1885		x	
		<i>Spirobranchus giganteus</i>	(Grube, 1862)	Christmas-Tree Worm	x x	
		<i>Spirobranchus giganteus corniculatus</i>	(Grube, 1862)	Christmas Tree Worm	x	
		<i>Trypanosyllis zebra</i>	(Grube, 1860)		x	
		Unid. Aphroditidae			x	
		PORIFERA	cf. <i>Axinyssa aculeata</i>	Wilson, 1925	Yellow Axinyssa	x
			<i>Clathria</i> sp.		Vermillion Clathria	x x x
	<i>Hyrtios</i> sp.			Yellow Hyrtios	x	
	<i>Leucetta solida</i>		Schmidt, 1862	White Leucetta	x	
	<i>Timea</i> sp.			Polyp-Bearing Sponge	x	
	UROCHORDATA	<i>Aplidium</i> sp. B		Gold Ring Aplidium	x	
		<i>Didemnum</i> sp.		White Didemnid	x	
		<i>Didemnum</i> sp. 2		Orange-Red Didemnid	x	
	Invertebrates Total					41 64 69
	Marine Fish	OSTEICHTHYES	<i>Abudefduf abdominalis</i>	(Quoy & Gaimard, 1824)	Hawaiian Sergeant	x x
			<i>Abudefduf sordidus</i>	(Forsskål, 1775)	Indo-Pacific Sergeant	x x x
			<i>Acanthurus achilles</i>	Shaw 1803	Achilles Tang	x
			<i>Acanthurus blochii</i>	Valenciennes, 1835	Ringtail Surgeonfish	x x
			<i>Acanthurus dussumieri</i>	Valenciennes, 1835	Eyestripe Surgeonfish	x x
			<i>Acanthurus leucopareius</i>	(Jenkins, 1903)	Whitebar Surgeonfish	x x x
			<i>Acanthurus nigricans</i>	(Linnaeus, 1758)	Golden Surgeonfish	x
			<i>Acanthurus nigrofuscus</i>	(Forsskål, 1775)	Lavender Tang	x x
			<i>Acanthurus olivaceus</i>	Bloch & Schneider 1801	Orangeband Surgeonfish	x
			<i>Acanthurus triostegus</i>	Streets, 1877	Convict Tang	x
			<i>Acanthurus xanthopterus</i>	Valenciennes 1835	Yellowfin Surgeonfish	x
<i>Anampses cuvier</i>			Quoy & Gaimard, 1824	Pearl Wrasse	x x	
<i>Aphareus furca</i>			(Lacepède, 1802)	Smalltooth Jawfish	x	
<i>Bodianus bilunulatus</i>			(Lacepède, 1802)	Hawaiian Hogfish	x x	
<i>Calotomus carolinus</i>			(Valenciennes, 1839)	Stareye Parrotfish	x x x	
<i>Cantherhines</i> sp.					x	

Organism	Taxa	Scientific name	Author Date	Common name	HuluKaemiMolokini
Marine Fish	OSTEICHTHYES	<i>Cantherhines dumerilii</i>	(Hollard, 1854)	Barred Filefish	x x
		<i>Cantherhines sandwichiensis</i>	(Quoy & Gaimard, 1824)	Squaretail Filefish	x
		<i>Canthigaster amboinensis</i>	(Bleeker, 1865)	Ambon Toby	x x
		<i>Canthigaster jactator</i>	(Jenkins, 1901)	Whitespotted Toby	x x x
		<i>Caranx melampygus</i>	Cuvier 1833	Bluefin Trevally	x
		<i>Centropyge potteri</i>	Jordan & Metz 1912	Potter's Angelfish	x
		<i>Cephalopholis argus</i>	Bloch & Schneider, 1801	Peacock Grouper	x
		<i>Chaetodon auriga</i>	Forsskål 1775	Threadfin Butterflyfish	x
		<i>Chaetodon fremblii</i>	Bennett, 1828	Bluestripe Butterflyfish	x x
		<i>Chaetodon kleinii</i>	Bloch 1790	Blacktail Snapper	x
		<i>Chaetodon lunula</i>	(Lacepède, 1803)	Racoon Butterflyfish	x
		<i>Chaetodon miliaris</i>	Quoy & Gaimard 1824	Milletseed Butterflyfish	x
		<i>Chaetodon multicinctus</i>	Garrett, 1863	Pebbled Butterflyfish	x x x
		<i>Chaetodon ornatissimus</i>	Solander in Cuvier, 1831	Ornate Butterflyfish	x x
		<i>Chaetodon quadrimaculatus</i>	Gray, 1831	Fourspot Butterflyfish	x x x
		<i>Chlorurus perspicillatus</i>	(Steindachner, 1879)	Spectacled Parrotfish	x
		<i>Chlorurus sordidus</i>	(Forsskål, 1775)	Bullethead Parrotfish	x x x
		<i>Chromis agilis</i>	Smith 1960	Agile Chromis	x
		<i>Chromis hanui</i>	R&all & Swerdloff 1973	Chocolate Dip Chromis	x
		<i>Chromis vanderbilti</i>	(Fowler, 1941)	Blackfin Chromis	x x x
		<i>Chromis verater</i>	Jordan & Metz 1912	Threespot Chromis	x
		<i>Cirrhitops fasciatus</i>	(Bennett, 1828)	Redbarred Hawkfish	x
		<i>Coris gaimard</i>	(Quoy & Gaimard, 1824)	Yellowtail Coris	x x x
		<i>Coris venusta</i>	Vaillant & Sauvage, 1875	Elegant Coris	x
		<i>Ctenochaetus hawaiiensis</i>	Randall 1955	Blackfin Surgeonfish	x
		<i>Ctenochaetus strigosus</i>	(Bennett, 1828)	Goldring surgeonfish	x x x
		<i>Dascyllus albisella</i>	Gill 1862	Hawaiian Dascyllus	x
		<i>Decapterus macarellus</i>	(Cuvier, 1833)	Mackerel Scad	x x
		<i>Forcipiger flavissimus</i>	Jordan & McGregor, 1898	Forcepsfish	x x x
		<i>Gomphosus varius</i>	Lacepède 1801	Bird Wrasse	x
		<i>Gymnothorax flavimarginatus</i>	(Rüppell, 1830)	Yellowmargin Goatfish	x x
		<i>Halichoeres ornatissimus</i>	(Garrett, 1863)	Ornate Wrasse	x x x
		<i>Hemitaurichthys polylepis</i>	(Bleeker, 1857)	Pyramid Butterflyfish	x
		<i>Kyphosus cinerascens</i>	(Forsskål, 1775)	Highfin Chub	x
		<i>Kyphosus</i> sp.		Chub	x x
		<i>Labroides phthirophagus</i>	Randall, 1958	Cleaner Wrasse	x x
		<i>Lutjanus fulvus</i>	(Forster in Bloch & Schneider, 1801)	Blacktail Snapper	x
		<i>Lutjanus kasmira</i>	(Forsskål, 1775)	Blueline Snapper	x x
		<i>Macropharyngodon geoffroyi</i>	(Quoy & Gaimard, 1824)	Shortnose Wrasse	x
		<i>Melichthys niger</i>	(Bloch, 1786)	Black Triggerfish	x
		<i>Melichthys vidua</i>	(Solander, 1844)	Pinktail Triggerfish	x
		<i>Monotaxis grandoculis</i>	(Forsskål, 1775)	Bigeye Emperor	x
		<i>Mulloidichthys vanicolensis</i>	(Valenciennes, 1831)	Yellowfin Goatfish	x x
		<i>Myripristis berndti</i>	Jordan & Evermann, 1903	Bigscale Soldierfish	x x x
		<i>Naso hexacanthus</i>	(Bleeker, 1855)	Sleek Unicornfish	x
		<i>Naso lituratus</i>	(Forster & Schneider, 1801)	Orangespine Unicornfish	x x x
		<i>Naso unicornis</i>	(Forsskål, 1775)	Bluespine Unicornfish	x x 2
		<i>Ostracion meleagris</i>	Jenkins, 1901	Spotted Boxfish	x x
		<i>Oxycheilinus bimaculatus</i>	(Valenciennes, in Cuvier & Valenciennes, 1840)	Twospot Wrasse	x
		<i>Paracirrhites arcatus</i>	(Cuvier, 1829)	Arc-eyed Hawkfish	x x x
<i>Paracirrhites forsteri</i>	(Bloch & Schneider, 1801)	Blackside Hawkfish	x x		
<i>Parupeneus bifasciatus</i>	(Lacepède, 1802)	Doublebar Goatfish	x x		

