CIP GENERATION PROJECT

2011 COMMUNITY BENEFITS PROGRAM

REEF FISH MONITORING PROJECT

YEAR 4 RESULTS

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EXECUTIVE SUMMARY

The development of a electrical generating facility at Campbell Industrial Park at Barbers Point was the impetus to initiate a quarterly environmental monitoring program to follow changes in coral reef fish communities in the Barbers Point - Kahe Point area. This document is the fourth annual report for this effort covering the period from December 2007 through November 2011 with a focus on the surveys completed in 2011. On a quarterly basis, this study monitors the status of coral reef fish communities at sixteen permanently marked sites offshore of Barbers Point on the southeast to Nanakuli Beach Park about 7.9 km to the northwest. These monitoring stations are all in waters from 5 to 12 m in depth and thus are subject to impact from high surf events.

Because of Hawaiian Electric Company's construction/operation of the generating station at Kahe Point as well as the developments at West Beach and Barbers Point Harbor, long-term marine environmental data covering the status of fish and coral communities are available commencing from the mid-1970's up to present. The most comprehensive of those efforts occurred with the HECO program in support of the Kahe Generating facility at Kahe Point. The HECO monitoring program documented changes that occurred to marine communities following three major storm events: the January 1980 event, Hurricane Iwa in November 1982 and Hurricane Iniki in September 1992 all of which severely impacted coral reef communities in the area. These studies demonstrated the impact of those storm events and not the operation of the Kahe facility as the major source of impact to marine communities of the Kahe area.

In the present study there were no statistically-significant changes in the mean number of fish species, mean number of individual fish censused or in the mean standing crop per transect among the sixteen 2007-2011 survey periods, thus demonstrating stability in these communities. All species of fishes censused in the present study have been assigned to one of five feeding guilds (or trophic categories): herbivores (species feeding on algae), planktivores (species that feed on zooplankton up in the water column), omnivores (species that feed on both algae and small animals), coral feeders which are a specialized group feeding on coral tissue or mucous, and carnivores which are species feeding on smaller fishes and invertebrates living on the coral reef. Of the 139 species of fishes encountered in the sixteen 2007-2011 surveys, twenty-two species are herbivores, fourteen are planktivores, seven are omnivores, eight are coral feeders and 88 are carnivores. Fifteen of the sixteen monitored locations are established on natural substratum where 85% of the fish standing crop is comprised of herbivores and carnivores. However, at one station established on the Kahe Generating Station warm-water discharge, herbivores are largely replaced by planktivores but carnivores remain important as elsewhere. The reasons for this shift in dominance is due to the thermally-elevated discharge creating a unidirectional current and the high degree of shelter space afforded by the steel and armor rock covering the discharge pipe.

This study was undertaken to follow changes in coral reef fish communities as part of the environmental monitoring program related to the development of the CIP electrical generation facility and the data collected in the first year represent the preconstruction baseline (December 2007 - December 2008), while data collected in the second year represents the construction phase (January - September 2009) and the data collected in the third and fourth years (2010-2011) represent the operational phase of the plant. The sixteen stations geographically fall into four groups along the 7.9 km of coastline; on the southeast are four stations offshore of the generation plant at Campbell Industrial Park (station nos. 1-4), three stations seaward of Ko'Olina Resort (nos. 5-7), five stations fronting the Kahe generation facility (nos. 8-12) and three stations north of Kahe Point (13-15). Statistical analysis of the fish community parameters measured in this study (i.e., number of species, number of individuals and standing crop)

found that the diversity of fish species, the number of individual fish as well as the standing crop to be significantly greatest at the three Ko'Olina stations over those in the other three groups over the 2007-2011 survey period. These three measures were least (or nearly so) at the four stations offshore of Campbell Industrial Park and these differences are attributed to better benthic community development offshore of Ko'Olina than elsewhere. The data from stations offshore of Kahe and from those to the north were between the Ko'Olina and Campbell Industrial Park means. The above analysis excluded data from station 16 (the Kahe discharge pipe) because it is a man-made structure and not comprised of natural substratum as present at all other stations. However, to better understand the differences among the sixteen stations, the three fish community measures (mean number of species per transect, mean number of individuals per transect and mean estimated biomass per transect) were statistically examined comparing all stations. Two findings emerge; (1) the Kahe discharge pipe station had a non-significant greater number of species present and a clearly-separable significantly greater mean number of fish individuals and standing crop over all other stations and (2) the means for all parameters from all other stations were not statistically separable except for three stations (numbers 1, 11 and 14) where the number of fish species was significantly less than all other stations. Thus the development in the fish communities at the fifteen stations situated on natural substratum monitored in this study pales relative to that found on the man-made Kahe discharge.

Seven of the permanently marked monitoring stations in this study have been used in earlier HECO studies and the methods used herein are similar, allowing comparative analysis of the data. Comparing old fish community data (1976-1984) to present (2007-2011) data finds that there are no statistically significant differences in the annual mean number of fish species or annual mean number of individual fish censused per transect despite the imposition of three major storm events in 1980, 1982 and 1992 suggesting that the fish communities have to some extent recovered from these disturbances. These early storm events impacted marine communities offshore of the Barbers - Kahe Point areas. These impacts were probably greatest on the coral communities which are the source of much of the natural local topographical relief creating shelter for fishes. If disturbance to the coral community occurs frequently and corals are known to be slow-growing, they are unable to contribute much to the local topography upon which many fish species depend thus keeping the fish community at an earlier point is community succession. The early studies demonstrated the large impact that these storms had at the time on corals as well as the movement of sand away from the Kahe area leaving much near-barren limestone that is present today and is scoured by small wave events keeping benthic community development to a minimum. This has resulted in a relatively poor development of the fish communities at many of the Kahe sample sites which continues to today. Where topographical relief and benthic communities are well-developed, the fish communities are likewise better developed. Given the long-term data set spanning 35 years and the apparent lack of strong significant changes occurring to fish communities with the three early storm events which is probably due to some level of recovery, suggests that the variation seen in the measures of the fish community used in this study will continue to fluctuate at a similar magnitude in future monitoring events as this program moves forward. Furthermore, the analysis of the 2007-2011 data suggest that benthic community development/topographic complexity creating shelter for fishes remain the overriding factors determining the degree of development in fish communities at the stations monitored in this study. Since these factors were heavily impacted by the early storm events many years ago (as documented by HECO), the present findings will probably continue much the same in future years of this study.

INTRODUCTION

1. Purpose

Hawaiian Electric Company, Inc. (hereafter HECO) has constructed a new generating station on vacant portions of its existing Barbers Point Tank Farm in Campbell Industrial Park (CIP) on the island of O'ahu. This generating facility was constructed in light of the fact that there is an urgent need for new generating capacity on the island. Initially, the generating station would consist of a single 110 MW Siemans-Westinghouse combustion turbine (CT) and two single 2 MW capacity black-start diesel engine generators. The system will be fueled using biofuels which assists in fulfilling the State's goals of energy security and sustainability. However, alternative fuels (e.g., diesel, naphtha, etc.) may be used if biofuels are unavailable. The system is designed to accept a second generation unit and would only be constructed if and when it is needed to meet system requirements. It is expected that the generation system will be used to help meet peak load periods on the island's system which normally occur between 5:00 pm and 9:00 pm on weekdays.

The single CT generation unit utilizes approximately 600 gpm of water which is used for water injection into the CT for air pollution control, equipment cooling, plant washdown, landscape irrigation and domestic use by operating personnel. Disposal of used water is via injection wells on the project site. Thus, unlike the nearby Kahe Generating Station where seawater is used for cooling in the plant and discharged back into the marine environment, the new CIP plant does not discharge cooling water into the nearby ocean thus precluding or reducing potential environmental impacts to the marine environment.

As part of the environmental monitoring program for the CIP Generating Station, it was suggested that a coral reef fish monitoring program be put in place to track the changes that may occur with fish populations offshore of the proposed plant at Barbers Point. The data presented herein were collected in 2011. Data were initially collected in 2008 representing the preconstruction baseline, in 2009 representing the "construction period" of the generating facility and in 2010 representing the commencement of the operational phase of the plant and continuing through 2011. The 2008 information was presented in Brock (2009), the "during construction" information was given in Brock (2010) and data collected since the commencement of plant operations in 2010 is given in Brock (2011) and the continuing operational phase data for 2011 are presented herein.

Since HECO had such a monitoring plan in place offshore of its Kahe power plant in the 1970's and 1980's, the present study has included a reassessment of some of those locations which should provide information on the changes that have occurred to fish communities in the Barbers Point - Kahe Point area over the last 30 years. This study addresses the question, "What are the changes in the coral reef fish community structure that occur through time in the Barbers

Point - Kahe Point area?" Community structure is defined as the diversity of species, their abundance and biomass as well as their place in the food web of the coral reef. This document addresses this question and represents the fourth annual report which covers the continuing of plant operations as well as undertakes a comparative assessment to baseline and during plant construction periods.

2. Natural Events and Impacts to Hawaii's Coral Reefs

Past dogma has perpetuated the concept that coral reefs and their fish communities exist in stable environments which have resulted in the high diversity of species that is often seen in these systems. More recent data has shown that the environment in which coral reefs exist is dynamic, i.e., undergoing constant change, thus the organisms are subjected to a variety of stresses, resulting in shifts in community structure and abundance of species (Grassle 1973, Connell 1978, Dollar and Tribble 1993). Indeed, the concept that "intermediate levels of disturbance" may result in higher diversity has been demonstrated in a number of studies of coral communities (Connell 1978, Dollar 1982, Grigg 1983). Benign environments result in final successional stages of coral community development with low species diversity where one or just a few species dominate. This decrease in species diversity is found also with the coral-associated fish communities. Stability in coral species populations has been recently viewed as ever-changing in time and space, where species diverge by genetic drift due to isolation or converge by hybridization, producing constant change which has been described as reticulate evolution (Veron 1995).

Stochastic (i.e., random) processes create a nonequilibrium situation in coral reef communities. A major causal mechanism of stochastic events is the occurrence of occasional storms, which have been shown to be the single most important factor influencing the structure, diversity, and abundance of coral communities in Hawai'i (Dollar 1982, Grigg 1983, Dollar and Tribble 1993). Coral reefs have been described as "temporally varying mosaics" (Bak and Luckhurst 1980) in which the coral community undergoes a continual cycle of disturbance or removal and recovery or renewal. The effects of severe disturbance that drive this cycle have been documented for specific reef areas. The removal or destructive phase due to large storm events has been recorded in the Caribbean (Ball *et al*. 1967, Perkins and Enos 1968, Stoddart 1969, 1974, Woodley *et al.* 1981) and in the Pacific (Blumenstock *et al.* 1961, Cooper 1966, Dollar 1982, Dollar and Tribble 1993, Done *et al.* 1991, Harmelin-Vivien and Laboute 1986, Maragos *et al.* 1973, Ogg and Koslow 1978).

Following the impact of large storm events that disrupt the coral and fish communities is a period of regrowth. This period has received less study because the recovery of most coral communities is a slow process and because having pre-storm study sites where post-storm sampling can be done is rare (Dollar and Tribble 1993). Corals are relatively slow-growing and long-lived, thus the successional processes on most reefs take place on a scale of years to decades (Grigg and Maragos 1974).

In exposed locations in Hawaii, storm waves keep coral communities at an early point in succession (Dollar 1982, Grigg 1983, Dollar and Tribble 1993). Under such situations, coral colonies never attain any significant size and growth forms are usually prostrate, thus reducing their exposure to wave energy. Since much of the development in the associated fish community is related to the topographical complexity of the substratum (Risk 1972) and much of this complexity is directly due to the growth of corals, fish community development is usually reduced where coral communities are poorly developed and shelter space is lacking. Besides topographical complexity providing shelter habitat for fishes, the highly variable shelter created by coral communities serves a wide range of invertebrate and algal communities which may be forage for many fish species. Thus the development of coral reef fish communities is often directly linked to the degree of development of coral communities and factors that negatively affect the coral community frequently will have a similar negative impact to the fish community.

In general, many corals in Hawaii have relatively slow growth rates, and many species produce annual growth bands much like the large conifers of temperate forests (Knutson *et al.* 1972). The large hemispherical colonies of *Porites lobata* do this, accreting about a centimeter per year in radial diameter. In Hawaii, *P. lobata* colonies may attain diameters in excess of 4 m, thus large colonies may be more than 150 years in age. Under these circumstances, significant storm events do not have to occur with much frequency to have a strong influence on the successional state and development of coral communities where this species occurs.

Since 1980, three major storm events have created large surf that has impacted Hawaii's reefs over levels that normally occur. The January 1980 storm brought waves which attained heights of at least 6 m, from a south-southwest direction to the islands (Dollar 1982) thus impacting the Barbers Point - Kahe Point region. The next major storm event was Hurricane Iwa, which struck the islands in November 1982. Again, storm waves which attained estimated heights of 9 m, impacted the south and west shores of all islands (Coles and Fukuda 1984). The most recent major storm event was Hurricane Iniki, which passed over Kauai on 11 September 1992 with sustained winds of 144 mph. It also created large surf that again impacted the south and west shores of Oahu with storm generated surf arriving from a SSE direction. On the south shore of Oahu, wave heights were estimated to reach 8 m (personal observations).

3. HECO's Environmental Monitoring Program: A Synopsis of Impacts from the Construction and Operation of the Kahe Generating Station (1970's-1980's)

As part of the permit conditions allowing the discharge of thermally-elevated cooling water into the marine environment at Kahe Point, HECO was required to monitor the status of the coral, algae and fish communities in the waters fronting and in the vicinity of the plant. The findings from these early monitoring efforts provide an excellent overview of the environmental changes that occurred in the Kahe Point area prior to the three storm events occurring in 1980, 1982 and 1992 as well as subsequent to the January 1980 and November 1982 events. Studies on coral coverage showed a significant decrease of 7% between 1973 to 1975 and an additional 13% from 1975 to 1977. These decreases were significantly correlated with proximity to the Kahe

plant discharge but the analyses did not determine whether the disturbance associated with outfall construction or operation was the definitive factor producing the mortality. In contrast to the increased mortality, settlement and growth of coral recruits increased with proximity to the outfall subsequent to beginning its operation which suggests that outfall construction rather than its operation was the major factor in producing the mortality. Fish populations throughout the study area showed no changes except on the marginal reefs to the northeast of the outfall where both the numbers of species and individuals censused decreased following the commencement of outfall operations. However, the number of intertidal species on the rocky shoreline increased in the areas of thermal impingement (Coles *et al.* 1985a).

In 1978 the analysis of all reef fish population data collected since the beginning of the offshore outfall operation in December 1976 indicated that fish populations were being displaced from the immediate vicinity of the outfall (Coles 1979). These changes pale relative to the impact of the January 1980 "Kona" storm that generated extreme surf on the south and western shores of the islands. The Kahe study area was heavily impacted by waves at that time. Subsequent survey work found that the storm was responsible for reductions in coral coverage, fish populations and the redistribution of beach sand that were all much greater than the subtle changes which had occurred in these parameters over the previous seven years (Coles *et al.* 1981).

During 1981 the generating capacity of the Kahe Station was increased by the addition of Unit 6 to a total of 638 MW which increased the cooling water flow to 645 MGD, a 33% increase above the flow rate for Units 1 to 5. With this change came a reduction in the surface plume area to about one-half while the area of benthic thermal impingement nearly doubled, but was restricted primarily on offshore sand areas. A result of these changes was a moderation in coral coverage declines seen previously but coral reef fish populations continued to decline probably in response to the decrease in reef habitat produced by the 1980 storm (Coles *et al.* 1982).

In November 1982, Hurricane Iwa struck the Hawaiian Islands with the greatest destruction occurring on Kauai. On Oahu, damage was greatest on the northwest coastline which included the Kahe Point area. Waves and winds were substantially greater than seen in the January 1980 event with waves heights estimated at 30 feet (Noda 1983). As described in Coles *et al.* (1985a, page 16):

"Surprisingly, coral communities in shallow water areas appeared relatively undisturbed by hurricane wave turbulence. However, reefs further offshore at depths of 20 feet or more appeared to have been substantially destroyed by the force of breaking waves. Measurements of reef coral coverage and fish populations just prior to the hurricane had indicated stable populations compared to the previous year, indicating that damage had resulted from the catastrophic forces released by the hurricane. A further observation of interest was that sand along the reef front had been swept away by the hurricane's waves, exposing reef pavement and rubble that had been buried by up to five feet of sand.

The 1983 monitoring investigations verified the preliminary conclusions that had been determined shortly after Hurricane Iwa occurred. Quantitative estimates indicated substantial reductions in coral, algal and fish communities corresponding to locations where hurricane wave forces had been greatest. Due to removal of sand from shallow areas and the extreme cutting back of beaches that had occurred during the hurricane, sand entrainment through the Kahe Station was substantially less in 1983 than during previous years. A study of coral recolonization in the area indicated a positive influence of the Kahe outfall in the re-establishing of reef corals on denuded reef surfaces."

Coles and Fukuda (1984) noted the net significant decrease in coverage of 18.7% between 1979-1980 due to the January 1980 storm as measured at the Kahe permanent monitoring stations. Hurricane Iwa contributed a further significant decline of coral offshore of the Kahe facility; in 1982-83 the net change in coral coverage decreased 5.4%. The greater decline in coverage with the 1980 storm relative to Hurricane Iwa was probably related to two facts: (1) since the wave energy of the January 1980 event was less that the 1982 hurricane, the impact of that energy was probably released at shallower depths where coral coverage had been high and (2) Hurricane Iwa occurred just two years after the January 1980 storm event leaving little time for significant coral recovery to occur.

4. The Impact of Hurricane Iniki

As noted above, Hurricane Iniki struck the Hawaiian Islands in September 1992 with high waves impacting the south and west shores of all islands. Fifty-four days following Hurricane Iniki, a qualitative survey was carried out to determine the extent of damage to coral communities in the vicinity of Hawaiian Electric Company's generating facility at Kahe Point (Brock 1992a). Fourteen of the more than 38 permanently marked monitoring stations were visited. With respect to coral damage, two general findings emerged: (1) that damage due to storm waves to corals was minimal and was primarily restricted to the cauliflower coral *Pocillopora meandrina.* The reasons for this restricted damage was related to the branching nature of this species as well as the fact that this coral frequently colonizes the tops of high points on hard bottom (i.e., limestone ridges and boulders). In these locations, cauliflower corals have relatively greater exposure to wave energy impinging on the bottom than would coral colonies situated down in depressions. The second finding was that the greatest damage to corals occurred at those stations situated in areas with greatest exposure to wave forces impinging from the SSE direction which was consistent with the direction of Hurricane Iniki's storm waves. Finally, the field survey noted that a considerable amount of sand was removed by the storm at some stations with a net result of a greater amount of hard substratum previously covered by sand was now exposed and available for benthic recruitment. Only one station examined in the study showed evidence of net deposition of loose materials (i.e., coral rubble and broken live pieces) while at all other stations, sand, broken live corals and rubble were not present and assumed to have been advected to deeper water seaward and outside of the study area (Brock 1992a). These findings were similar to those noted in Mamala Bay, southeast of Kahe study area (Brock 1996).

As noted above, HECO carried out environmental surveys following the January 1980 storm and Hurricane Iwa in 1982. Several interesting facts emerge in comparing the findings following the 1980 storm to those from the post-Hurricane Iniki study; the January 1980 event had a much greater impact to the Kahe coral communities relative to Hurricane Iniki, (2) it caused considerable deposition of sand at many stations which in some cases caused burial of corals and (3) it was responsible for significant abrasion of many corals which was not obvious following Hurricane Iniki. The finger coral, *Porites compressa*, was present at many of monitoring stations in 1980 and by the time of the post-Iniki survey, this species contributed little to the coverage estimates at sampled stations. Because of its relatively delicate skeletal structure, *P. compressa* is prone to damage by storm surge (Dollar 1982) and the storms since 1980 have probably contributed to the decline of this species at many Kahe Point locations (Brock 1992a).

The energy from the high amplitude, short period waves generated by all three storm events (January 1980, November 1982 and September 1992) was dissipated in deeper water thus coral communities in these deeper areas were potentially exposed greater impact (see Dollar 1982, Walsh 1983). As noted by Coles and Fukuda (1984), fully 90 percent of the coral coverage offshore of the Kahe generating facility was at depths of 10 m or more prior to the January storm. These deeper water coral communities apparently received much of the damage in 1980 and again in 1982 with much of that damage occurring to the finger coral, *Porites compressa*. Brock (1992b) examining marine communities southeast of the Barbers Point Deep Draft Harbor two weeks after Hurricane Iniki, found considerable damage to corals below 13 m and the damage was greatest in areas exposed to a SSE swell. Coral communities inshore of this or those protected from a direct SSE swell direction, appeared to have suffered little impact. His observations included the disappearance of a large amount of loose coral rubble in the 12 to 22 m depth range where rubble that had accumulated intermittently along the base of a submarine cliff disappeared. Individual estimated volumes were in excess of 2,000 m^3 over linear distances of 30-50 m and this material was not found within diving depths (here from shore to 30 m). This is a testament as to the power of such a storm.

As noted by Brock (1992a, page 5):

"The two storms preceding Hurricane Iniki produced opposite impacts subtidally with respect to the movement of sand offshore of the Kahe facility. The January 1980 storm resulted in the deposition of sand over many reef areas, thus burying or scouring benthic communities. In contrast, Hurricane Iwa resulted in 3 to 5 feet of sand being removed along the seaward edge of the reef exposing coral reef framework that had been formerly covered. Coles and Fukuda (1983) noted '...sand which had been deposited by the Kahe outfall and swept on to the reefs by previous storms was completely removed from along the entire reef front. The substratum available in the area is now similar to the conditions when marine monitoring began in 1973...'. It appears that Hurricane Iniki also removed sand from the area seaward of the forereef but to a much lesser extent than in the November 1982 event (i.e., up to 0.75 m in 1992 versus up to 1.5 m in 1982); perhaps the sand had not returned before the 11 September 1992 storm."

The three strong storms commencing in January 1980 and ending 12 years later with Hurricane Iniki documented tremendous change to the bottom communities in the Barbers Point - Kahe Point area. These changes to the benthic communities also created a negative impact to the resident fish communities which has been documented elsewhere in Hawaii (Walsh 1983). Thus knowledge of the past environmental history can lead to a better understanding of the biological resources present in the area today. It is against this environmental history that the present study is assessed below.

METHODS

The fish communities at sixteen permanently marked sites are monitored on a quarterly schedule. These sixteen sites are located in the Barbers Point to Nanakuli area on the west coast of Oahu (see below). The monitoring of fish communities is carried out using a visual census method. The sampling protocol occurs in the following sequence: on arrival at a given station, the individual conducting the visual fish census enters the water and carries out the visual census over a 50 m long by 4 m wide corridor run parallel to shore. (Only station 16, which is located on the HECO discharge, runs perpendicular to shore). All fishes within this area to the water's surface are counted. Data collected include the species, numbers of individuals and an estimate of the length of each individual fish counted. The length data are later converted to standing crop estimates using linear regression techniques. The single diver equipped with SCUBA, transect line, slate and pencil enters the water, counts and notes all fishes in the prescribed area (method modified from Brock 1954). The 50 m transect line is paid out as the census progresses, thereby avoiding any previous underwater activity in the area which could frighten wary fishes. The length data are used in making estimates of biomass for each species present coupling the length data with species-specific regression coefficients (Ricker, 1975, Brock and Norris 1989).

Fish abundance and diversity is often related to small-scale topographical relief over short linear distances. A long transect may bisect a number of topographical features (e.g., cross coral mounds, sand flats and algal beds), thus sampling more than one community and obscuring distinctive features of individual communities. To alleviate this problem, a relatively short transect (50 m in length) has proven adequate in sampling many Hawaiian benthic communities. In addition, the transect length used by Coles *et* al. (1985a) was also 50 m thus making the present counts collected under this program comparable to the earlier data collected by HECO.

Besides frightening wary fishes, other problems with the visual census technique include the underestimation of cryptic species such as moray eels (family Muraenidae) and nocturnal species, e.g. squirrelfishes (family Holocentridae), aweoweos or bigeyes (family Priacanthidae), etc. This problem is compounded in areas of high relief and coral coverage affording numerous shelter sites. Species lists and abundance estimates are more accurate for areas of low relief, although some fishes with cryptic habits or protective coloration (e.g., the nohus, family Scorpaenidae; the flatfishes, family Bothidae) might still be missed. Obviously, the effectiveness of the visual census technique is reduced in turbid water and species of fishes which move quickly and/or are very numerous may be difficult to count and to estimate individual sizes. Additionally, bias

related to the experience of the diver conducting counts should be considered in making any comparison between surveys. In spite of these drawbacks, the visual census technique probably provides the most accurate nondestructive method available for the assessment of diurnally-active fishes (Brock 1982).

In the analysis of the data, all fishes encountered were classified as to their primary foraging behavior as a means to better understand the trophic relationships in the fish communities. These functional groups are carnivores which includes all fishes feeding on other coral reef animals (fish and invertebrates) greater than zooplankton in size, planktivores which are species that feed primarily on zooplankton and detritus in the watercolumn, herbivores which are species feeding primarily on algae, omnivores which are usually small species that feed on a combination of algae and benthic animals and the coral feeders which are a specialized group of fishes that feed on coral polyps and mucous. The determination of which species were in each feeding guild utilized the findings of Hiatt and Strasburg (1960), Hobson (1974), Brock *et al*. (1979) and Randall (2007). Primarily nonparametric statistical procedures are used thus avoiding the requirements for normality in the data, etc. that are necessary in parametric statistical analyses.

RESULTS AND DISCUSSION

1. Station Locations

To assess the status of coral reef fish communities in the Kahe-Barbers Point area, sixteen permanently marked stations were established. These stations are spread along 7.9 km (4.9 miles) of coastline fronting the CIP Generating Station at Barbers Point on the southeast to the south boundary of the Nanakuli Beach Park on the northwest and their locations are shown in Figure 1. The locations of eight of these stations are new and the remainder are stations established by the HECO environmental monitoring program in the 1970's. Four stations are located offshore of Campbell Industrial Park at Barbers Point in waters from 7 to about 10 m in depth. These stations (Station nos. 1 - 4, Table 1) monitor the status of fish communities in closest proximity to the CIP Generation site and are located to the southeast of the Barbers Point Harbor entrance channel. Two stations are located northwest of the Barbers Point Harbor entrance channel fronting the Ko'Olina Resort and Paradise Cove area (Station nos. 5 and 6, Table 1). Again the water depths at these two stations is from 7 to 9 m. Coles *et al.* (1985) monitored fish community structure at seven stations fronting and adjacent to the Hawaiian Electric Company's Kahe Generation Station. These seven stations are also monitored in the present study (here numbered as Station nos. 7 through 13 in Table 1) to obtain information on the status of these fish communities today but also to compare the fish community structure today to what was present at these locations more than 25 years ago. These stations are in water ranging from 5 m to 12 m in depth.

The old Hawaiian Electric environmental monitoring program also monitored a control station offshore of Nanakuli (Coles *et al.* 1985a) which has also been added to the stations monitored under the present program (here Station 14, Table 1). A second control station (Station 15, Table

1) approximately 70 m north of Station 14 has been established for the present monitoring program. Finally Station 16 was established on the Kahe discharge pipe directly offshore of the generating facility in water from 5 to 7 m in depth.

As noted above, the locations of all stations are shown in Figure 1. The "start point" for each station is marked using 90 cm long nylon cable ties and small subsurface floats that are tied to the substratum in proximity to the start point for each transect. Because of high public use by dive tour operators and individuals SCUBA diving from shore fronting the Kahe Generating Station, Stations 7 - 12 as well as Station 16 have not been marked but rely on prominent natural points on the local substratum. Past experience in permanently marking biological monitoring stations in "high use" areas results in divers removing materials of anthropogenic origin thus destroying and negating this method for relocation of stations. Low cost modern global positioning systems (GPS) can put the diver/monitor within a few feet of any known point. The GPS waypoints for each of the 16 stations sampled in this study are given in Table 1.