Organism	Taxa	Scientific name	Author Date	Common name	HuluKaemiMolokini
Marine Fish	OSTEICHTHYES	<i>Parupeneus cyclostomus</i>	(Lacepède, 1801)	Blue Goatfish	x
		<i>Parupeneus multifasciatus</i>	(Quoy & Gaimard, 1825)	Manybar Goatfish	x x x
		<i>Parupeneus porphyreus</i>	(Jenkins, 1902)	Whitesaddle Goatfish	x
		<i>Plagiotremus goslinei</i>	(Strasburg, 1956)	Gosline's Fangblenny	x x
		<i>Plectroglyphidodon imparipennis</i>	(Vaillant & Sauvage, 1875)	Bright-eye Damselfish	x x x
		<i>Plectroglyphidodon johnstonianus</i>	Fowler & Ball, 1924	Blue-eye Damselfish	x x
		<i>Plectroglyphidodon sindonis</i>	(Jordan & Evermann, 1903)	Hawaiian Rock Damselfish	x
		<i>Priacanthus meeki</i>	Jenkins, 1904	Hawaiian Bigeye	x
		<i>Pseudocheilinus octotaenia</i>	Jenkins 1901	Eightstripe Wrasse	x
		<i>Rhinecanthus rectangulus</i>	(Bloch & Schneider, 1801)	Reef Triggerfish	x x
		<i>Scarus dubius</i>	Bennett, 1828	Regal Parrotfish	x x
		<i>Scarus psittacus</i>	Forsskål 1775	Palenose Parrotfish	x x
		<i>Scarus rubroviolaceus</i>	Bleeker, 1849	Redlip Parrotfish	x x x
		<i>Seriola dumerili</i>	(Risso, 1810)	Greater Amberjack	x
		<i>Stegastes fasciolatus</i>	(Ogilby, 1889)	Pacific Gregory	x x x
		<i>Stethojulis balteata</i>	(Quoy & Gaimard, 1824)	Belted Wrasse	x x
		<i>Sufflamen bursa</i>	(Bloch & Schneider, 1801)	Lei triggerfish	x x x
		<i>Sufflamen fraenatus</i>	(Latrielle, 1804)	Bridled Triggerfish	x
		<i>Thalassoma ballieui</i>	(Vaillant & Sauvage, 1875)	Old Woman Wrasse	x
		<i>Thalassoma duperrey</i>	(Quoy & Gaimard, 1824)	Saddle Wrasse	x x x
		<i>Thalassoma trilobatum</i>	(Lacepède, 1801)	Christmas Wrasse	x x x
		<i>Triaenodon obesus</i>	(Rüppell, 1837)	Whitetip Reef Shark	x
		<i>Xanthichthys auromarginatus</i>	(Bennett, 1831)	Gilded Triggerfish	x
		<i>Zanclus cornutus</i>	(Linnaeus, 1758)	Moorish Idol	x x x
		<i>Zebrasoma flavescens</i>	(Bennett, 1828)	Yellow Tang	x
Marine Fish Total					58 42 67
Grand Total					139 136 151

APPENDIX D

Organisms observed or collected at Moloka'i Sites, Mōkapu, Nāmoku and 'Ōkala

Organism	Taxa	Scientific name	Author Date	Common name	Mōkapu Nāmoku	Ōkala		
Algae	CHLOROPHYTA	<i>Caulerpa nummularia</i>	Harvey ex J. Agardh		x			
		<i>Codium edule</i>	Silva			x		
		<i>Dictyosphaeria versluysii</i>	Weber-van Bosse				x	
		<i>Halimeda</i> sp.					x	
		<i>Microdictyon setchellianum</i>	Howe				x	
		<i>Microdictyon umbilicatum</i>	(Velle) Zanardini			x		
		<i>Neomeris vanbosseae</i>	Howe				x	x
		<i>Parvocaulis parvula</i>	(Solms-Laubach) Berger et al.			x		
		unknown #164				x		
		unknown #165				x		
		unknown #186						x
		unknown #198					x	
		CYANOBACTERIA	unknown #159				x	
			unknown #160				x	
	unknown #161					x		
	unknown #162					x		
	unknown #183							x
	unknown #184							x
	unknown #191						x	
	unknown #192						x	
	PHAEOPHYTA	<i>Dictyota</i> sp.					x	x
		<i>Distromium flabellatum</i>	Wormersley				x	
		<i>Lobophora variegata</i>	Wormersley ex Oliviera			x	x	
		<i>Padina</i> spp.					x	
		<i>Sargassum</i> sp.					x	
		<i>Sporochnus dotyi</i>	Brostoff				x	
		<i>Turbinaria ornata</i>	(Turner) J. Agardh				x	
	RHODOPHYTA	<i>Acanthophora pacifica</i>	(Setchell) Kraft			x	x	
		<i>Amansia glomerata</i>	C. Agardh			x	x	
		<i>Botryocodiella skottsbergii</i>	(Borgesén) Levring					x
		<i>Ceramium borneense</i>	Weber-van Bosse			x		
		<i>Ceramium dumosertum</i>	Norris & Abbott					x
		<i>Ceramium fibriatum</i>						x
		<i>Dasya iridescens</i>	(Schlech) A.Millar & I.A.Abbott			x		
		<i>Gibsmithia hawaiiensis</i>	Doty			x		
		<i>Haloplegma duperryi</i>	Montagne					x
		<i>Halymenia stipitata</i>	Abbott			x		
		<i>Hypoglossum barbatum</i>	Okamura					x
		<i>Jania</i> sp.				x	x	x
		<i>Martensia flabelliformis</i>	Harvey ex J. Agardh			x		
		<i>Neosiphonia</i> sp.						x
		<i>Polysiphonia</i> sp.				x		x
		<i>Portieria hornemannii</i>	(Lyngbye) Silva					x
		<i>Taenioma perpusillum</i>	J. Agardh					x
		<i>Tolypocladiella glomerulata</i>	(C. Agardh) F. Schmitz			x	x	x
		unknown #179				x		
		unknown #180				x		
		unknown #181				x		
		unknown #182				x		
	unknown #215						x	
	unknown #216						x	
	Algae Total					24	29	8