2. The 2007-2008 (Preconstruction) Data

In the preconstruction period, fish transect data were collected on five occasions commencing on 27 December 2007. In 2008, transect work was carried out on 4 April, 30 May, 19 August and on 25 November. As noted above, sixteen stations were routinely sampled in this study and these early data are presented in Brock (2009). In the first survey, twelve of the sixteen stations were sampled; missing were stations 4 (East 4), 5 and 6 (Ko'Olina 1 and 2) and 16 (HECO discharge pipe). The second survey carried out on 4 April only missed one site, station 16 (the HECO discharge pipe) and by the third survey on 30 May 2008 all sixteen sites were sampled. The HECO thermally-elevated discharge (station 16) was added as a monitoring station because of the well-developed fish community present at that location. Because station 16 is unusual with a highly developed community on a man-made structure, it is treated separately in many of the analyses below. In total, 122 species of fishes were censused in these first five surveys and these are given in Brock (2009).

3. The 2009 During Construction Data

In 2009 field surveys were conducted on 19 March, 11 May and 21 July. When the fourth quarter 2009 period commenced, weather deteriorated with a series of fronts that started in October 2009 and carried though unabated April 2010. Locally, these weather fronts brought surf as did weather fronts occurring elsewhere in the Pacific which affected the south, west, northwest and north coastline of O'ahu. Surf from these directions impinge on some or all of the sample sites precluding field sampling during these periods. The result was that the fourth quarter 2009 field survey was not completed. Thus the analysis below includes data from the first three quarters of 2009 which represent the during construction period for the new generation facility at Campbell Industrial Park.

4. The 2010 and 2011 Operational Phase Data

In 2010 field surveys were carried out on 29 March, 14 May, 12 August and 29 October representing the first year of operations of the new generating facility at Campbell Industrial Park. However, the splitting of data into "preconstruction", "during construction" and operational periods is arbitrary because the construction and operation of the new generation facility is situated well inland of the ocean and its operation has no input to the sea. The 2011 surveys were carried out on 25 February, 16 June, 29 July and 23 November and these data are presented below.

The complete data set from the four 2011 surveys is given in Appendix 1 and this information is summarized in Table 2 along with the earlier (2007-2010) information. Drawing from some of these data and excluding station 16, we may ask the question, "Are there any statistically significant differences among the mean number of fish species seen per transect, the mean number of individual fish censused per transect or the mean estimated total standing crop (in grams) among the sixteen 2007-2011 sample periods?" To address this question two nonparametric tests were used: the Kruskal-Wallis analysis of variance (ANOVA) and the Student-Newman-Kuels (SNK) Test. The Kruskal-Wallis ANOVA is able to demonstrate statistically significant differences among parameter means (by date) but cannot show where those differences are. The SNK Test is used to group related sample means and separate those means that are significantly different from one another. The results of these analyses are given in Table 3. Referring to Table 3, the Kruskal-Wallis ANOVA noted no statistically significant differences exist among the means for each of the sixteen sample dates for the number of fish species per transect, the number of individual fish censused per transect or for the total estimated fish standing crop per transect. These results point out that when considering grand means for the number of species, number of individuals or biomass (in g/m^2) per transect on each of the sixteen sample dates, there are no significant differences. Thus at this level of analysis (i.e., grand means), there is no statistical separation among the dates which suggests a level of stability in the fish communities at these sample sites.

Station 16 established on the terminus of the Kahe Generating Station discharge pipe is discussed separately because it is a man-made structure deployed in an area of sand bottom and having a 3,193.5 m^3 x 10^3/day seawater discharge at its terminus. The topographical relief afforded by the steel and basalt rock substratum as well as coverage by corals is considerably more attractive to many fishes than the nearby surrounding natural reefs and the discharge of thermally-elevated water serves to attract many fishes. These features result in a an enhancement of the local fish community making the structure of the fish community very different than that of any other of the fifteen natural reef sites sampled in this study. Thus as noted above, the results of fish censuses undertaken at station 16 are discussed separately in most analyses.

The fishes censused in the sixteen recent December 2007 - November 2011 surveys were assigned to one of five trophic categories or feeding guilds. As noted above, these groups are herbivores (species that feed on algae), planktivores or species that feed up in the water column

on zooplankton, omnivores that feed both on plant material as well as small animals, coral feeders which are a specialized group feeding on coral tissue and mucous, and the carnivores which are species feeding on fishes and invertebrates found on coral reefs. In the five surveys carried out during the preconstruction (2007-2008) period there were 113 species of fishes encountered at the sixteen sample sites. The three during plant construction surveys completed in 2009 found 107 species of fishes at these sixteen sample sites. In the four operational phase 2010 surveys, there were 109 species of fishes recorded at the sixteen sites and in 2011, 106 species of fishes were sighted at the sixteen sites. In total among the sixteen surveys, 139 species of fishes have been recorded among the sixteen survey sites. Sixty percent or 84 species encountered were in common among the sixteen surveys carried out over the four years. These data suggest a reasonable level of stability in these fish communities.

Of the 139 species of fishes recorded over the sixteen surveys, sixty-three percent (or 88 species) are carnivores, sixteen percent (or 22 species) are herbivores, ten percent (or 14 species) are planktivores, five percent (or 7 species) are omnivores and six percent or eight species are coral feeders. The assignment of fish species to the five trophic categories are given in Appendix 1 of this report as well as in Brock (2009, 2010, 2011) for species encountered on each transect and earlier survey dates. Table 4 summarizes the feeding guild information by survey date providing the mean percent contribution by weight of each trophic category for stations in two groups; the first group includes stations 1 through 15 (natural substratum) and the second group considers only station 16 (the Kahe outfall station). Although the data in Table 4 are in summary form, two facts emerge, (1) that the majority (here 85%) of the weight of fishes censused at the first fifteen stations is comprised of herbivores and carnivores and (2) the importance of herbivores is largely replaced by planktivores at the Kahe outfall station (station 16) but carnivores remain important at Station 16 as they are elsewhere. The large volume of thermally-elevated water (3193.5 m^3 $x10^3$/day) is probably serving both as a source of food (entrained particles that have passed through the plant) as well as a warm and strong unidirectional current serving to attract and hold planktivorous species that naturally orient into the current seeking food. In addition and as mentioned above, the steel and armor rock superstructure that covers the discharge pipe along with high coral coverage provides habitat shelter and for some fish species a suitable substratum for spawning. A considerable part of the planktivore biomass at station 16 is comprised of two sergeant major or mamo species (*Abudefduf abdominalis* and the recently recognized *Abudefduf vaigiensis*) both of which not only feed in the discharge plume and environs, but also lay demersal eggs on the rocky substratum overlaying the discharge pipe. These two species along with the paletail unicornfish or kala lolo (*Naso brevirostris*) dominate the planktivore biomass at this site together comprising almost 58% of the total estimated standing crop present based on the 2008-2011 data.

4. Differences in Fish Community Structure in the Study Area

This study was undertaken to follow changes in coral reef fish communities as part of the environmental monitoring program related to the development of the CIP generation facility. Sixteen sites spread along 7.9 km of coastline are monitored (Figure 1); referring to Figure 1,

these sites geographically fall into four groups: on the southeast are four stations offshore of Campbell Industrial Park and the generation plant (station nos. 1-4 or East 1 through 4), three stations seaward of Ko'Olina Resort (station nos. 5-7 or Ko'Olina 1 and 2 as well as HECO 1D), five stations fronting the Kahe generation facility (station nos. 8-12 or HECO 5B, 7B, 7C, 7D, and 7E) and three stations to the north of Kahe Point (station nos.13-15 or HECO 10C, Nanakuli 1 and 2). Because station 16 (the Kahe discharge pipe) is a man-made structure and not natural substratum like the other fifteen monitored sites, it is excluded from the present analysis.

The question, "Are there any statistically significant differences among the mean number of fish species per transect, the mean number of individual fish per transect or the mean estimated standing crop (in g/m^2) per transect among the four above geographic groups of stations established on natural substratum and sampled in the 2007-11 period?" can be answered again using the Kruskal-Wallis ANOVA and the SNK Test. The results of these statistical procedures are given in Table 5. As noted previously, the Kruskal-Wallis ANOVA can discern whether means differ significantly but cannot separate those that are thus the SNK Test is used to demonstrate which means differ significantly from the others. In all cases the ANOVA noted significant differences exist among the four areas (i.e., CIP, Ko'Olina, Kahe and Nanakuli) for all three parameters (i.e., mean number of fish species per transect, mean number of individual fish per transect and mean standing crop of fishes per transect). The SNK Test demonstrated that the mean number of fish species, individuals and standing crops are significantly greater and statistically separable at the Ko'Olina group of stations over the three other station groups, all of which were related (Table 5). Coral community development (coverage) appears to be greater at the three Ko'Olina stations than found at any of the other transect sites and may be responsible for the greater diversity of species, numbers of individuals and standing crops present there.

Summarizing the results as given in Table 5, several (often non-significant) trends are apparent. First, the diversity of fish species, the numbers of fishes counted and their estimated biomass are greatest at the three Ko'Olina stations (station nos. 5-7) and are least at the four stations offshore of Campbell Industrial Park (station nos. 1-4) for two of the three parameters. The development of benthic communities including corals is greater at Ko'Olina than found offshore of Campbell Industrial Park where the topographical complexity which often serves as shelter for fishes is probably the least among the four station groups. Benthic community development which includes the development of corals and topographical complexity are probably less at the Kahe (station nos. 8-12) and the North group (station nos. 13-15) of stations relative to Ko'Olina but greater than found offshore of Campbell Industrial Park. Finally, the mean number of fish species and individuals censused per transect as well as the mean estimated biomass of fishes per transect were greater at the north group of stations (station nos.13-15) relative to the Kahe stations (station nos. 8-12) and the CIP stations (station nos. 1-4).

The final statistical analysis of the 2007-2011 fish census data examines the mean number of fish species per transect, the mean number of individual fish per transect and the mean fish biomass per transect (in g/m^2) examining each of the sixteen stations again using the Kruskal-Wallis ANOVA and the SNK Test. In this analysis, the question is "Are there any statistically

significant differences between the mean number of fish species per transect, the mean number of individual fish per transect or the mean estimated standing crop among the 16 stations sampled in 2007-2011?" and the results are given in Table 6. Referring to Table 6, two simple facts emerge: (1) the Kahe discharge pipe station has a greater (but insignificant) mean number of fish species, individuals (significantly greater) and standing crop (significantly greater) over all other stations and (2) the means from all of the other fifteen stations (located on natural substratum) are all related due to overlap in the SNK Test results except for three stations (numbers 1, 11 and 14) where little shelter space is present and the number of fish species least. Again this obviously greater mean number of species, and significantly greater number individuals and standing crop at the Kahe discharge pipe is related to the presence of ample shelter, a unidirectional flow of thermally-elevated water and sufficient food resources present relative to all other stations which are located on natural substratum.

5. Fishery Resources

Appendix 1 in this report as well as in Brock (2009, 2010, 2011) provides lists of all fish species seen over the sixteen 2007-2011 surveys. In these lists are both species that are sought-after by commercial, subsistence and recreational fishers as well as species that are usually not. In the usually sought-after group of species, most of the individual fishes encountered on the transects were juveniles but occasionally adult individual fishes were seen. Among the species seen include a number of small schools of the mackerel scad or opelu (*Decapterus macarellus*) especially around stations fronting the Kahe Generating facility in the December 2007 survey and scattered through the various stations and sample dates were seen adults of the moano kea (*Parupeneus cyclostomus*), omilu (*Caranx melampygus*), smaller individuals (papio) of the barred jack (*Carangoides ferdau*), lemon spot jack (*C. orthogrammus*), ulua aukea (*Caranx ignobilis*), pa'opa'o (*Gnathanodon speciosus*). Adults of other species seen include the lai (*Scomberoides lysan*), uku (*Aprion virescens*), wahanui (*Aphareus furca*), the introduced ta'ape (*Lutjanus kasmira*) especially at stations 13 and 16 and to'au (*Lutjanus fulvus*), weke (*Mulloidichthys flavolineatus*), weke'ula (*M. vanicolensis*), munu (*Parupeneus insularis*), moano (*P. multifasciatus*), malu (*P. pleurostigma*) kumu (*P. porphyreus*), nenue (*Kyphosus sandwicensis*), a'awa (*Bodianus bilunulatus*), kupoupou (*Cheilio inermis*), po'ou (*Oxycheilinus unifasciatus*), laenihi (*Iniistius umbrilatus*), the parrotfishes or uhus (*Scarus rubroviolaceus, S. psittacus, S. sordidus, S. perspicillatus, Calotomus carolinus*), the surgeonfishes including paku'iku'i (*Acanthurus achilles*), palani (*A. dussumieri*), maikoiko (*A. leucoparieus*), ma'i'i'i (*A. nigrofuscus*), maiko (*A. nigroris*), na'ena'e (*A. olivaceus*), manini (*A. triostegus*), pualu (*A. xanthopterus* and *A. blochii*), kole (*Ctenochaetus strigosus*), kala lolo (*Naso brevirostris*), kala holo (*N. hexacanthus*), umaumalei (*N. lituratus*), kala (*N. unicornis*), paki'i (*Bothus pantherinus*), humuhumu ele'ele (*Melichthys niger*), humuhumu hi'ukole (*M. vidua*) and the loulu (*Aluterus scriptus*). Besides these species as adults, juveniles of these and other species (e.g., the mu - *Monotaxis grandoculis*) were seen. Many of the adult individual fishes in the highly sought-after group were seen at varying distances away from the actual census areas, thus some species do not appear in the station counts (Appendix 1).

Usually the most consistent location for finding many of the sought-after fish species both as adults and as juveniles is on the armor rock and steel protective cover for the Kahe plant warm-water discharge (station 16). Because of the high degree of shelter afforded by the armor rock as well as the well-developed coral community present on it and also due to the outfall (discharge), many species congregate there. Among these are many mamo (two species recognized, the Hawaiian mamo - *Abudefduf abdominalis* and the recently recognized species *Abudefduf vaigiensis*). Under the cover of the rocks are seen menpachi (*Myripristes amaneus*), aweoweo (*Priacanthus cruentatus*) and ‘upapalu (*Apogon kallopterus*). In the December 2007 survey an estimated 200 grey mullet or ama’ama (*Mugil cephalus*) were encountered at station 13. These fish had an average estimated length of 33 cm (~13 inches) contributing an estimated weight of 97.7 kilograms (215 lbs) to the standing crop at this station.