Organism	Taxa	Scientific name	Author Date	Common name	Mōkapu Nāmoku	‘Ōkala	
Invertebrates	ALCYONACEA	<i>Sinularia densa</i>	Whitelegge, 1897	Dense Leather Coral	x	x	
	ANTHOZOA	<i>Antipathes ulex</i>	Ellis & Solander, 1786	Feathery Black Coral		x	
		<i>Carijoa</i> aff. <i>riisei</i>	(Duchassaing & Michelotti, 1860)	Snowflake Coral	x	x	x
		<i>Cirripathes anguina</i>	Dana, 1846	Common Wire Coral	x		x
		<i>Cyphastrea agassizi</i>	Vaughan, 1907	Agassiz's Coral	x		
		<i>Leptastrea bewickensis</i>	(Veron et al., 1977)	Bewick's Coral		x	
		<i>Leptastrea purpurea</i>	Dana, 1846	Crust Coral	x		
		<i>Montipora capitata</i>	(Dana, 1846)	Rice Coral		x	x
		<i>Montipora patula</i>	Verrill, 1864	Sandpaper Rice Coral		x	
		<i>Myriopathes ulex</i>	Ellis & Solander, 1786	Feathery Black Coral			x
		<i>Palythoa caesia</i>	Dana, 1848	Blue-Gray Zoanthid	x		x
		<i>Pavona varians</i>	Verrill, 1864	Corrugated Coral	x	x	x
		<i>Pocillopora eydouxi</i>	Milne Edwards & Haime, 1860	Antler Coral		x	x
		<i>Pocillopora meandrina</i>	Dana, 1846	Cauliflower Coral	x	x	x
		<i>Pocillopora molokensis</i>	Vaughan, 1907	Moloka'i Cauliflower Coral	x	x	x
		<i>Porites compressa</i>	Dana, 1846	Finger Coral			x
		<i>Porites evermanni</i>	Vaughan, 1907	Mound Coral	x		x
		<i>Porites lobata</i>	Dana, 1846	Lobe Coral	x	x	x
		<i>Protospalythoa</i> spp.		Toadstool Zoanthid	x		
		<i>Rhizopsammia verrilli</i>	Horst, 1926	Verrill's Cup Coral			x
		<i>Sarcothelia edmondsoni</i>	(Verrill, 1928)	Blue Octocoral	x		
		<i>Tubastraea coccinea</i>	Lesson, 1829	Orange Cup Coral	x		x
		<i>Zoanthus</i> sp.				x	
		<i>Zoanthus</i> sp. B		Pink Zoanthus	x		
	ASCIDIACEA	<i>Aplidium crateriferum</i>	(Sluiter, 1909)	Cratered Aplidium	x	x	x
		<i>Aplidium</i> sp.		Gray Tunicate			x
		<i>Ascidia sydneiensis</i>	Stimpson, 1855	Yellow-Green Sea Squirt			x
		<i>Didemnum</i> sp.		White Didemnid	x	x	x
		<i>Hermania momus</i>	(Savigny, 1816)	Herdman's Sea Squirt	x		
	ASTEROIDEA	<i>Acanthaster planci</i>	Linnaeus, 1758	Crown-of-thorns Starfish		x	
	BIVALVIA	<i>Spondylus violacescens</i>	Lamarck, 1819	Cliff Oyster		x	
	BIVAVIA	<i>Arca ventricosa</i>	Lamarck, 1819	Ventricose Ark Shell	x		
		<i>Pinctada margaritifera</i>	(Linnaeus, 1758)	Black-Lipped Pearl Oyster	x		x
	CHELICERATA	Unid. Halacaridae		Marine Mite	x		x
	DECAPODA	<i>Alpheus brevipes</i>	Stimpson, 1860	Snapping Shrimp		x	
		<i>Alpheus clypeatus</i>	Coutiere, 1905	Snapping Shrimp		x	x
		<i>Caecopilumnus crassipes</i>	(Randall, 1839)			x	
		<i>Calcinus guamensis</i>	Wooster, 1982	Guam Hermit Crab	x	x	
		<i>Chlorodiella laevissima</i>	(Dana, 1852)			x	
		<i>Chlorodiella nigra</i>	(Forskal, 1775)		x		
		<i>Ciliopagurus strigatus</i>	(Herbst, 1804)	Cone Shell Hermit Crab			x
		<i>Dardanus sanguinocarpus</i>	Degener, in Edmondson, 1925	Bloody Hermit Crab		x	x
		<i>Domecia hispida</i>	Eydoux & Souleyet, 1842			x	
		<i>Echinoecus pentagonus</i>	(A. Milne Edwards, 1879)	Sea Urchin Crab			x
		<i>Liocarpilodes integerrimus</i>	Dana, 1852		x	x	
		<i>Metalpheus paragracilis</i>	Coutiere, 1897	Snapping Shrimp		x	
		<i>Metalpheus rostratipes</i>	(Pocock, 1890)	Snapping Shrimp		x	
<i>Pachycheles pisoides</i>		(Heller, 1865)		x			
<i>Panulirus marginatus</i>		(Quoy & Gaimard, 1825)	Banded Spiny Lobster	x			

Organism	Taxa	Scientific name	Author_Date	Common name	Mōkapu Nāmoku	ʻŌkala	
Invertebrate	DECAPODA	<i>Panulirus penicillatus</i>	(Oliver, 1791)	Tufted Spiny Lobster		x	
		<i>Perinea tumida</i>	Dana, 1852	Collector Crab	x	x	x
		<i>Pilodius areolatus</i>	(H. Milne Edwards, 1834)			x	
		<i>Pilodius flavus</i>	Rathbun, 1893	Xanthid Crab			x
		<i>Platypodia semigranosa</i>	(Heller, 1861)		x		
		<i>Pseudolimera variolosa</i>	(Borradaile, 1902)	Xanthid Crab			x
		<i>Pseudoliomera speciosa</i>	(Dana, 1852)	Showy Xanthid Crab		x	
		<i>Stenopus hispidus</i>	(Olivier, 1811)	Banded Coral Shrimp	x		x
		<i>Synalpheus paraneomeris</i>	Coutiere, 1905	Snapping Shrimp	x	x	
		<i>Trapezia bidentata</i>	(Forsskål, 1775)	Rusty Guard Crab		x	
		<i>Trapezia digitalis</i>	Latreille, 1825	Brown Guard Crab		x	x
		<i>Trapezia</i> sp.		Coral Guard Crab	x	x	
		<i>Trapezia tigrina</i>	Eydoux & Souleyet, 1842	Coral Guard Crab			x
		Unid. Galatheidae				x	
		Unid. Paleomonidae		Commensal Shrimp		x	
		Unid. xanthid			x		
		ECHINODERMATA	<i>Culcita novaeguineae</i>	Muller & Troschel, 1842	Cushion Star	x	
	<i>Mithrodia fisheri</i>		Holly, 1932	Fisher's Star	x		
	ECHINOIDEA	<i>Echinometra mathaei</i>	(Blainville, 1825)	Rock-Boring Urchin	x	x	
		<i>Echinostrephus aciculatus</i>	Agassiz, 1863	Needle-Spined Urchin	x	x	x
		<i>Echinothrix calamaris</i>	Pallas, 1774	Banded Urchin	x	x	x
		<i>Eucidaris metularia</i>	Lamarck, 1816	Ten-Lined Urchin	x		
		<i>Heterocentrotus mammillatus</i>	(Linnaeus, 1758)	Red Pencil Urchin		x	
	ECTOPROCTA	<i>Bugula dentata</i>	(Lamouroux, 1816)	Blue Fan Bryozoan			x
		<i>Crisina radians</i>	(Lamarck, 1816)	Tuning Fork Bryozoan	x	2	x
		<i>Parasmittina</i> sp.		Yellow Crust Bryozoan			x
		<i>Reteporellina denticulata</i>	(Busk, 1884)	Lace Bryozoan	x		x
		<i>Vittaticella uberrima</i>	Harmer, 1957	Lafont's Bryozoan	x		
	GASTROPODA	<i>Cellana exarata</i>	(Reeve, 1854)	Black-foot Ophi	x		
		<i>Conus circumactus?</i>	Iredale, 1929	Circumactis Cone		x	
		<i>Conus flavidus?</i>	Linnaeus, 1758	Yellow Cone		x	
		<i>Conus imperialis?</i>	Linnaeus, 1758	Imperial Cone		x	
		<i>Conus lividus?</i>	Hwass in Bruguière, 1792	Spiteful Cone		x	
		<i>Cypraea leviathan</i>	Schilder & Schilder, 1938	Leviathan Cowry	x		
		<i>Cypraea maculifera</i>	Schilder, 1932	Reticulated Cowry		x	x
		<i>Drupa rubusidaeus</i>	(Röding, 1798)	Brilliant Drupe	x		x
		<i>Latirus nodatus</i>	(Gmelin, 1791)	Knobby Spindle		x	x
		<i>Morula uva</i>	(Röding, 1798)	Grape Morula		x	
	<i>Serpulorbis variabilis</i>	Hadfield & Kay, 1972	Variable Worm Snail	x	x		
	HOLOTHUROIDEA	<i>Actinopyga mauritiana</i>	(Quoy & Gaimard, 1833)	White-Spotted Sea Cucumber			x
		<i>Holothuria (Halodeima) atra</i>	Jaeger, 1833	Black Sea Cucumber	x	x	x
		<i>Holothuria (Microthele) whitmaei</i>	Bell, 1887	Teated Sea Cucumber	x		x
	HYDROZOA	<i>Aglaophenia</i> sp.				x	x
		<i>Antennella secundaria</i>	(Gmelin, 1791)				x
		<i>Dynamena</i> sp.		Green Hydroid	x		
		<i>Gymnangium hians</i>	(Busk, 1852)	Feather Hydroid	x		
		<i>Lytocarpia niger</i>	(Nutting, 1905)	Black Hydroid	x		x
		<i>Macrorhynchia philippina</i>	Kirchenpauer, 1872	Phillipine Hydroid	x		x
		<i>Pennaria disticha</i>	Goldfuss, 1820	Christmas Tree Hydroid		x	
		<i>Plumularia strictocarpa</i>	Pictet, 1893		x	x	