Many coral reef species other than fish are caught and consumed by people; among these are specific algae and a number of invertebrates. Some individuals are interested in the collection of shells and when these usually cryptic species are seen at a station, they are so noted. Two species of molluscs have been seen on several occasions in the 2007-2011 surveys; these are the tiger cowry (*Cypraea tigris*) and the triton shell (*Charonia tritonis*). A species important in the making of fishing lures is the pearl oyster or pa (*Pinctado margaritifera*) which is protected by law and is commonly seen at many of the survey sites. The octopus or he’e (*Octopus cyanea*) was occasionally encountered at some of the stations. Individual he’e ranged from less than a pound in weight up to an estimated four pounds. The sought-after alga, limu kohu (*Asparagopsis taxiformis*) is seasonally common at many of the stations sampled in this study.

6. Standing Crops

Coral reefs function as relatively closed systems and thus in the pristine situation may represent the accumulation of carbon over a considerable period of time (Johannes *et al.* 1972). Some of this carbon is tied up in the living biomass of the reef of which fishes are only a part. Goldman and Talbot (1975) have suggested that a reasonable maximum biomass of coral reef fishes is approximately 200 g/m^2 (or 2,000 kg/ha). Space and cover are important agents governing the distribution of coral reef fishes (Sale 1977). Similarly the standing crop of fishes on a reef is correlated with the degree of vertical relief of the substratum (Risk 1972). Studies conducted on coral reefs in Hawai’i and elsewhere have estimated fish standing crops to range from 20 to 200 g/m^2 (Brock 1954, Goldman and Talbot 1975, Brock *et al.*1979). Eliminating the direct impact of man due to fishing pressure and/or pollution, the variation in standing crop appears to be related to the variation in the local topographical complexity of the substratum which is governed, in part, by the degree of development in the coral community. Thus habitats with high structural complexity affording considerable shelter space usually harbor a greater estimated standing crop of coral reef fish; conversely, transects conducted in structurally simple habitats (e.g., sand flats) usually result in lower estimated standing crops (0.2 to 20 g/m^2). Local studies (Brock and Norris 1989) suggest that with the manipulation (increasing) of habitat space or food resources (Brock 1987), fish standing crops may approach 2,000 g/m^2. Thus under certain circumstances, coral reefs may be able to support much larger standing crops of fishes

than previously realized.

High standing crops (i.e., above 200 g/m^2) were encountered during every survey at several stations. In the 27 December 2007 survey at station 9 where the estimated standing crop was 290 g/m^2, the opelu (*Decapterus macarellus*) made up 89% of this total at that location. Opelu are a coastal neritic species meaning that they school and move freely through the coastal waters which is very different than many coral reef fish species that have much smaller areas in which they forage. Similarly at station 13 where the standing crop was estimated to be 594 g/m^2, the school of grey mullet or ama'ama (*Mugil cephalus*) described above comprised 82% of the total biomass. Again, ama'ama are usually seasonal in their appearance in coastal waters and travel over large areas of Hawaii's waters. In the 4 April 2008 survey at station 2, a school of 60 adult na'ena'e (*Acanthurus olivaceus*) swam through the census area bringing the total estimated biomass to 238 g/m^2 and these fish comprised 84% of the total weight present at this station. The 30 May 2008 survey noted a high standing crop at station 16 (358 g/m^2) where the mamo (*Abdufduf abdominalis* and *A. viagiensis*) made up 29% of the total and the kala lolo (*Naso brevirostris*) added 13% to the total estimated weight at this station. On 19 August 2008 at station 16 the estimated biomass was 396 g/m^2 and again, the mamo comprised 51% of the total and a school of opelu passed through the census area and contributed 22% to the standing crop present at this station. In the 25 November 2008 survey at station 16 where the estimated standing crop was 225 g/m^2, the two mamo species again comprised 38% of the biomass present at that time. In March 2009 survey station 6 had an estimated sanding crop of 259 g/m^2 and the palukaluka (*Scarus rubroviolaceus*) contributed 16% of the standing crop while the na'ena'e (*Acanthurus olivaceus*) added 40% to the biomass at this station. At station 16 the where the standing crop was estimated to be 577 g/m^2, two mamo species made up 15%, the kala lolo (*Naso brevirostris*) contributed 15% and the uhu (*Scarus sordidus*) added 22% to the standing crop present. In the May 2009 survey station 5 had an estimated standing crop of 224 g/m^2 and the na'ena'e (*Acanthurus olivaceus*) made up 33% of it while at station 16 where the standing crop was estimated to be 425 g/m^2, the two mamo species comprised 20% of the total weight present. The July 2009 survey noted that the estimated standing crop at station 4 was 209 g/m^2 and the na'ena'e (*Acanthurus olivaceus*) made up 70% of it while at station 5 the standing crop was 267 g/m^2 and again, na'ena'e made up 30% of the total biomass present. The standing crop of fishes at station 16 was estimated to be 431 g/m^2 and the two mamo species made up 27% of it while the kala lolo (*Naso brevirostris*) added 8% to the biomass present.

The 29 March 2010 survey noted only one station with an estimated standing crop greater than 200 g/m 2 ; this was station 16 where the standing crop was 561 g/m^2 and the opelu (*Decapterus macarellus*) comprised 26% and the kala lolo (*Naso brevirostris*) made up 24% of the total estimated standing crop at this station. The 14 May survey encountered estimated standing crops in excess of 200 g/m^2 at two stations; station 5 noted a biomass of 242 g/m^2 with the na'ena'e (*Acanthurus olivaceus*) contributing 62% of this estimated weight and the kole (*Ctenochaetus strigosus*) adding another 13% to the total weight at this station. The estimated standing crop at station 16 was 390 g/m^2 and the two mamo species (*Abudefduf abdominalis* and *A. viagiensis*) contributed 35% of this estimated weight and the kala lolo (*Naso brevirostris*)

added 25% to the total at this station. In the 12 August 2010 survey the standing crop at station 15 was estimated to be 207 g/m^2 and the whitebar surgeonfish or maiko'iko (*Acanthurus leucoparieus*) provided 27% of this total and the na'ena'e (*Acanthurus olivaeus*) added 52% to the standing crop at this station. Again the estimated biomass at station 16 in the August 2010 survey was elevated (603 g/m^2) and five species were important contributors: the opelu (*Decapterus macarellus* - 25%), the two mamo species (*Abudefduf abdominalis* and *A. viagiensis* - 13%), the hinalea lauwili (*Thalassoma duperrey* - 18%) and the kala lolo (*Naso brevirostris* - 11%). The 29 October 2010 survey found three stations with estimated standing crops in excess of 200 g/m^2. The standing crop at station 7 was estimated to be 245 g/m^2 and the humuhumu ele'ele (*Melichthys niger*) added 49% to the total and the red weke or weke'ula (*Mulloides vanicolensis*) contributed 26%. At station 9 the standing crop was estimated to be 730 g/m^2 where a large school of white weke (*Mulloides flavolineatus*) in the transect area made up 99% of the biomass at this station. Finally at station 16 the biomass was estimated to be 554 g/m^2 and several schools of opelu (*Decapterus macarellus*) made up 41% of the total and a school of blue-lined snapper or ta'ape (*Lutjanus kasmira*) added 23% to the total at this station.

The 25 February 2011 survey noted only one station with a high estimated standing crop which was Station 16 on the Kahe discharge pipe where the estimated stnding crop was 430 g/m^2 and the bluelined snapper or ta'ape (*Lutjanus kasmira*) comprised 52 percent of it and the kala lolo (*Naso breivrostris*) made up 21 percent of the estimated weight at this station. The 16 June survey found a high standing crop (273 g/m^2) at Station 3 where the na'ena'e (*Acanthurus olivaceus*) made up 75 percent ot the total estimated weight recorded at this station. At Station 6 the standing crop was estimated to be 206 g/m^2 and the palukaluka (*Scarus rubroviolaceus*) contributed 38 percent to this and the na'ena'e (*Acanthurus olivaceus*) added 27 percent to this estimated biomass while at station 16 the standing crop was estimated to be 318 g/m^2 and the two mamo species (*Abudefduf abdominalis* and *A. viagiensis*) added 25 percent while the kala lolo (*Naso brevirostris*) contributed 33 percent to the total at this station. In the 29 July 2011 survey the standing crop at Station 3 was 435 g/m^2 and the na'ena'e (*Acanthurus olivaceus*) made up 89 percent of the total while at Station 6 where the standing crop was 234 g/m^2, the na'ena'e comprised 22 percent and the palukaluka (*Scarus rubroviolaceus*) added 24 percent to the biomass at this station. Again the standing crop at Station 16 was high (436 g/m^2) and the ta'ape (*Lutjanus kasmira*) contributed 32 percent, the weke'ula (*Mulloides vanicolensis*) added 23 percent while the kala lolo (*Naso brevirostris*) comprised 17 percent of the biomass at this station. Finally the 23 November 2011 survey found a high standing crop at Station 2 (263 g/m^2) and Station 3 (379 g/m^2) both due to the na'ena'e (*Acanthurus olivaceus*) making up 67 percent at Station 2 and 60 percent at Station 3. At Station 10 on this date, a school of weke'ula (*Mulloides vanicolensis*) made up 71 percent of the estimated 318 g/m^2 and at Station 16 another school of weke'ula comprised 66 percent of the total 681 g/m^2 estimated biomass at this station.

A simple review of the above data finds that the same species often contribute substantially to the estimated standing crops at the same stations over time. A major reason for this is despite many station not having a high degree of topographic complexity present in the 4 x 50 m transect area, it may be present in the near vicinity. Since many of the fishes encountered on a transect

such as the na'ena'e (*Acanthurus oliveceus*) and the palukaluka (*Scarus rubroviolaceus*) move and forage over areas considerably larger than the census area, they often will pass through the census area while it is being conducted and are thus counted.

7. Comparative Analysis of Early HECO Biological Data to the 2007-2011 Data

As noted above, HECO's environmental monitoring program for the Kahe Generating facility started in the 1970's, monitoring many of the same locations that are monitored today fronting the plant. These data are given in Coles *et al.* (1985b) and in a summary table (Table 33) in Coles *et al.* (1985a). Fish transect data from seven stations sampled in the 1976-1984 period fronting the Kahe Generating facility have been compared to the 2007-2011 data collected from those same sites. The sites include station 7 (old #1-D started in 1979), station 8 (old #5-B started in 1976), station 10 (old #7-C started in 1976), station 11 (old #7-D started in 1976), station 12 (old #7-E started in 1980), station 13 (old #10-C started in 1979) and station 14 (old Nanakuli control started in 1979). In this analysis, the annual means for the number of fish species and number of fish individuals encountered over those seven stations in common between the two groups of surveys are compared by addressing the question, "Are there any statistically significant differences among the annual mean number of fish species or annual mean number of individual fish censused per transect over the 1979-1984 and 2007-2011 periods?" Again, to address this question two nonparametric tests were used: the Kruskal-Wallis analysis of variance (ANOVA) and the Student-Newman-Kuels (SNK) Test where the Kruskal-Wallis ANOVA is used to demonstrate statistically significant differences among parameter means (by date) but cannot show where those differences are and the SNK Test is used to group related sample means and separate those means that are significantly different from one another.

The results of these analyses are given in Table 7 and referring to this table, we find that there are no significant differences among either of the annual means for the number of fish species seen per transect or the number of individual fish censused per transect despite the imposition of three major storm events. With respect to the annual mean number of species seen per transect, we find the greatest annual means occurring prior to the January 1980 storm event and the lowest mean (1983) occurring following Hurricane Iwa in 1982. With the annual mean number of individual fish seen per transect, the highest means occur with the recent (2007-2011) surveys and the lowest following Hurricane Iwa (1983) but the order among the dates does not parallel that for the fish species (Table 7). Thus not all species of fish were impacted to the same degree with the occurrence of these two early high wave events. Fish standing crop information was not readily available for Stations 7, 8, 10, 11, 12, 13 or 14 in the early (1976-1984) HECO dataset except for 1984 thus was not included in the above (Table 7) analysis. However, the nonparametric Wilcoxon Two-Sample Test was used to examine the mean estimated standing crop of fishes in 1984 at the above seven stations comparing this mean to the mean estimated biomass at these stations in the 2007-2011 dataset. Despite the mean estimated standing crop (here 50 g/m^2) being greater in 2007-2011 than in 1984 (26 g/m^2), the Kruskal-Wallis ANOVA failed to find any statistically significant differences ($p<0.26$, n.s., where a $p>0.05$ signifies significance) in the estimated standing crop at these seven stations sampled minimally 22 years

apart. Again the standing crop statistical results support those found with the mean number of fish species or the mean number of individual fish censused per transect (Table 7). In summary, there are no statistically significant differences among the annual mean number of fish species or individuals censused utilizing data that span a 35-year period (1976-2011) at seven monitoring stations fronting the Kahe Generating facility despite the imposition of three major storm events. These data suggest that the fish communities have to some extent recovered from these disturbances.

8. Federally Protected Species

When encountered during field work, federally protected species are noted. Five species that are encountered (or heard underwater) around the high Hawaiian Islands are the green turtle (*Chelonia mydas*), the hawksbill turtle (*Eretmochelys imbricata*), the spinner porpoise (*Stenella longirstris*), the Hawaiian monk seal (*Monachus schauinslandi*) and present seasonally, the humpback whale (*Megaptera novaeangliae*).

Because of low population numbers, the Hawaiian green sea turtle was given protection under the federal Endangered Species Act in the mid-1970's. Green turtles as adults are known to forage and rest in the shallow waters around the main Hawaiian Islands. Reproduction in the Hawaiian population occurs primarily during the summer months in the Northwest Hawaiian Islands with adults migrating during the early summer to these isolated atolls and returning in the late summer or early fall. In the main Hawaiian Islands, green turtles rest along ledges, caves or around large coral mounds in coastal waters usually from 15 to 20 m in depth during the day. Under the cover of darkness, turtles will travel inshore to shallow subtidal and intertidal habitats for foraging on algae or limu. (Balazs *et al.* 1987). The normal range of these daily movements between resting and foraging areas is about one kilometer (Balazs 1980, Balazs *et al.* 1987). In general appropriate algal forage for these turtles is found in shallow waters inshore of the resting areas. Selectivity of algal species consumed by Hawaiian green turtles appears to vary with the locality of sampling, but stomach content data show *Acanthophora spicifera* (an introduced species) and *Amansia glomerata* to quantitatively be the most important (Balazs *et al.* 1987); the preferences may be due to the ubiquitous distribution of these algal species.