Organism	Taxa	Scientific name	Author Date	Common name	Mōkapu	Nāmoku	‘Ōkala
Invertebrate	HYDROZOA	<i>Sertularella diaphana</i>	(Allman, 1885)	Diaphanous Hydroid			x
		<i>Sertularella tongensis</i>	Stechow, 1919			x	
		<i>Tridentata ligulata</i>	(Thornely, 1904).			x	
	NEMERTINA	<i>Baseodiscus cingulatus</i>	(Coe, 1906)	Banded Ribbon Worm	x		
	NUDIBRANCHIA	<i>Chromodoris vibrata</i>	(Pease, 1860)	Trembling Nudibranch	x		
		<i>Glossodoris rufomarginata</i>	(Bergh, 1890)	White-Margin Nudibranch	x		x
		<i>Peltodoris fellowsi</i>	Kay & Young, 1969	Fellow's Nudibranch			x
		<i>Phyllidia pustulosa</i>	(Cuvier, 1804)	Pustulose Phyllidia			x
	OPHIUROIDEA	<i>Phyllidia varicosa</i>	Lamarck, 1801	Varicose Phyllidia			x
		<i>Ophiocoma pica</i>	Muller & Troschel, 1842	Pied Brittle Star		x	
	PLATYHELMINTHES	Unid. Ophiuroid		Brittle Star			x
		<i>Pseudoceros ferrugineus</i>	Hyman, 1959	Fuchsia Flatworm	x		x
	POLYCHAETA	<i>Loimia medusa</i>	(Savigny, 1818)	Medusa Spaghetti Worm	x		x
		<i>Phyllochaetopterus socialis</i>	(Claparede, 1870)		x		
		<i>Polyophthalmus pictus</i>	Dujardin, 1839				x
		<i>Pseudovermilia occidentalis</i>	McIntosh, 1885		x	x	x
		<i>Salmacina dysteri</i>	(Huxley, 1855)	Sea Frost	x	x	x
		<i>Spirobranchus giganteus corniculatus</i>	(Grube, 1862)	Christmas Tree Worm	x	x	x
		PORIFERA	<i>Clathria</i> sp.		Vermilion Clathria	x	x
	<i>Leucetta solida</i>		Schmidt, 1862	White Leucetta	x		
	<i>Spongia oceania</i>		de Laubenfels, 1950	Black Reef Sponge	x		
	<i>Timea</i> sp.			Polyp-Bearing Sponge			x
	Invertebrates Total					65	58
Marine Fish	OSTEICHTHYES	<i>Abudefduf abdominalis</i>	(Quoy & Gaimard, 1824)	Hawaiian Sergeant	x	x	
		<i>Abudefduf sordidus</i>	(Forsskål, 1775)	Indo-pacific Sergeant			x
		<i>Abudefduf vaigiensis</i>	(Quoy & Gaimard, 1825)	Indo-pacific Sergeant	x	x	
		<i>Acanthurus blochii</i>	(Valenciennes, 1831)	Ringtail Surgeonfish		x	x
		<i>Acanthurus dussumieri</i>	Valenciennes, 1835	Eyestripe Surgeonfish	x	x	x
		<i>Acanthurus guttatus</i>	(Bloch & Schneider, 1801)	Whitespotted Surgeonfish			x
		<i>Acanthurus leucopareius</i>	(Jenkins, 1903)	Whitebar Surgeonfish	x	x	x
		<i>Acanthurus nigrofuscus</i>	(Forsskål, 1775)	Lavender Tang	x	x	x
		<i>Acanthurus nigroris</i>	Valenciennes, 1835	Blueline Surgeonfish	x	x	x
		<i>Acanthurus olivaceus</i>	Forster & Schneider, 1801	Orangeband Surgeonfish	x	x	
		<i>Acanthurus triostegus</i>	Streets, 1877	Convict Tang			x
		<i>Anampses chrysocephalus</i>	Randall, 1958	Psychedelic Wrasse	x		
		<i>Aphareus furca</i>	(Lacepède, 1802)	Smalltooth Jawfish		x	x
		<i>Aprion virescens</i>	Valenciennes, 1830	Green Jobfish			x
		<i>Arothron meleagris</i>	(Lacepède, 1798)	Spotted Puffer	x		
		<i>Aulostomus chinensis</i>	(Linnaeus, 1766)	Trumpetfish	x		
		<i>Bodianus bilunulatus</i>	(Lacepède, 1802)	Hawaiian Hogfish	x	x	x
		<i>Calotomus carolinus</i>	(Valenciennes, 1839)	Stareye Parrotfish	x	x	x
		<i>Cantherhines dumerilii</i>	(Hollard, 1854)	Barred Filefish			x
		<i>Cantherhines sandwichiensis</i>	Quoy & Gaimard, 1824)	Squartetail Filefish	x	x	x
		<i>Cantherhines verecundus</i>	E.K. Jordan, 1925	Shy Filefish	x		
		<i>Canthigaster coronata</i>	(Vaillant & Sauvage, 1875)	Crown Toby	x		
		<i>Canthigaster jactator</i>	(Jenkins, 1901)	Whitespotted Toby	x	x	x
		<i>Caracanthus typicus</i>	Kroyer, 1845		x	x	
		<i>Caranx melampygus</i>	Cuvier 1833	Bluefin Trevally			x
		<i>Centropyge potteri</i>	Jordan & Metz, 1912	Potter's Angelfish	x		x
		<i>Cephalopholis argus</i>	Bloch & Schneider, 1801	Peacock Grouper			x
		<i>Chaetodon auriga</i>	Forsskål, 1775	Threadfin Butterflyfish			x