The Hawaiian green turtle population has rebounded under the more than 30 years of federal protection afforded to it such that today, green turtles are commonly seen in the waters fronting most beaches around the islands. In contrast, the hawksbill turtle is much less common and much less is known about its biology in Hawaiian waters. Hawksbill turtles do not attain the size of green turtles in Hawaiian waters, nest on very small and isolated beaches around the main islands and are omnivorous in their feeding habitats. In the waters surveyed under the present study, no hawksbill turtles have been seen by us.

Green turtles were seen on ten of the sixteen surveys completed to date. All turtles seen were juveniles (i.e., having a carapace length estimated to be less than 75 cm) except for a pair of adults (estimated straight-line carapace lengths = 90 cm) in the 10 August 2010 survey at station

9. Some turtles were sleeping while others seen were actively swimming. There is a depression in the limestone at station 8 where green turtles often rest; in 2009 a small (~45 cm straight-line carapace length) green turtle was seen in this depression in the 19 March and 21 July 2009 surveys. In the August 2010 and 16 June 2011 surveys this same depression was occupied by a ~65 cm sleeping juvenile turtle. On the 23 November 2011 survey two turtles (~ 60 cm and ~70 cm) were found in this same depression sleeping. In the 25 November 2008 survey six green turtles were found resting on the bottom in a depression just seaward of station 5. In no cases were any tags or tumors seen on any of the turtles sighted to date.

For many years, Hawaiian monk seals were not seen very often around the main Hawaiian Islands but the population was located in the Northwest Hawaiian Islands and over time the population numbers have declined. Despite this, in recent years an increasing number of Hawaiian monk seals are now seen on the beaches around the main islands with the occasional female giving birth on island beaches. The reason(s) for these changes in the population are unknown but the result is monk seals are now occasionally seen while carrying out environmental surveys around the main islands. On the 30 May 2008 survey an adult male monk seal approached the vessel while at anchor at station 14. This seal carried a tag (not readable at distance) and it swam around the vessel and subsequently left heading towards the shoreline. This seal has not been seen subsequently.

It should be noted that the endangered humpback whale is known to frequent island waters in their annual migrations to Hawaiian wintering grounds. They normally arrive in island waters about December and depart by April. In general their distribution in Hawaii appears to be limited to the 180 m (100 fathom) isobath and in shallower waters (Nitta and Naughton 1989). Whales were seen well seaward of the Barbers Point - Kahe Point study area and their songs could be heard underwater during the 27 December 2007, the 19 March 2009, the 24 March 2010 and the 25 February 2011 surveys.

Spinner porpoises are occasionally seen in the Kahe Point area and were first encountered there in this study on the 30 May 2008 survey where three pods were seen each having about 35 individuals present. In the 14 May 2010 survey a pod of about 30 individuals passed by during a census at station 10. Hawaiian spinner porpoises are known to rest in shallow bays during the day and at night move offshore to feed on midwater fishes and squids that rise to the surface to forage.

9. Long-Term Perspective on the Barbers Point-Kahe Point Fish Communities

As noted and documented above, the three early storm events (1980, 1982 and 1992) all impacted marine communities offshore of the Barbers Point - Kahe Point areas. These impacts were probably greatest on the coral communities which due to their sessile nature, must withstand the wave forces impinging on them or perish. Corals are relatively slow-growing and depending on the species, individual colonies may live for a considerable time and in doing so create habitat for fishes and other reef species. If disturbance to the coral community is relatively

frequent, surviving corals probably do not contribute much to the three-dimensional structure of the habitat, thus keeping the fish community development in an earlier successional stage than it might otherwise be. Storms not only directly impact the living resources but also the geological status of reef areas. As noted by the early HECO studies, considerable sand movement occurred with the first two major storms such that today much of the area west of the Kahe facility's ocean outfall is now nearly devoid of sand leaving a near-featureless hard bottom that is scoured with passing small wave events which retards benthic and fish community development. A similar situation exists east of the Barbers Point Harbor entrance channel where considerable hard (limestone) substratum is present with much of it having poor benthic community development. This again results in a poorly developed resident fish community which is what we see in much of the area today and did so forty years ago (personal observations). Thus the measures of fish community development used here (the diversity of species and numbers of individuals present as well as the standing crop) do not suggest well-developed resident fish communities at many of the sample sites. However where topographical complexity is greater and benthic communities are better developed, the resulting fish communities are well-developed. This is best illustrated at station 16 (the HECO warm water discharge) where despite high use which includes snorkel/dive tours as well as spear fishermen, the fish community remains relatively well-developed. The high degree of development in the resident fish communities on the Kahe discharge structure lend further support to the lack of negative impact due to the operation of the discharge.

Given the long-term extant data set spanning 35 years and the apparent lack of strong significant changes occurring with the three early (1980, 1982 and 1992) storm events (which is probably due to some level of recovery in the intervening period), suggests that the variation seen in the measures of the fish community used here will continue to fluctuate at a similar magnitude in future monitoring events as this program moves forward. The 35 years of well-documented environmental history for the Barbers Point - Kahe Point area (completed largely by the HECO environmental program), provides much of the explanation to the degree of development of resident fish communities we encounter in the area today.

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TABLE 1. Latitude and Longitude waypoints (in decimal minutes) for each of the sixteen permanently marked fish monitoring stations utilized in this study (GPS waypoints courtesy of the Environmental Department, HECO). Note that the first survey carried out on 27 December 2007 did not sample station numbers 5, 6, 7 and 16. The second survey on 4 April 2008 missed station 16 while surveys carried out subsequently have sampled all sites.

Station No.	Station Area Name	Latitude	Longitude	Remarks
1	East 1	21°18.237' N	158°07.024'W	New- offshore CIP
2	East 2	21°18.452'N	158°07.152'W	New - offshore CIP
3	East 3	21°18.558'N	158°07.239'W	New - offshore CIP
4	East 4	21°18.406'N	158°07.285'W	New - offshore CIP
5	Ko'Olina 1	21°19.724'N	158°07.581'W	New - offshore Ko'Olina
6	Ko'Olina 2	21°19.904'N	158°07.693'W	New - offshore Ko'Olina
7	HECO station 1D	21°20.763'N	158°07.773'W	Old HECO station
8	HECO station 5B	21°21.145'N	158°07.819'W	Old HECO station
9	HECO station 7B	21°21.239'N	158°07.855'W	Old HECO station
10	HECO station 7C	21°21.255'N	158°07.881'W	Old HECO station
11	HECO station 7D	21°21.268'N	158°07.893'W	Old HECO station
12	HECO station 7E	21°21.272'N	158°07.977'W	Old HECO station
13	HECO station 10C	21°21.522'N	158°07.925'W	Old HECO station
14	Nanakuli Control 1	21°22.329'N	158°08.440'W	Old HECO station
15	Nanakuli Control 2	21°22.353'N	158°08.462'W	New control station
16	On Outfall	21°21.193'N	158°07.869'W	New north side of outfall

TABLE 2. Summary of the fish censuses carried out at sixteen locations on sixteen surveys over the December 2007 - November 2011 period. The percent of the total biomass is that assigned to each of five trophic categories: herbivores, planktivores, omnivores, carnivores and coral feeders is also given. Note that these percentages are rounded to the nearest whole number.

Sample Date	Transect No.	No. Species	No. Individuals	Biomass g/m2	% Total Biomass (g) Herb.	Plankt.	Omni	Carni	CF
27-Dec-07	1	12	69	15	18		1	51	30
	2	19	155	143	87			9	4
	3	30	189	41	28		6	51	15
	4	Not sampled							
	5	Not sampled							
	6	Not sampled							
	7	28	306	92	40		40	19	1
	8	25	241	43	51	7	3	39	
	9	23	259	290	6	1	1	92	
	10	17	261	154		9	3	88	
	11	13	23	104	6		5	82	7
	12	34	581	63	21	1	24	51	3
	13	31	580	594	85	3	1	11	
	14	18	124	7	23	2	3	72	
	15	23	164	94	51		8	40	1
	16	Not sampled							
04-Apr-08	1	10	129	8		1	1	59	39
	2	25	333	238	89		1	9	1
	3	18	146	21	38		7	54	1
	4	25	270	116	57		3	37	3
	5	34	307	146	81	2	2	13	2
	6	31	292	164	67	1	2	29	1
	7	21	365	158	14		75	11	
	8	27	499	29	26	5	4	64	1
	9	17	75	74	25	1	1	73	
	10	11	117	8	42	1	5	52	
	11	6	21	4		1	2	97	
	12	25	390	31		1	15	79	5
	13	16	401	62	3	15	7	70	5
	14	12	260	14	1	1		98	
	15	17	214	129	83		1	15	1
	16	Not sampled							
30-May-08	1	12	77	9		1	17	82	
	2	21	220	64	65			34	1
	3	22	136	37	24		9	62	4
	4	30	293	49	28	1	23	45	3
	5	30	250	84	73		8	20	2
	6	32	265	132	77	1	7	14	1
	7	24	292	94	21		53	25	1
	8	26	412	75	70	9	1	20	
	9	21	152	95	21	67	1	11	
	10	21	167	55	60	14	3	23	
	11	12	81	21	35	2	37	26	
	12	25	453	14		4	28	60	8
	13	24	263	24	5	11	18	66	
	14	26	188	20	9		1	67	23
	15	13	80	34	69		3	26	2
	16	42	1205	358	8	43	2	47	

TABLE 2. Continued

Sample Date	Transect No.	No. Species	No. Individuals	Biomass g/m2	% Total Biomass (g) Herb.	Plankt.	Omni	Carni	CF
19-Aug-08	1	19	155	13	1		9	90	
	2	20	280	120	85		2	13	
	3	23	231	40	27		5	66	2
	4	26	415	108	43	8	6	43	
	5	24	227	69	67		9	22	2
	6	35	302	165	79	1	6	14	
	7	24	213	65	9		56	35	
	8	27	463	39	49	1	2	47	
	9	23	235	34	56	4	6	34	
	10	39	201	33	9	1	5	85	
	11	32	126	41	1	2	23	57	17
	12	23	514	33	19	2	13	56	10
	13	21	385	63	45	16	4	35	
	14	19	192	8	4	1		95	
	15	15	104	16	44	1	2	47	6
	16	37	1023	396	3	55	1	41	
25-Nov-09	1	6	20	2			6	53	40
	2	10	41	4	21		6	73	
	3	21	100	12	47	3	3	46	1
	4	20	165	79	54		1	45	
	5	31	289	91	81		1	17	1
	6	36	263	189	82	2	4	10	2
	7	31	394	60	37		36	27	
	8	33	147	29	49	6	1	43	1
	9	25	374	171	14	1		85	
	10	31	364	62	45	4	2	49	
	11	9	52	18	44	1	2	53	
	12	31	426	19	17	6	30	38	9
	13	32	931	155	20	57	4	18	1
	14	19	170	15	38		1	61	
	15	24	234	171	91		2	7	
	16	40	1017	225	10	49	1	39	1
19-Mar-09	1	14	93	13	11		1	83	5
	2	14	102	15	16		2	79	3
	3	22	126	21	18		23	50	8
	4	18	125	25	21		18	61	
	5	27	302	113	82		2	14	2
	6	33	370	259	91	2	1	5	1
	7	32	349	91	41	1	44	13	1
	8	21	353	31	32	1	3	63	1
	9	17	111	74	6		2	92	
	10	13	52	14	35			64	1
	11	5	7	4		1		99	
	12	28	251	15	34	2	2	57	5
	13	30	458	84	17	5	6	72	
	14	17	84	7	35		2	63	
	15	23	148	115	92		1	6	1
	16	48	1438	577	31	34	2	32	1

TABLE 2. Continued

Sample Date	Transect No.	No. Species	No. Individuals	Biomass g/m2	% Total Biomass (g) Herb.	Plankt.	Omni	Carni	CF
11-May-09	1	11	108	12	22		1	77	
	2	18	231	41	27		1	68	4
	3	26	224	65	64		7	27	2
	4	25	328	61	58		3	36	3
	5	31	383	224	87		3	9	1
	6	30	240	153	86	2	4	6	2
	7	26	263	51	31	1	45	22	1
	8	27	363	35	56	4	9	30	1
	9	15	88	20	51		1	48	
	10	20	159	22	32	1	14	52	1
	11	4	9	12			7	93	
	12	24	267	20	13	1	11	74	1
	13	28	459	147	20	8	1	71	
	14	11	43	6	25		8	67	
	15	17	194	174	87		1	12	
	16	39	1333	425	35	22	6	37	
21-Jul-09	1	17	141	18	2		9	81	8
	2	25	389	73	52			43	4
	3	31	301	80	26	5	31	34	4
	4	27	506	209	80		4	15	1
	5	39	582	267	65	5	6	23	1
	6	37	354	188	74	2	7	16	1
	7	33	589	155	28	2	49	21	
	8	26	800	47	47	2	7	44	
	9	27	204	70	6	4	3	87	
	10	24	212	30	15	42	2	41	
	11	10	40	12		1	2	97	
	12	26	432	20	18	6	18	46	12
	13	24	405	145	7	11	1	81	
	14	15	111	9	1	1	2	96	
	15	21	258	140	77	6	7	8	2
	16	40	1605	431	5	36	3	56	
29-Mar-10	1	17	162	30	56	0	9	25	10
	2	22	315	33	34	0	4	57	5
	3	27	197	45	70	1	10	17	2
	4	24	324	105	65	0	2	32	1
	5	31	312	129	76	4	8	10	2
	6	29	313	176	85	1	5	9	1
	7	26	336	67	26	0	46	28	0
	8	29	265	56	51	2	5	42	
	9	19	83	18	23	2	0	74	1
	10	13	53	10	40	0	21	38	
	11	10	28	14	1	0	4	95	
	12	24	245	54	7	54	15	23	0
	13	34	312	69	18	14	6	62	0
	14	11	101	7	31	0	2	65	2
	15	24	149	77	75		4	20	1
	16	29	1192	561	24	27	2	47	