Organism	Taxa	Scientific name	Author Date	Common name	Mōkapu	Nāmoku	‘Ōkala
Marine Fish	OSTEICHTHYES	<i>Chaetodon fremblii</i>	Bennett, 1828	Bluestripe Butterflyfish	x	x	x
		<i>Chaetodon kleinii</i>	Bloch, 1790	Bluehead Butterflyfish	x		
		<i>Chaetodon lunula</i>	(Lacepède, 1803)	Raccoon Butterflyfish		x	x
		<i>Chaetodon lunulatus</i>	Quoy & Gaimard, 1825	Oval Butterkyfish	x	x	
		<i>Chaetodon miliaris</i>	Quoy & Gaimard, 1824	Milletseed Butterflyfish	x	x	x
		<i>Chaetodon multicinctus</i>	Garrett, 1863	Pebbled Butterflyfish	x	x	x
		<i>Chaetodon quadrimaculatus</i>	Gray, 1831	Fourspot Butterflyfish	x	x	x
		<i>Chlorurus perspicillatus</i>	(Steindachner, 1879)	Spectacled Parrotfish	x	x	
		<i>Chromis agilis</i>	Smith, 1960	Agile Chromis		x	x
		<i>Chromis hanui</i>	R&all & Swerdloff, 1973	Chocolate Dip Chromis	x	x	x
		<i>Chromis ovalis</i>	Steindacher, 1900	Oval Chromis	x	x	x
		<i>Chromis vanderbilti</i>	(Fowler, 1941)	Blackfin Chromis	x	x	x
		<i>Chromis verater</i>	Jordan & Metz, 1912	Threespot Chromis	x		x
		<i>Cirrhitops fasciatus</i>	(Bennett, 1828)	Redbarred Hawkfish	x	x	x
		<i>Cirrhitus pinnulatus</i>	(Bloch & Schneider, 1801)	Stocky Hawkfish		x	
		<i>Cirripectes vanderbilti</i>	(Fowler, 1938)	Scarface Blenny		x	
		<i>Coris gaimard</i>	(Quoy & Gaimard, 1824)	Yellowtail Coris		x	
		<i>Coris venusta</i>	Vaillant & Sauvage 1875	Elegant Coris			x
		<i>Ctenochaetus strigosus</i>	(Bennett, 1828)	Goldring Surgeonfish	x	x	x
		<i>Decapterus macarellus</i>	(Cuvier, 1833)	Mackerel Scad	x	x	
		<i>Dendrochirus barberi</i>	(Steindachner, 1900)	Hawaiian Lionfish		x	
		<i>Desmoholacanthus arcuatus</i>	(Gray, 1831)	Bandit Angelfish	x		x
		<i>Forcipiger flavissimus</i>	Jordan & McGregor, 1898	Forcepsfish		x	x
		<i>Gomphosus varius</i>	Lacepède, 1801	Bird Wrasse		x	
		<i>Halichoeres ornatissimus</i>	(Garrett, 1863)	Ornate Wrasse		x	x
		<i>Hemiramphus depauperatus</i>	Lay & Bennett 1839			x	
		<i>Kyphosus bigibbus</i>	Lacepede, 1801	Brown Chub	x	x	
		<i>Kyphosus cinerascens</i>	(Forsskål, 1775)	Highfin Chub		x	x
		<i>Labroides phthirophagus</i>	Randall, 1958	Cleaner Wrasse	x	x	x
		<i>Lutjanus fulvus</i>	(Forster, 1801)	Blacktail Snapper		x	
		<i>Lutjanus kasmira</i>	(Forsskål, 1775)	Blueline Snapper	x	x	
		<i>Macropharyngodon geoffroyi</i>	(Quoy & Gaimard, 1824)	Shortnose Wrasse		x	
		<i>Melichthys niger</i>	(Bloch, 1786)	Black Triggerfish	x		x
		<i>Melichthys vidua</i>	(Solander, 1844)	Pinktail Triggerfish	x	x	x
		<i>Monotaxis grandoculis</i>	(Forsskål, 1775)	Bigeye Emperor		x	
		<i>Mulloidichthys vanicolensis</i>	(Valenciennes, 1831)	Yellowfin Goatfish	x		
		<i>Myripristis amaena</i>	(Castelnau, 1873)	Brick Soldierfish		x	
		<i>Myripristis berndti</i>	Jordan & Evermann, 1903	Bigscale Soldierfish	x	x	x
		<i>Naso brevirostris</i>	(Valenciennes, 1835)	Spotted Unicornfish	x	x	
		<i>Naso hexacanthus</i>	(Bleeker, 1855)	Sleek Unicornfish	x	x	
		<i>Naso lituratus</i>	Forster & Schneider, 1801	Orangespine Unicornfish	x	x	x
		<i>Naso unicornis</i>	(Forsskål, 1775)	Bluespine Unicornfish		x	x
		<i>Ostracion meleagris</i>	(Shaw & Nodder, 1796)	Spotted Boxfish	x		
		<i>Paracirrhites arcatus</i>	(Cuvier, 1829)	Arc-eyed Hawkfish	x	x	x
		<i>Paracirrhites forsteri</i>	(Bloch & Schneider, 1801)	Blackside Hawkfish		x	x
		<i>Parupeneus bifasciatus</i>	(Lacepede, 1801)	Doublebar Goatfish		x	
		<i>Parupeneus cyclostomus</i>	(Lacepède, 1801)	Blue Goatfish		x	x
		<i>Parupeneus multifasciatus</i>	(Quoy & Gaimard, 1825)	Manybar Goatfish	x	x	x
		<i>Parupeneus pleurostigma</i>	(Bennett, 1831)	Sidespot Goatfish		x	
		<i>Parupeneus porphyreus</i>	(Jenkins., 1902)	Whitesaddle Goatfish		x	
<i>Plagiotremus ewaensis</i>	(Brock, 1948)	Ewa Fangblenny		x			

Organism	Taxa	Scientific name	Author Date	Common name	Mōkapu Nāmoku	‘Ōkala	
Marine Fish	OSTEICHTHYES	<i>Plagiotremus goslinei</i>	(Strasburg, 1956)	Gosline's Fangblenny	x		
		<i>Plectroglyphidodon imparipennis</i>	(Vaillant & Sauvage, 1875)	Bright-eye Damselfish	x	x	
		<i>Plectroglyphidodon johnstonianus</i>	Fowler & Ball, 1924	Blue-eye Damselfish	x	x	x
		<i>Pseudocheilinus octotaenia</i>	Jenkins, 1901	Eightstripe Wrasse			x
		<i>Pseudocheilinus tetrataenia</i>	Schultz, 1960	Fourstripe Wrasse	x	x	x
		<i>Rhinecanthus rectangulus</i>	(Bloch & Schneider, 1801)	Reef Triggerfish		x	
		<i>Scarus dubius</i>	Bennett, 1828	Regal Parrotfish		x	
		<i>Scarus psittacus</i>	Forsskål, 1775	Palenose Parrotfish	x	x	x
		<i>Scarus rubroviolaceus</i>	Bleeker, 1849	Redlip Parrotfish	x	x	x
		<i>Scomberoides lysan</i>	(Forsskål, 1775)	Leatherback	x		
		<i>Scorpaenopsis cacopsis</i>	Jenkins,, 1901	Titan Scorpionfish	x		
		<i>Sebastapistes ballieui</i>	(Sauvage, 1875)	Spotfin Scorpionfish	x		x
		<i>Sebastapistes coniorta</i>	Jenkins, 1903	Speckled Scorpionfish	x		x
		<i>Sphyræna barracuda</i>	(Walbaum, 1792)	Great Barracuda			x
		<i>Stegastes fasciolatus</i>	(Ogilby, 1889)	Pacific Gregory	x	x	x
		<i>Stethojulis balteata</i>	(Quoy & Gaimard, 1824)	Belted Wrasse		x	x
		<i>Sufflamen bursa</i>	(Bloch & Schneider, 1801)	Lei triggerfish	x	x	x
		<i>Sufflamen fraenatus</i>	(Latrielle, 1804)	Bridled Triggerfish	x		x
		<i>Thalassoma duperrey</i>	(Quoy & Gaimard, 1824)	Saddle Wrasse	x	x	x
		<i>Thalassoma trilobatum</i>	(Lacepède, 1801)	Christmas Wrasse	x	x	x
		<i>Xanthichthys auromarginatus</i>	(Bennett, 1831)	Gilded Triggerfish	x		
		<i>Zanclus cornutus</i>	(Linnaeus, 1758)	Moorish Idol	x	x	x
		<i>Zebrasoma flavescens</i>	(Bennett, 1828)	Yellow Tang		x	
<i>Zebrasoma veliferum</i>	(Bloch, 1797)	Sailfin Tang		x			
Marine Fish Total					61	82	59
Grand Total					150	169	127