TABLE 2. Continued

Sample Date	Transect No.	No. Species	No. Individuals	Biomass g/m2	% Total Biomass (g) Herb.	Plankt.	Omni	Carni	CF
14-May-10	1	18	94	15	55	0	8	37	
	2	17	91	14	33		7	48	13
	3	23	160	63	70	0	3	24	2
	4	16	326	85	71	0	6	19	4
	5	35	511	242	87	3	4	6	1
	6	37	241	164	82	2	3	14	1
	7	23	395	113	11	1	39	49	1
	8	26	361	80	78	2	6	13	0
	9	28	179	159	24	3	1	72	0
	10	21	119	55	53	24	2	20	0
	11	9	43	21		1	36	63	
	12	25	299	51	31	18	26	23	1
	13	31	369	57	9	35	5	50	0
	14	10	19	2	22		8	70	
	15	26	201	139	91	0	1	8	0
	16	33	1767	390	13	63	8	16	
12-Aug-10	1	22	198	157	69	0	1	31	0
	2	25	313	69	34	0	6	59	1
	3	25	225	28	42	0	8	49	1
	4	22	358	151	67	0	12	21	
	5	36	426	163	73	1	7	19	1
	6	30	233	118	63	2	11	23	1
	7	26	271	100	29	0	40	31	1
	8	24	425	62	73	1	5	21	0
	9	28	104	40	47	7	0	46	0
	10	20	106	31	24	49	4	23	0
	11	13	58	19	9	2	36	53	
	12	31	317	24	29	31	15	25	0
	13	32	359	60	11	12	10	68	
	14	13	51	23	85	0	0	14	2
	15	26	248	207	89	0	1	10	0
	16	33	1584	603	14	27	1	58	0
29-Oct-10	1	14	104	96	79		0	21	
	2	13	208	56	73		0	26	0
	3	27	183	49	61	0	6	32	2
	4	22	195	66	61	0	8	31	
	5	38	315	98	69	0	5	24	2
	6	36	294	123	79	2	3	15	2
	7	31	743	245	7	0	50	42	0
	8	28	262	24	33	1	6	60	0
	9	22	467	730	0	0	0	99	0
	10	17	57	21	31	0	10	59	1
	11	13	38	15	1	1	34	64	
	12	36	334	23	34	2	13	50	1
	13	35	478	192	23	5	1	69	1
	14	9	57	7		0	1	99	
	15	28	169	31	24	0	11	46	19
	16	35	1039	554	7	16	1	76	

TABLE 2. Continued

Sample Date	Transect No.	No. Species	No. Individuals	Biomass g/m2	% Total Biomass (g) Herb.	Plankt.	Omni	Carni	CF
25-Feb-11	1	9	42	5	13		1	86	
	2	16	183	66	83		1	17	
	3	17	119	18	17		16	66	1
	4	20	266	25	47	1	18	34	
	5	31	307	99	54	0	4	40	1
	6	27	328	196	49	6	4	40	1
	7	18	235	93	8		67	25	
	8	25	307	33	13	7	2	77	0
	9	13	61	10	11	19	21	48	0
	10	7	26	4		0	19	80	
	11	8	15	12		0	41	59	
	12	24	243	14	29	7	21	42	1
	13	27	427	119	22	19	5	54	
	14	9	32	2	13	1	3	83	
	15	14	69	23	28	0	6	66	0
	16	24	910	430	8	32	2	59	0
16-Jun-11	1	18	162	124	91	0	1	8	0
	2	17	123	66	78	0	2	19	0
	3	27	275	273	88		1	10	1
	4	25	340	80	66	0	6	28	0
	5	24	270	74	63	5	9	22	1
	6	33	281	207	82	1	8	8	0
	7	27	434	131	35	0	32	32	
	8	27	464	37	60	6	6	28	
	9	15	54	14	25	0	18	56	0
	10	16	103	13	6	1	0	93	
	11	11	42	6	1	1	0	98	
	12	28	769	50	2	54	8	36	0
	13	29	383	75	3	8	8	79	3
	14	12	88	5	0	1		99	
	15	21	340	108	94	0	3	3	1
	16	40	1315	318	17	59	6	17	0
29-Jul-11	1	16	137	14	4		8	89	0
	2	21	183	52	59	0	2	39	0
	3	23	277	435	96	1	2	1	0
	4	26	299	52	42	0	13	44	
	5	34	333	138	88	0	1	10	1
	6	36	375	234	86	1	5	6	1
	7	23	309	100	8	2	55	35	
	8	33	802	38	42	12	3	39	4
	9	22	477	285	13	0	0	86	0
	10	11	58	5	0	1		98	
	11	9	53	2	1	9	1	90	
	12	32	297	22	3	2	42	53	1
	13	33	327	36	13	23	10	53	0
	14	12	67	5	5	0	1	93	
	15	22	113	82	84		5	11	
	16	38	864	436	4	25	1	70	0

TABLE 2. Continued

Sample Date	Transect No.	No. Species	No. Individuals	Biomass g/m2	% Total Biomass (g) Herb.	Plankt.	Omni	Carni	CF
23-Nov-11	1	15	179	161	92		0	8	0
	2	22	348	263	88		0	11	1
	3	38	320	379	92		2	5	1
	4	26	360	166	81	0	4	14	1
	5	29	320	122	83	0	3	13	0
	6	30	291	188	85	0	3	11	1
	7	26	244	68	16	0	64	19	1
	8	27	343	32	45	7	5	41	1
	9	23	102	29	61	0	4	34	0
	10	20	85	19	40	0	5	53	2
	11	13	26	50	5		10	86	
	12	34	691	24	30	4	21	44	1
	13	35	1253	318	1	6	2	91	
	14	12	44	7	56	0	1	43	
	15	17	85	16	56	0	17	21	6
	16	28	1318	681	10	19	0	70	0

TABLE 3. Results of the Kruskal-Wallis ANOVA and the Student-Neuman-Keuls (SNK) Test addressing the question , "Are there any statistically significant differences among the mean number of fish species seen per transect,the mean number of individual fish censused per transect or the mean estimated total standing crop (in g.m2) per transect for the 15 stations among the sixteen 2007-2011 sample periods?" The Kruskal-Wallis result is given as a "p" value at the top of the entry where (p>0.05 or less for significance). The SNK Test is used to separate means that are significantly different from one another. In the body of the table are given the sample date and mean for a given parameter on that date. Letters are used to show differences with the SNK Test; letters with the same designation show means and sample dates that are related and changes in letter designation show where significant differences exist. Overlaps in letters indicate a lack of significant differences and in such cases, only the extremes may be significantly different.

1. Mean Number of Fish Species Per Transect (p>0.61, n.s.)

Date	[n]	Mean	SNK Grouping
Jul-09	15	25.5	A
Aug-10	15	24.9	A
Aug-08	15	24.7	A
Oct-10	15	24.6	A
Nov-11	15	24.5	A
Nov-08	15	23.9	A
Jul-11	15	23.5	A
May-10	15	23.0	A
Dec-07	12	22.8	A
Mar-10	15	22.7	A
May-08	15	22.6	A
Jun-11	15	22.0	A
Mar-09	15	20.9	A
May-09	15	20.9	A
Apr-08	15	20.3	A
Feb-11	15	17.7	A

Interpretation: There are no significant differences among the mean number of species found per transect over the sixteen sample periods.

TABLE 3.Continued.

2. Mean Number of Individual Fish Per Transect (p>0.74, n.s.)

YEAR	[n]	Mean	SNK Grouping
Jul-09	15	355	A
Nov-11	15	313	A
Jun-11	15	275	A
Jul-11	15	274	A
Aug-08	15	270	A
Nov-08	15	265	A
Oct-10	15	260	A
Apr-08	15	255	A
Aug-10	15	246	A
Dec-07	12	246	A
May-10	15	227	A
May-09	15	224	A
May-08	15	222	A
Mar-10	15	213	A
Mar-09	15	195	A
Feb-11	15	177	A

Interpretation: There are no significant differences among the mean number of species found per transect over the sixteen sample periods.

3. Mean Total Standing Crop of Fish Per Per Transect (p>0.79, n.s.)

YEAR	[n]	Mean	SNK Grouping
Dec-07	12	25969	A
Nov-11	15	24047	A
Oct-10	15	23517	A
Jul-11	15	19978	A
Jul-09	15	19389	A
Jun-11	15	16764	A
May-10	15	16578	A
Aug-10	15	16463	A
Apr-08	15	15984	A
Nov-08	15	14174	A
May-09	15	13782	A
Mar-10	15	11747	A
Mar-09	15	11705	A
Aug-08	15	10883	A
May-08	15	10531	A
Feb-11	15	9469	A

Interpretation: Despite the range in the estimated total standing crop per station over the sixteen sample dates, there are no significant differences.

TABLE 4. Percent contribution based on estimated biomass for each of five feeding guilds of fishes as determined across all fifteen natural substratum stations over sixteen survey dates in Part A. In Part B is given the same information for station 16 (Kahe outfall pipe) which was sampled commencing with the 30 May 2008 survey. In the body of the table are given the percent contribution by weight to each trophic category. Note that the December 2007 survey did not sample three of the fifteen stations. Data summarized from Table 2.

PART A. Stations 1 - 15:

Mean Percent by Weight

Date	[n]	Herbivore	Planktivore	Omnivore	Coral Feeder	Carnivore
27-Dec-07	12	35	2	8	5	50
04-Apr-08	15	35	2	8	4	51
30-May-08	15	37	7	14	3	39
19-Aug-08	15	36	2	10	3	49
25-Nov-08	15	43	5	6	4	42
19-Mar-09	15	35	1	7	2	55
11-May-09	15	44	1	8	1	46
21-Jul-09	15	33	6	10	2	49
29-Mar-10	15	44	5	9	2	40
19-May-10	15	51	6	9	1	33
12-Aug-10	15	49	7	10	1	33
29-Oct-10	15	41	1	9	1	48
25-Feb-11	15	30	6	15	1	54
16-Jun-11	15	46	6	7	1	41
29-Jul-11	15	36	4	11	1	50
23-Nov-11	15	55	2	9	1	33
Grand Means		40.6	3.9	9.4	2.0	44.5

PART B. Stations 16 (Outfall Pipe) Only:

Mean Percent by Weight

Date	[n]	Herbivore	Planktivore	Omnivore	Coral Feeder	Carnivore
30-May-08	1	8	43	2		47
19-Aug-08	1	3	55	1		41
25-Nov-08	1	10	49	1	>1	39
19-Mar-09	1	32	34	2	>1	32
11-May-09	1	35	22	6		37
21-Jul-09	1	5	36	3		56
29-Mar-10	1	24	27	2		47
19-May-10	1	13	63	8		16
12-Aug-10	1	14	27	1		58
29-Oct-10	1	7	16	1		76
25-Feb-11	1	8	32	2	>1	59
16-Jun-11	1	17	59	6	>1	17
29-Jul-11	1	4	25	1	>1	70
23-Nov-11	1	10	19	0	>1	70
Grand Means		13.6	36.2	2.6	0.1	47.5

TABLE 5. Results of the Kruskal-Wallis ANOVA and the Student-Neuman-Kuels (SNK) Test addressing the question, "Are there any statistically significant differences among the mean number of fish species per transect, the mean number of individual fish per transect or the mean estimated standing crop (in g/m^2) per transect among the four geographic groups of stations established on natural substratum and sampled in the 2007-2011 period?" The four groups of transects are CIP (station nos. 1-4), Ko'Olina (station nos. 5-7), Kahe (station nos. 8-12) and North (station nos. 13-15). The Kruskal-Wallis result is given as a "p" value at the top of the entry where (p>0.05 or less for significance). The SNK Test is used to separate means that are significantly different from one another. In the body of the table are given the four geographically-related groups of stations and parameter means per transect for each of those groups. Letters are used to show differences with the SNK Test; letters with the same designation show means and station groups that are related and changes in letter designation show where significant differences exist. Overlaps in the letters indicate a lack of significant differences and in such cases, only the extremes may be significantly different.

1. Mean Number of Fish Species Per Transect by Station Group (p>0.0001, Significant)

Station Group	(n)	Mean	SNK Grouping
Ko'Olina	45	30.2	A
Nanakuli	48	21.4	B
Kahe	80	21.2	B
CIP	64	20.5	B

Interpretation: The mean number of fish species per transect at Ko'Olina stations is significantly greater than at any of the other station groups which are all related over the sixteen sample periods.

2. Mean Number of Individual Fish Per Transect by Station Group (p>0.0001, Significant)

Station Group	(n)	Mean	SNK Grouping
Ko'Olina	45	334	A
Nanakuli	48	254	B
Kahe	80	236	B
CIP	64	211	B

Interpretation: The mean number of individual fish per transect at Ko'Olina is significantly greater than at any of the other station groups which are all related over the sixteen sample periods.

TABLE 5. Continued.

3. Mean Standing Crop of Fishes (in g/m^2) Per Transect by Station Group (p>0.0001, Significant)

Station Group	(n)	Mean	SNK Grouping
Ko'Olina	45	140	A
Nanakuli	48	81	B
CIP	64	79	B
Kahe	80	52	B

Interpretation: Both the Kruskal-Wallis ANOVA and the SNK Test found significant differences among station groups, where the mean estimated fish standing crop was significantly greater at stations offshore of Ko'Olina than at any of the other three station groups which were all statistically related.

TABLE 6. Results of the Kruskal-Wallis ANOVA and the Student-Neuman-Keuls (SNK) Test addressing the question, "Are there any statistically significant differences among the mean number of fish species per transect, the mean number of individual fish per transect or the mean estimated standing crop (in g/m2) per transect seen among the sixteen stations established and sampled over the sixteen periods in 2007-2011?" The Kruskal-Wallis result is given as a "p" value at the top of the entry (where p>0.05 or less for significance). The SNK Test is used to separate means that are significantly different from one another. In the body of the table are given the stations, the number of times each was sampled (n) and parameter means per transect for each. Letters are used to show differences with the SNK Test; letters with the same designation show means and station groups that are related and changes in letter designation show where significant differences exist. Overlaps in the letters indicate a lack of significant differences and in such cases, only the extremes may be significantly different.