APPENDIX E

Organisms observed or collected at O'ahu Sites, Kāohikaipu, and Kāpapa

Organism	Taxa	Scientific name	Author Date	Common name	Kāohikaipu Kāpapa
Algae	CHLOROPHYTA	<i>Codium arabicum</i>	Kutzing		x
		<i>Codium edule</i>	Silva		x
		<i>Dictyosphaeria cavernosa</i>	(Forsskål) Borgesen		x
		<i>Halimeda copiosa</i>	Goreau & Graham		x
		<i>Halimeda discoidea</i>	Decaisne		x
		<i>Neomeris vanbosseae</i>	Howe		x x
		<i>Phylodictyon anastomosans</i>	(Harvey) Kraft & Wynne		x
	CYANOBACTERIA	<i>Blennothrix cf. lyngbyacea</i>	(Kutzing) Anagnostidis & Komarek		x
		<i>Hormothamnion enteromorphioides</i>	Grunow ex Bornet & Flahault		x
		<i>Lynbya cf. majuscula</i>	(Dillwyn) Harvey		x
		<i>Phormidium laysanense</i>	Lemmermann		x
		<i>Schizothrix calcicola</i>	Kutzing Ex Gomont		x
		<i>Schizothrix sp.</i>			x
		<i>Spirocoleus sp.</i>			x
	PHAEOPHYTA	<i>Dictyota bartayresiana</i>	Lamouroux		x
		<i>Dictyota friabilis</i>	Setchell		x
		<i>Lobophora variegata</i>	Wormersley ex Oliviera		x
		<i>Padina boryana</i>	Thivy		x
		<i>Styopodium flabelliforme</i>	Weber-van Bosse		x
		<i>Turbinaria ornata</i>	(Turner) J. Agardh		x
	RHODOPHYTA	<i>Acanthophora pacifica</i>	(Setchell) Kraft		x x
		<i>Actinotrichia fragilis</i>	(Forsskål) Borgesen		x
		<i>Amansia glomerata</i>	C. Agardh		x x
		<i>Asparagopsis taxiformis</i>	(Delile) Trevisan		x x
		<i>Ceramium dumosertum</i>	Norris & Abbott		x
		<i>Ceramium flaccidum</i>	(Kutzing) Ardissonne		x
		<i>Ceramium? Polysiphonia?</i>			x
		<i>Chondrophyucus parvipapillatus</i>	(Tseng) Garbary & Harper		x
		<i>Crouania minutissima</i>	Yamada		x
		<i>Dotyella sp.</i>			x
		<i>Galaxaura obtusata</i>	(Ellis & Solander) Lamouroux		x
		<i>Galaxaura rugosa</i>	Ellis & Solander		x
		<i>Gelidium sp.</i>			x
		<i>Gibsmithia hawaiiensis</i>	Doty		x
		<i>Griffithsia heteromorpha</i>	(Kutzing)		x
		<i>Haloplegma duperreyi</i>	Montagne		x
		<i>Halymenia stipitata</i>	Abbott		x
		<i>Herposiphonia secunda</i>	(C. Agardh) Ambronn		x
		<i>Herposiphonia sp.</i>			x
		<i>Hypnea spinella</i>	(C. Agardh) Kutz		x
		<i>Hypoglossum sp.</i>			x
		<i>Jania sp.</i>			x x
		<i>Laurencia sp.</i>			x x
		<i>Liagora sp.</i>			x
		<i>Martensia fragilis</i>	Harvey		x
		<i>Neosiphonia sphaerocarpa</i>	(Borgesen) Kim & Lee		x
		<i>Peleophycus multiprocarpum</i>	Abbott		x
		<i>Polysiphonia flaccidissima</i>	Hollenberg		x
	<i>Polysiphonia sp.</i>			x	
	<i>Portieria hornemannii</i>	(Lyngb.) P.C.Silva		x	
<i>Tolypocladia glomerulata</i>	(C. Agardh) F. Schmitz		x x		
Algae Total				18	40

Organism	Taxa	Scientific name	Author Date	Common name	Kāohikaipu Kāpapa	
Invertebrate	ALCYONACEA	<i>Sinularia</i> sp.		Leather Coral	x	
	AMPHIPODA	<i>Unid. Caprellidae</i>			x	
	ANTHOZOA	<i>Anthelia edmondsoni</i>	(Verrill, 1928)	Blue Octocoral	x	
		<i>Fungia scutaria</i>	Lamarck, 1801	Mushroom Coral	x	
		<i>Leptastrea transversa</i>	Klunzinger, 1879	Transverse Coral	x	
		<i>Leptoseris incrustans</i>	(Quelch, 1886)	Swelling Coral	x	
		<i>Leptoseris tubulifera</i>	Vaughan, 1907	Tube Coral	x	
		<i>Montipora capitata</i>	(Dana, 1846)	Rice Coral	x x	
		<i>Montipora flabellata</i>	Studer, 1902	Blue Rice Coral	x x	
		<i>Montipora patula</i>	Verrill, 1864	Sandpaper Rice Coral	x x	
		<i>Palythoa caesia</i>	Dana, 1848	Blue-Gray Zoanthid	x	
		<i>Palythoa ceasia</i>	Dana, 1848	Blue-Gray Zoanthid	x	
		<i>Pavona duerdeni</i>	Vaughan, 1907	Duerden's Coral	x x	
		<i>Pavona varians</i>	Verrill, 1864	Corrugated Coral	x x	
		<i>Pocillopora eydouxi</i>	Milne Edwards & Haime , 1860	Antler Coral	x	
		<i>Pocillopora meandrina</i>	Dana, 1846	Cauliflower Coral	x x	
		<i>Porites compressa</i>	Dana, 1846	Finger Coral	x	
		<i>Porites evermanni</i>	Vaughan, 1907	Mound Coral	x	
		<i>Porites lobata</i>	Dana, 1846	Lobe Coral	x x	
		<i>Psammocora stellata</i>	Verrill, 1864	Stellar Coral	x	
		<i>Sarcothelia edmondsoni</i>	(Verrill, 1928)	Blue Octocoral	x	
		<i>Sinularia densa</i>	Whitelegge, 1897	Dense Leather Coral	x	
		<i>Tubastraea coccinea</i>	Lesson, 1829	Orange Cup Coral	x	
		<i>Zoanthus</i> sp.			x	
		<i>Zoanthus</i> sp. B		Pink Zoanthus	x	
		ASCIDACEA	<i>Didemnum</i> sp.		White Didemnid	x
			<i>Didemnum</i> sp. 1		Orange Didemnid	x
		ASCIDIACEA	<i>Aplidium crateriferum</i>	(Sluiter, 1909)	Cratered Aplidium	x
	<i>Didemnum</i> sp.			White Didemnid	x	
	BIVALVIA	<i>Pinctada margaritifera</i>	(Linnaeus, 1758)	Black-lipped Pearl Oyster	x	
		<i>Spondylus violacescens</i>	Lamarck, 1819	Cliff Oyster	x	
		<i>Streptopinna saccata</i>	(Linnaeus, 1758)	Baggy Pen Shell	x	
	CEPHALOPODA	<i>Octopus cyanea</i>	Gray, 1849	Day Octopus	x x	
	DECAPODA	<i>Alpheus brevipes</i>	Stimpson, 1860	Snapping Shrimp	x	
		<i>Calcinus elegans</i>	Milne Edwards, 1836	Hawaiian Elegant Hermit Crab	x	
		<i>Calcinus guamensis</i>	Wooster, 1982	Guam Hermit Crab	x	
		<i>Calcinus haigae</i>	Wooster, 1982	Haig's hermit Crab	x	
		<i>Chlorodiella laevisissima</i>	(Dana, 1852)		x	
		<i>Chlorodiella nigra</i>	(Forsk., 1775)		x	
		<i>Dynomene hispida</i>	Guerin-Meneville, 1832		x	
		<i>Liocarpilodes integerrimus</i>	Dana, 1852		x	
		<i>Percnon abbreviatum</i>	(Dana, 1851)		x	
		<i>Perinea tumida</i>	Dana, 1852		x x	
		<i>Pilodius flavus</i>	Rathbun, 1893	Xanthid Crab	x	
		<i>Platypodia semigranosa</i>	(Heller, 1861)		x	
		<i>Saron neglectus?</i>	de Man, 1902	Eyespot Shrimp	x	
		<i>Stenopus hispidus</i>	(Olivier, 1811)	Banded Coral Shrimp	x	
<i>Trapezia</i> sp.			Coral Guard Crab	x		
Unid. Alpheidae				x		
Unid. Galatheididae				x		
Unid. Paguridae				x		
Unid. Paleomonidae			Commensal Shrimp	x		