1. Mean Number of Fish Species Per Station in 2007-11 (p < 0.0001, Significant)

Station Group	[n]	Mean	SNK Grouping			
16 (Pipe)	14	36	A			
6 (Ko'Olina 2)	15	33	A	B		
5 (Ko'Olina 1)	15	32		B	C	
13 (HECO 10C)	16	30		B	C	D
12 (HECO 7E)	16	28	E		C	D
8 (HECO 5B)	15	27	E			D
7 (HECO 1D)	16	26	E			D
3 (East 3)	16	25	E	F		D
4 (East 4)	16	23	E	F		
9 (HECO 7B)	16	21		F	G	
15 (Nana-2)	16	21		F	G	
2 (East 2)	16	19			G	
10 (HECO 7C)	16	19			G	
1 (East 1)	16	14				H
14 (Nana-1)	16	14				H
11 (HECO 7D)	16	11				H

Interpretation:
Despite the Kruskal-Wallis ANOVA finding significant differences in the mean number of fish species per transect across the sixteen stations, these differences were obscured due to overlap in the SNK Test results except for the three least diverse stations (numbers 1, 11, and 14) which is probably related to the poor development of topographical complexity at these stations, where topographical complexity is better developed and affords shelter space, the diversity of species is usually greater.

TABLE 6. Continued.

2. Mean Number of Individual Fish Censused Per Station in 2007-11 (p < 0.0001, Significant)

Station Group	[n]	Mean	Grouping			
16 (Pipe)	14	1258	A			
13 (HECO 10C)	16	487		B		
12 (HECO 7E)	15	407		B	C	
8 (HECO 5B)	16	407		B	C	
7 (HECO 1D)	16	359			C	
5 (Ko'Olina 1)	15	342			C	D
4 (East 4)	16	305	E		C	D
6 (Ko'Olina 2)	15	296	E		C	D
2 (East 2)	16	220	E	F		D
3 (East 3)	16	201	E	F		
9 (HECO 7B)	16	189	E	F		
15 (Nana-2)	16	173	E	F	G	
10 (HECO 7C)	16	134		F	G	
1 (East 1)	16	117		F	G	
14 (Nana-1)	16	102		F	G	
11 (HECO 7D)	16	41			G	

Interpretation:
The Kruskal-Wallis ANOVA noted statistically significant differences in the mean number of individual fish censused among the 16 transects over the twelve surveys in 2007-11. However, the SNK Test found only one clearly-obvious statistically significant station (i.e., without overlap); this was with station 16 (Kahe discharge pipe) having significantly more individual fishes present than any other and station otherwise overlap obscures other separation.

3. Mean Estimated Fish Standing Crop (g/m2) by Station in 2007-11 (p < 0.0001, Significant)

Station Group	[n]	Mean	Grouping			
16 (Pipe)	14	456	A			
6 (Ko'Olina 2)	15	177		B		
13 (HECO 10C)	16	137		B	C	
5 (Ko'Olina 1)	15	137		B	C	
9 (HECO 7B)	16	132		B	C	
7 (HECO 1D)	16	105		B	C	D
3 (East 3)	15	101		B	C	D
15 (Nana-2)	16	97		B	C	D
4 (East 4)	16	92		B	C	D
2 (East 2)	16	82			C	D
1 (East 1)	16	43			C	D
8 (HECO 5B)	16	43			C	D
10 (HECO 7C)	16	33				D
12 (HECO 7E)	16	30				D
11 (HECO 7D)	16	22				D
14 (Nana-1)	16	9				D

Interpretation:
Only one station (Kahe Discharge) had a statistically greater estimated standing crop of fishes present than found at any of the other fifteen stations whose estimated standing crops are all statistically related due to overlap.

TABLE 7. Results of the Kruskal-Wallis ANOVA and the Student-Neuman-Keuls (SNK) Test addressing the question , "Are there any statistically significant differences among the annual mean number of fish species seen per transect or the annual mean number of individual fish censused per transect among seven stations sampled in common over fourteen years encompassing a 34-year period (i.e., 1976-1984 and 2007-2011 sample periods)?" The Kruskal-Wallis result is given as a "p" value at the top of the entry where (p>0.05 or less for significance). The SNK Test is used to separate means that are significantly different from one another. In the body of the table are given the sample date and mean for a given parameter on that date. Letters are used to show differences with the SNK Test; letters with the same designation show means and sample dates that are related and changes in letter designation show where significant differences exist. Overlaps in the letters indicate a lack of significant differences and in such cases, only the extremes may be significantly different.

1. Mean Number of Fish Species Per Transect (p>0.43, n.s.)

YEAR	[n]	Mean	SNK Grouping
1976	3	29.0	A
1977	3	26.0	A
1979	6	24.3	A
1978	3	24.0	A
2007	7	23.7	A
2008	7	23.5	A
1984	7	23.4	A
1980	6	23.2	A
2010	7	22.3	A
2011	7	22.1	A
2009	7	21.1	A
1981	6	19.2	A
1982	6	17.7	A
1983	6	15.8	A

Interpretation:
There are no significant differences among the mean number of species found per transect at these seven stations among the fourteen years of sampling. Note that the highest annual means occur before the January 1980 storm event and the lowest follow that period as well as after the November 1982 hurricane.

TABLE 7. Continued.

2. Mean Number of Individual Fish Per Transect (p>0.39, n.s.)

YEAR	[n]	Mean	SNK Grouping
2008	7	303.1	A
2007	7	302.3	A
2011	7	276.7	A
2009	7	271.7	A
1980	6	250.3	A
2010	7	232.3	A
1976	3	201.7	A
1979	6	195.0	A
1981	6	173.2	A
1978	3	169.0	A
1977	3	163.0	A
1984	7	150.0	A
1982	6	141.0	A
1983	6	85.8	A

Interpretation:
There are no significant differences among the mean number of individual fish censused per transect at these seven stations among the fourteen years of sampling. Note that the hierarchy of annual mean number of individual fish censused does not parallel that for the annual mean number of species counted at these stations. In other words, the impact of the two storm events (1980 and 1982) produced a different result with respect to the number of individual fish and the number of species counted.

FIGURE 1. Map showing the southwest coastline of Oahu from the Barbers Point Harbor on the southeast to Nanakuli Beach Park 7.9 km to the northwest. The approximate locations of each of the sixteen permanently marked 50-m long transect stations monitored in this study are numbered. All stations except station 16 have an orientation that parallels the coastline. Station 16 is established on the terminus of the Kahe Generating facility ocean warm-water outfall and thus has an orientation that is perpendicular to the shoreline. Map courtesy of the Environmental Department, HECO.


Nana Control 2
Nana Control 1
Station 10C
Station 7D
Station 7E
Station 7C
Station 7B
Outfall Pipe
Station 5B
Station 1D
Ko Olina 2
Ko Olina 1
EAST 3
EAST 2
EAST 4
EAST 1
NANAKULI
MAKAKILO CITY
HONOULIULI
KALAELOA AIRPORT
Barbers Point Harbor
CORAL PIT
Honokai Hale
Milo Cove
Anianikū Cove
Ka'ula Bay
Kahe Point
Gilbert
Kalaeloa
Map created with TOPO! ©2006 National Geographic
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APPENDIX 1. Results of fish censuses carried out on each of four 2011 surveys carried out on 25 February, 16 June, 29 July and 23 November 2011. Data from the earlier surveys that comprise the first annual report are given in Brock (2009), second annual report (Brock 2010) and Brock (2011) provides the third year data set. In the body of the table are given the list of fish species seen at each station, the trophic or feeding guild category for each species (where C=carnivore, H=herbivore, O=omnivore, P=planktivore and CF=coral feeder), the station number (here 1 through 16) as well as station name, the number of individuals of each species censused as well as the biomass (in grams) for each. Also given for each of the five trophic categories is a summary of the total number of individual fishes, the total standing crop and the percent of the total standing crop for each trophic category. Note that the total standing crop is given in grams and the area censused at each station is 200 m^2 except for station 11 (old HECO Station 7-D) which the census area is 10.5 m long and 4 m wide or 42 m^2. Biomass estimates for each species are based on species-specific regression coefficients using linear regression techniques (Ricker 1975, Brock and Norris 1989).

25 FEBRUARY 2011 FIELD DATA

25-Feb-11

GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Plectroglyphidodon imparipenni	1	EAST-1	1	0.86			
C	Thalassoma duperrey	1	EAST-1	1	97.05			
C	Thalassoma duperrey	1	EAST-1	8	89.31			
C	Thalassoma duperrey	1	EAST-1	2	6.30			
C	Thalassoma duperrey	1	EAST-1	9	246.51			
C	Coris venusta	1	EAST-1	1	23.64			
C	Stethojulis balteata	1	EAST-1	2	28.82			
C	Stethojulis balteata	1	EAST-1	1	4.00			
C	Stethojulis balteata	1	EAST-1	3	107.29			
C	Rhinecanthus rectangulus	1	EAST-1	3	136.09			
C	Rhinecanthus rectangulus	1	EAST-1	2	171.75	33	911.62	86.0
H	Acanthurus blochii	1	EAST-1	1	12.25			
H	Naso lituratus	1	EAST-1	2	29.80			
H	Naso unicornis	1	EAST-1	1	5.44			
H	Naso unicornis	1	EAST-1	1	73.36			
H	Naso unicornis	1	EAST-1	1	17.19	6	138.03	13.0
O	Canthigaster jactator	1	EAST-1	3	10.69	3	10.69	1.0
		1	EAST-1	42	1060.33	42	1060.33	100
C	Parupeneus multifasciatus	2	EAST-2	2	192.16			
C	Parupeneus multifasciatus	2	EAST-2	2	108.80			
C	Parupeneus cyclostomus	2	EAST-2	1	88.57			
C	Plectroglyphidodon imparipenni	2	EAST-2	1	0.86			
C	Paracirrhites arcatus	2	EAST-2	3	24.35			
C	Thalassoma duperrey	2	EAST-2	3	164.85			
C	Thalassoma duperrey	2	EAST-2	8	89.31			
C	Thalassoma duperrey	2	EAST-2	7	679.36			
C	Thalassoma duperrey	2	EAST-2	14	383.47			
C	Coris gaimard	2	EAST-2	1	139.13			
C	Stethojulis balteata	2	EAST-2	1	35.76			
C	Halichoeres ornatissimus	2	EAST-2	1	25.14			
C	Rhinecanthus rectangulus	2	EAST-2	3	257.62	47	2189.38	16.7
H	Calotomus carolinus	2	EAST-2	2	144.56			
H	Acanthurus nigrofuscus	2	EAST-2	13	97.82			
H	Acanthurus nigrofuscus	2	EAST-2	40	955.88			
H	Acanthurus nigrofuscus	2	EAST-2	53	753.27			
H	Acanthurus olivaceus	2	EAST-2	6	3379.02			
H	Acanthurus olivaceus	2	EAST-2	14	5504.94			
H	Naso unicornis	2	EAST-2	1	17.19	129	10852.70	82.6
O	Stegastes fasciolatus	2	EAST-2	1	7.39			
O	Cantherhines sandwichiensis	2	EAST-2	1	82.05			
O	Canthigaster jactator	2	EAST-2	3	6.62			
O	Canthigaster jactator	2	EAST-2	2	7.12	7	103.18	0.8
		2	EAST-2	183	13145.26		13145.26	100
C	Plectroglyphidodon johnstonian	3	EAST-3	1	1.72			
C	Bodianus bilunulatus	3	EAST-3	1	1141.37			
C	Pseudocheilinus octotaenia	3	EAST-3	1	35.76			
C	Thalassoma duperrey	3	EAST-3	1	97.05			
C	Thalassoma duperrey	3	EAST-3	5	55.82			
C	Thalassoma duperrey	3	EAST-3	7	384.64			
C	Thalassoma duperrey	3	EAST-3	9	246.51			
C	Gomphosus varius	3	EAST-3	1	4.02			
C	Gomphosus varius	3	EAST-3	1	11.04			
C	Stethojulis balteata	3	EAST-3	1	35.76			
C	Macropharyngodon geoffroy	3	EAST-3	1	18.63			
C	Halichoeres ornatissimus	3	EAST-3	2	19.05			
C	Halichoeres ornatissimus	3	EAST-3	2	32.90			
C	Halichoeres ornatissimus	3	EAST-3	1	25.14			
C	Sufflamen bursa	3	EAST-3	3	257.62			
C	Ostracion meleagris	3	EAST-3	1	24.55	38	2391.60	65.6