Organism	Taxa	Scientific name	Author Date	Common name	Kāohikaipu	Kāpapa	
Invertebrate	DECAPODA	Unid. Pilumnidae			x		
		Unid. xanthid				x	
	ECHINOIDEA	<i>Echinometra mathaei</i>	(Blainville, 1825)	Rock-Boring Urchin	x	x	
		<i>Echinostrephus aciculatus</i>	Agassiz, 1863	Needle-Spined Urchin	x	x	
		<i>Echinothrix calamaris</i>	(Pallas, 1774)	Banded Urchin	x	x	
		<i>Echinothrix diadema</i>	(Linnaeus, 1758)	Blue-Black Urchin		x	
		<i>Heterocentrotus mammillatus</i>	(Linnaeus, 1758)	Red Pencil Urchin	x		
		<i>Tripneustes gratilla</i>	(Linnaeus, 1758)	Collector Urchin	x	x	
	ECTOPROCTA	<i>Reteporellina denticulata</i>	(Busk, 1884)	Lace Bryozoan	x		
		<i>Triphyllozon</i> sp.		Chex Bryozoan	x		
	GASTROPODA	<i>Conus abbreviatus</i>	Reeve, 1843	Abbreviated Cone		x	
		<i>Conus miles</i>	Linnaeus, 1758	Soldier Cone	x		
		<i>Conus</i> sp.		Unid. Cone Shell	x		
		<i>Cypraea mauritiana</i>	Linnaeus, 1758	Humpback Cowry		x	
		<i>Drupa (Drupa) ricina</i>	(Linnaeus, 1758)	Spotted Drupe		x	
		<i>Drupa rubusidaeus</i>	(Röding, 1798)	Brilliant Drupe	x	x	
		<i>Hipponix australis</i>	(Lamarck, 1819)	Conical Hoof Shell	x		
		<i>Morula uva</i>	(Röding, 1798)	Grape Morula	x		
		<i>Serpulorbis variabilis</i>	Hadfield & Kay, 1972	Variable Worm Snail		x	
		<i>Synaptocochlea concinna</i>	(Gould, 1845)		x		
		<i>Thais armigera</i>	(Link, 1807)	Armored Dye Shell	x		
		<i>Tricolia variabilis</i>	(Pease, 1861)	Variable Pheasant Shell	x		
		Unid. Turbinidae				x	
		HOLOTHUROIDEA	<i>Holothuria (Halodeima) atra</i>	Jaeger, 1833	Black Sea Cucumber	x	
	<i>Holothuria (Microthele) whitmaei</i>		Bell, 1887	Teated Sea Cucumber		x	
	HYDROZOA	<i>Aglaophenia</i> sp.				x	
		<i>Campanularia</i> sp.				x	
		<i>Eudendrium</i> sp.				x	
		<i>Gymnangium hians</i>	(Busk, 1852)	Feather Hydroid	x		
		<i>Lytocarpia niger</i>	(Nutting, 1905)	Black Hydroid	x		
		<i>Macrorhynchia philippina</i>	Kirchenpauer, 1872	Phillipine Hydroid	x		
		<i>Pennaria disticha</i>	(Goldfuss, 1820)	Christmas Tree Hydroid	x		
		<i>Solanderia secunda</i>	Inaba, 1892	Sea Fan Hydroid	x		
		<i>Tridentata humpferi</i>	Broch, 1914		x		
	NUDIBRANCHIA	<i>Caloria indica</i>	(Berg, 1896)			x	
		<i>Pteraeolidia ianthina</i>	(Angas, 1864)	Blue Dragon Nudibranch	x		
		Unid. Phyllidiidae				x	
	OPHIUROIDEA	<i>Ophiocoma erinaceus</i>	Muller & Troschel, 1842	Spiny Brittle Star	x	x	
		<i>Ophiocoma pica</i>	Muller & Troschel, 1842	Pied Brittle Star	x		
	PLATYHELMINTHES	<i>Pseudoceros ferrugineus</i>	Hyman, 1959	Fuchsia Flatworm	x		
	POLYCHAETA	<i>Chaetopterus</i> sp.		Parchment Worm	x		
		<i>Spirobranchus giganteus corniculatus</i>	(Grube, 1862)	Christmas Tree Worm	x	x	
	PORIFERA	<i>Clathria</i> sp.		Vermilion Clathria	x		
		<i>Spongia oceania</i>	de Laubenfels, 1950	Black Reef Sponge	x		
	Invertebrates Total					69	43
	Marine Fish	OSTEICHTHYES	<i>Abudefduf abdominalis</i>	(Quoy & Gaimard, 1824)	Hawaiian Sergeant	x	
			<i>Acanthurus leucopareius</i>	(Jenkins, 1903)	Whitebar Surgeonfish	x	x
<i>Acanthurus nigrofuscus</i>			(Forsskal, 1775)	Lavender Tang	x	x	
<i>Acanthurus nigroris</i>			Valenciennes, 1835	Blueline Surgeonfish	x		
<i>Acanthurus olivaceus</i>			Forster & Schneider, 1801	Orangeband Surgeonfish	x	x	
<i>Acanthurus triostegus</i>			Streets, 1877	Convict Tang	x		

Organism	Taxa	Scientific name	Author Date	Common name	Kāohikaipu Kāpapa
Marine Fish	OSTEICHTHYES	<i>Aphareus furca</i>	(Lacepède, 1802)	Smalltooth Jawfish	x
		<i>Apogon</i> sp.	Randall, 1997		x
		<i>Arothron meleagris</i>	(Lacepède, 1798)	Spotted Puffer	x
		<i>Aulostomus chinensis</i>	(Linnaeus, 1766)	Trumpetfish	x
		<i>Bodianus bilunulatus</i>	(Lacepède, 1802)	Hawaiian Hogfish	x x
		<i>Calotomus carolinus</i>	(Valenciennes, 1839)	Stareye Parrotfish	x
		<i>Calotomus zonarchus</i>	(Jenkins, 1903)	Yellowbar Parrotfish	x x
		<i>Cantherhines dumerilii</i>	(Hollard, 1854)	Barred Filefish	x
		<i>Canthigaster amboinensis</i>	(Bleeker, 1865)	Ambon Toby	x
		<i>Canthigaster coronata</i>	(Vaillant & Sauvage, 1875)	Crown Toby	x
		<i>Canthigaster jactator</i>	(Jenkins, 1901)	Whitespotted Toby	x x
		<i>Caranx melampygus</i>	Cuvier, 1833	Bluefin Trevally	x
		<i>Centropyge potteri</i>	Jordan & Metz, 1912	Potter's Angelfish	x
		<i>Cephalopholis argus</i>	Bloch & Schneider, 1801	Peacock Grouper	x x
		<i>Chaetodon auriga</i>	Forsskål, 1775	Threadfin Butterflyfish	x
		<i>Chaetodon ephippium</i>	Cuvier, 1831	Saddleback Butterflyfish	x
		<i>Chaetodon fremblii</i>	Bennett, 1828	Bluestripe Butterflyfish	x
		<i>Chaetodon kleinii</i>	Bloch, 1790	Bluehead Butterflyfish	x
		<i>Chaetodon lineolatus</i>	Cuvier, 1831	Lined Butterflyfish	x
		<i>Chaetodon lunula</i>	(Lacepède, 1803)	Racoon Butterflyfish	x x
		<i>Chaetodon millaris</i>	Quoy & Gaimard, 1824	Milletseed Butterflyfish	x
		<i>Chaetodon multicinctus</i>	Garrett, 1863	Pebbled Butterflyfish	x
		<i>Chaetodon ornatissimus</i>	Solander in Cuvier, 1831	Ornate Butterflyfish	x
		<i>Chaetodon quadrimaculatus</i>	Gray, 1831	Fourspot Butterflyfish	x x
		<i>Chaetodon unimaculatus</i>	Bloch, 1788	Teardrop Butterflyfish	x
		<i>Cheilio inermis</i>	(Forsskål, 1775)	Cigar Wrasse	x
		<i>Chlorurus sordidus</i>	(Forsskål, 1775)	Bullethead Parrotfish	x
		<i>Chromis agilis</i>	Smith, 1960	Agile Chromis	x
		<i>Chromis hanui</i>	Randall & Swerdloff, 1973	Chocolate Dip Chromis	x
		<i>Chromis ovalis</i>	Steindacher, 1900	Oval Chromis	x x
		<i>Chromis vanderbilti</i>	(Fowler, 1941)	Blackfin Chromis	x x
		<i>Chromis verater</i>	Jordan & Metz, 1912	Threespot Chromis	x
		<i>Cirrhitops fasciatus</i>	(Bennett, 1828)	Redbarred Hawkfish	x
		<i>Coris flavovittata</i>	(Bennett, 1829)	Yellowstripe Coris	x
		<i>Coris gaimard</i>	(Quoy & Gaimard, 1824)	Yellowtail Coris	x x
		<i>Coris venusta</i>	Vaillant & Sauvage, 1875	Elegant Coris	x
		<i>Ctenochaetus strigosus</i>	(Bennett, 1828)	Goldring surgeonfish	x x
		<i>Decapterus macarellus</i>	(Cuvier, 1833)	Mackeral Scad	x
		<i>Diodon hystrix</i>	Linnaeus, 1758	Porcupinefish	x
		<i>Forcipiger flavissimus</i>	Jordan & McGregor, 1898	Forcepsfish	x
		<i>Gomphosus varius</i>	Lacepède, 1801	Bird Wrasse	x x
		<i>Gymnothorax undulatus</i>	(Lacepède, 1803)		x
		<i>Halichoeres ornatissimus</i>	(Garrett, 1863)	Ornate Wrasse	x x
		<i>Kyphosus</i> sp.		Chub	x x
		<i>Labroides phthirophagus</i>	Randall, 1958	Cleaner Wrasse	x x
		<i>Lutjanus fulvus</i>	(Forster in Bloch & Schneider, 1801)	Blacktail Snapper	x
		<i>Macropharyngodon geoffroyi</i>	(Quoy & Gaimard, 1824)	Shortnose Wrasse	x
		<i>Melichthys niger</i>	(Bloch, 1786)	Black Triggerfish	x
		<i>Melichthys vidua</i>	(Solander, 1844)	Pinktail Triggerfish	x
		<i>Monotaxis grandoculis</i>	(Forsskål, 1775)	Bigeye Emperor	x
<i>Naso hexacanthus</i>	(Bleeker, 1855)	Sleek Unicornfish	x		

Organism	Taxa	Scientific name	Author_Date	Common name	Kāohikaipu	Kāpapa
Marine Fish	OSTEICHTHYES	<i>Naso lituratus</i>	(Forster & Schneider, 1801)	Orangespine Unicornfish	x	
		<i>Novaculichthys taeniourus</i>	(Lacepède, 1801)	Rockmover	x	x
		<i>Ostracion meleagris</i>	(Shaw & Nodder, 1796)	Spotted Boxfish	x	
		<i>Paracirrhites arcatus</i>	(Cuvier, 1829)	Arc-eyed Hawkfish	x	x
		<i>Parupeneus bifasciatus</i>	(Lacepède, 1802)	Doublebar Goatfish	x	
		<i>Parupeneus cyclostomus</i>	(Lacepède, 1801)	Blue Goatfish	x	
		<i>Parupeneus multifasciatus</i>	(Quoy & Gaimard, 1825)	Manybar Goatfish	x	x
		<i>Plagiotremus goslinei</i>	(Strasburg, 1956)	Gosline's Fangblenny		x
		<i>Plectroglyphidodon imparipennis</i>	(Vaillant & Sauvage, 1875)	Bright-eye Damselfish	x	x
		<i>Plectroglyphidodon johnstonianus</i>	Fowler & Ball, 1924	Blue-eye Damselfish	x	x
		<i>Pseudocheilinus octotaenia</i>	Jenkins, 1901	Eightstripe Wrasse		x
		<i>Scarus dubius</i>	Bennett, 1828	Regal Parrotfish	x	
		<i>Stegastes fasciolatus</i>	(Ogilby, 1889)	Pacific Gregory	x	x
		<i>Stethojulis balteata</i>	(Quoy & Gaimard, 1824)	Belted Wrasse	x	x
		<i>Sufflamen bursa</i>	(Bloch & Schneider, 1801)	Lei triggerfish	x	x
		<i>Sufflamen fraenatus</i>	(Latrielle, 1804)	Bridled Triggerfish	x	
		<i>Thalassoma ballieui</i>	(Vaillant & Sauvage, 1875)	Old Woman Wrasse		x
		<i>Thalassoma duperrey</i>	(Quoy & Gaimard, 1824)	Saddle Wrasse	x	x
		<i>Thalassoma purpurium</i>	(Forsskål, 1775)			x
				Unid. Blenniidae		
		<i>Zanclus cornutus</i>	(Linnaeus, 1758)	Moorish Idol	x	x
		<i>Zebrasoma flavescens</i>	(Bennett, 1828)	Yellow Tang	x	
Marine Fish Total					64	42
Grand Total					151	125