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
CF	Chaetodon multicinctus	3	EAST-3	4	52.12	4	52.12	1.4
H	Acanthurus nigrofuscus	3	EAST-3	34	255.84			
H	Acanthurus nigrofuscus	3	EAST-3	24	341.11			
H	Acanthurus blochii	3	EAST-3	1	12.25			
H	Acanthurus blochii	3	EAST-3	2	7.26	61	616.45	16.9
O	Stegastes fasciolatus	3	EAST-3	5	36.96			
O	Melichthys niger	3	EAST-3	2	326.67			
O	Melichthys vidua	3	EAST-3	1	199.03			
O	Canthigaster jactator	3	EAST-3	3	3.68			
O	Canthigaster jactator	3	EAST-3	5	17.81	16	584.15	16.0
		3	EAST-3	119	3644.32	119	3644.32	100
C	Parupeneus multifasciatus	4	EAST-4	1	54.40			
C	Parupeneus multifasciatus	4	EAST-4	11	121.57			
C	Parupeneus multifasciatus	4	EAST-4	3	81.35			
C	Paracirrhites arcatus	4	EAST-4	1	8.12			
C	Labroides phthirophagus	4	EAST-4	2	1.26			
C	Thalassoma duperrey	4	EAST-4	12	133.96			
C	Thalassoma duperrey	4	EAST-4	3	291.16			
C	Thalassoma duperrey	4	EAST-4	3	164.85			
C	Thalassoma duperrey	4	EAST-4	12	328.69			
C	Coris venusta	4	EAST-4	1	23.64			
C	Coris venusta	4	EAST-4	1	9.39			
C	Pseudojuloides cerasinus	4	EAST-4	1	11.16			
C	Anampses chrysocephalus	4	EAST-4	2	5.26			
C	Halichoeres ornatissimus	4	EAST-4	1	25.14			
C	Halichoeres ornatissimus	4	EAST-4	4	38.09			
C	Rhinecanthus rectangulus	4	EAST-4	2	90.72			
C	Sufflamen fraenatus	4	EAST-4	1	329.34	61	1718.07	34.1
H	Acanthurus nigrofuscus	4	EAST-4	25	355.32			
H	Acanthurus nigrofuscus	4	EAST-4	11	82.77			
H	Acanthurus nigrofuscus	4	EAST-4	11	262.87			
H	Acanthurus olivaceus	4	EAST-4	1	163.52			
H	Acanthurus olivaceus	4	EAST-4	2	1126.34			
H	Acanthurus blochii	4	EAST-4	1	155.58			
H	Naso lituratus	4	EAST-4	1	205.99	52	2352.38	46.7
O	Stegastes fasciolatus	4	EAST-4	1	7.39			
O	Melichthys niger	4	EAST-4	3	490.01			
O	Melichthys vidua	4	EAST-4	2	398.06			
O	Canthigaster jactator	4	EAST-4	2	2.45			
O	Canthigaster jactator	4	EAST-4	5	17.81	13	915.72	18.2
P	Dascyllus albisella	4	EAST-4	4	3.21			
P	Chromis vanderbilti	4	EAST-4	136	42.96	140	46.18	0.9
		4	EAST-4	266	5032.36	266	5032.36	100
C	Gymnothorax flavimarginatus	5	Ko Olina 1	1	4535.92			
C	Myripristis amaenus	5	Ko Olina 1	1	140.81			
C	Monotaxis grandoculis	5	Ko Olina 1	1	71.53			
C	Parupeneus multifasciatus	5	Ko Olina 1	1	27.12			
C	Parupeneus multifasciatus	5	Ko Olina 1	2	108.80			
C	Parupeneus multifasciatus	5	Ko Olina 1	2	192.16			
C	Parupeneus cyclostomus	5	Ko Olina 1	1	88.57			
C	Plectroglyphidodon johnstonianı	5	Ko Olina 1	3	5.17			
C	Paracirrhites arcatus	5	Ko Olina 1	1	8.12			
C	Cirrhitus pinnulatus	5	Ko Olina 1	1	90.86			
C	Labroides phthirophagus	5	Ko Olina 1	3	1.88			
C	Thalassoma duperrey	5	Ko Olina 1	10	273.90			
C	Thalassoma duperrey	5	Ko Olina 1	10	970.52			
C	Thalassoma duperrey	5	Ko Olina 1	15	824.23			
C	Thalassoma duperrey	5	Ko Olina 1	10	111.63			
C	Thalassoma ballieui	5	Ko Olina 1	1	167.53			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Coris gaimard	5	Ko Olina 1	1	8.57			
C	Zanclus cornutus	5	Ko Olina 1	1	54.90			
C	Sufflamen bursa	5	Ko Olina 1	3	257.62			
C	Ostracion meleagris	5	Ko Olina 1	1	6.76	69	7946.60	40.0
CF	Chaetodon unimaculatus	5	Ko Olina 1	6	151.82			
CF	Chaetodon multicinctus	5	Ko Olina 1	6	78.18	12	230.01	1.2
H	Scarus sordidus	5	Ko Olina 1	1	775.07			
H	Scarus psittacus	5	Ko Olina 1	1	79.27			
H	Scarus psittacus	5	Ko Olina 1	1	554.69			
H	Scarus rubroviolaceus	5	Ko Olina 1	1	1160.01			
H	Acanthurus triostegus	5	Ko Olina 1	4	185.26			
H	Acanthurus leucopareius	5	Ko Olina 1	3	200.22			
H	Acanthurus nigrofuscus	5	Ko Olina 1	5	271.26			
H	Acanthurus nigrofuscus	5	Ko Olina 1	23	326.89			
H	Acanthurus nigrofuscus	5	Ko Olina 1	40	955.88			
H	Acanthurus olivaceus	5	Ko Olina 1	1	393.21			
H	Acanthurus olivaceus	5	Ko Olina 1	10	937.69			
H	Acanthurus olivaceus	5	Ko Olina 1	1	261.67			
H	Ctenochaetus strigosus	5	Ko Olina 1	26	697.94			
H	Ctenochaetus strigosus	5	Ko Olina 1	59	3886.03			
H	Ctenochaetus strigosus	5	Ko Olina 1	9	136.79	185	10821.88	54.4
O	Stegastes fasciolatus	5	Ko Olina 1	13	191.92			
O	Melichthys niger	5	Ko Olina 1	4	653.34			
O	Canthigaster jactator	5	Ko Olina 1	2	2.45	19	847.72	4.3
P	Chaetodon miliaris	5	Ko Olina 1	1	0.88			
P	Abudefduf abdominalis	5	Ko Olina 1	1	31.33			
P	Chromis vanderbilti	5	Ko Olina 1	20	6.32	22	38.54	0.2
		5	Ko Olina 1	307	19884.73	307	19884.73	100
C	Mulloides vanicolensis	6	Ko Olina 2	31	14391.48			
C	Parupeneus multifasciatus	6	Ko Olina 2	1	235.75			
C	Plectroglyphidodon johnstonianu	6	Ko Olina 2	3	5.17			
C	Labroides phthirophagus	6	Ko Olina 2	4	2.51			
C	Thalassoma duperrey	6	Ko Olina 2	11	301.30			
C	Thalassoma duperrey	6	Ko Olina 2	8	439.59			
C	Thalassoma duperrey	6	Ko Olina 2	13	145.12			
C	Gomphosus varius	6	Ko Olina 2	2	22.08			
C	Halichoeres ornatissimus	6	Ko Olina 2	2	32.90			
C	Sufflamen bursa	6	Ko Olina 2	1	85.87	76	15661.77	40.0
CF	Chaetodon unimaculatus	6	Ko Olina 2	2	50.61			
CF	Chaetodon ornatissimus	6	Ko Olina 2	4	276.01			
CF	Chaetodon multicinctus	6	Ko Olina 2	2	26.06	8	352.68	0.9
H	Scarus psittacus	6	Ko Olina 2	2	289.88			
H	Scarus psittacus	6	Ko Olina 2	11	416.60			
H	Scarus psittacus	6	Ko Olina 2	2	158.54			
H	Scarus rubroviolaceus	6	Ko Olina 2	1	147.03			
H	Acanthurus triostegus	6	Ko Olina 2	14	648.41			
H	Acanthurus triostegus	6	Ko Olina 2	7	700.10			
H	Acanthurus leucopareius	6	Ko Olina 2	1	132.70			
H	Acanthurus leucopareius	6	Ko Olina 2	2	465.35			
H	Acanthurus nigrofuscus	6	Ko Olina 2	10	238.97			
H	Acanthurus nigrofuscus	6	Ko Olina 2	16	227.40			
H	Acanthurus olivaceus	6	Ko Olina 2	9	843.92			
H	Acanthurus olivaceus	6	Ko Olina 2	17	9573.89			
H	Acanthurus olivaceus	6	Ko Olina 2	3	785.00			
H	Acanthurus blochii	6	Ko Olina 2	1	155.58			
H	Acanthurus blochii	6	Ko Olina 2	1	56.70			
H	Ctenochaetus strigosus	6	Ko Olina 2	18	2378.41			
H	Ctenochaetus strigosus	6	Ko Olina 2	10	268.44			
H	Ctenochaetus strigosus	6	Ko Olina 2	5	37.88			
H	Ctenochaetus strigosus	6	Ko Olina 2	14	922.11			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
H	Zebrasoma flavescens	6	Ko Olina 2	7	372.96			
H	Zebrasoma veliferum	6	Ko Olina 2	2	292.46			
H	Naso lituratus	6	Ko Olina 2	1	205.99	154	19318.31	49.3
O	Melichthys niger	6	Ko Olina 2	5	816.68			
O	Melichthys vidua	6	Ko Olina 2	3	597.09			
O	Canthigaster jactator	6	Ko Olina 2	2	7.12	10	1420.89	3.6
P	Abudefduf abdominalis	6	Ko Olina 2	77	2412.61			
P	Chromis hanui	6	Ko Olina 2	3	2.24	80	2414.85	6.2
		6	Ko Olina 2	328	39168.50	328	39168.50	100
C	Scorpaenopsis diabolus	7	Kahe 1-D	1	53.01			
C	Parupeneus multifasciatus	7	Kahe 1-D	1	54.40			
C	Forcipiger flavissimus	7	Kahe 1-D	1	9.15			
C	Plectroglyphidodon johnstonianu	7	Kahe 1-D	3	5.17			
C	Paracirrhites arcatus	7	Kahe 1-D	1	16.35			
C	Labroides phthirophagus	7	Kahe 1-D	3	1.88			
C	Thalassoma duperrey	7	Kahe 1-D	31	1703.42			
C	Thalassoma duperrey	7	Kahe 1-D	20	1941.04			
C	Thalassoma duperrey	7	Kahe 1-D	9	246.51			
C	Gomphosus varius	7	Kahe 1-D	3	67.80			
C	Gomphosus varius	7	Kahe 1-D	11	121.46			
C	Zanclus cornutus	7	Kahe 1-D	2	109.80			
C	Rhinecanthus rectangulus	7	Kahe 1-D	1	45.36			
C	Rhinecanthus rectangulus	7	Kahe 1-D	1	85.87			
C	Sufflamen bursa	7	Kahe 1-D	1	85.87	89	4547.09	24.6
H	Scarus psittacus	7	Kahe 1-D	3	113.62			
H	Acanthurus triostegus	7	Kahe 1-D	1	46.32			
H	Acanthurus triostegus	7	Kahe 1-D	4	68.67			
H	Acanthurus nigrofuscus	7	Kahe 1-D	41	979.78			
H	Acanthurus olivaceus	7	Kahe 1-D	7	138.20			
H	Ctenochaetus strigosus	7	Kahe 1-D	9	136.79	65	1483.37	8.0
O	Stegastes fasciolatus	7	Kahe 1-D	5	73.82			
O	Melichthys niger	7	Kahe 1-D	76	12413.50	81	12487.31	67.4
		7	Kahe 1-D	235	18517.77	235	18517.77	100
C	Decapterus macarellus	8	Kahe 5-B	15	2874.50			
C	Parupeneus multifasciatus	8	Kahe 5-B	1	96.08			
C	Parupeneus multifasciatus	8	Kahe 5-B	1	155.42			
C	Parupeneus multifasciatus	8	Kahe 5-B	1	54.40			
C	Parupeneus multifasciatus	8	Kahe 5-B	2	54.23			
C	Plectroglyphidodon johnstonianu	8	Kahe 5-B	3	5.17			
C	Plectroglyphidodon imparipennis	8	Kahe 5-B	1	0.86			
C	Paracirrhites arcatus	8	Kahe 5-B	4	32.47			
C	Cirrhitops fasciatus	8	Kahe 5-B	1	3.75			
C	Labroides phthirophagus	8	Kahe 5-B	3	1.88			
C	Thalassoma duperrey	8	Kahe 5-B	4	219.80			
C	Thalassoma duperrey	8	Kahe 5-B	5	485.26			
C	Thalassoma duperrey	8	Kahe 5-B	10	273.90			
C	Thalassoma duperrey	8	Kahe 5-B	12	133.96			
C	Coris venusta	8	Kahe 5-B	1	9.39			
C	Coris venusta	8	Kahe 5-B	1	48.38			
C	Coris gaimard	8	Kahe 5-B	1	8.57			
C	Macropharyngodon geoffroy	8	Kahe 5-B	1	18.63			
C	Halichoeres ornatissimus	8	Kahe 5-B	1	9.52			
C	Halichoeres ornatissimus	8	Kahe 5-B	2	50.27			
C	Halichoeres ornatissimus	8	Kahe 5-B	1	16.45			
C	Zanclus cornutus	8	Kahe 5-B	1	104.16			
C	Rhinecanthus rectangulus	8	Kahe 5-B	1	45.36			
C	Sufflamen bursa	8	Kahe 5-B	4	343.49	77	5045.91	76.6
CF	Chaetodon multicinctus	8	Kahe 5-B	3	19.97			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
CF	Pervagor melanocephalus	8	Kahe 5-B	1	5.23	4	25.20	0.4
H	Acanthurus nigrofuscus	8	Kahe 5-B	13	97.82			
H	Acanthurus nigrofuscus	8	Kahe 5-B	21	298.47			
H	Acanthurus nigrofuscus	8	Kahe 5-B	10	238.97			
H	Naso lituratus	8	Kahe 5-B	2	72.69			
H	Naso lituratus	8	Kahe 5-B	2	145.17			
H	Naso unicornis	8	Kahe 5-B	1	5.44	49	858.55	13.0
O	Stegastes fasciolatus	8	Kahe 5-B	2	29.53			
O	Cantherhines sandwichiensis	8	Kahe 5-B	1	131.57			
O	Canthigaster jactator	8	Kahe 5-B	1	3.56	4	164.66	2.5
P	Chromis vanderbilti	8	Kahe 5-B	167	52.75			
P	Naso hexacanthus	8	Kahe 5-B	6	440.15	173	492.90	7.5
		8	Kahe 5-B	307	6587.23	307	6587.23	100
C	Parupeneus multifasciatus	9	Kahe 7-B	1	96.08			
C	Parupeneus multifasciatus	9	Kahe 7-B	2	310.84			
C	Parupeneus multifasciatus	9	Kahe 7-B	1	54.40			
C	Thalassoma duperrey	9	Kahe 7-B	1	11.16			
C	Thalassoma duperrey	9	Kahe 7-B	1	54.95			
C	Coris venusta	9	Kahe 7-B	1	23.64			
C	Coris venusta	9	Kahe 7-B	1	9.39			
C	Sufflamen bursa	9	Kahe 7-B	5	429.37	13	989.83	48.5
CF	Pervagor spilosoma	9	Kahe 7-B	1	9.75	1	9.75	0.5
H	Acanthurus nigrofuscus	9	Kahe 7-B	8	191.18			
H	Acanthurus nigrofuscus	9	Kahe 7-B	4	30.10	12	221.27	10.8
O	Melichthys vidua	9	Kahe 7-B	2	398.06			
O	Canthigaster coronata	9	Kahe 7-B	1	7.59			
O	Canthigaster coronata	9	Kahe 7-B	1	13.65			
O	Canthigaster jactator	9	Kahe 7-B	3	6.62	7	425.92	20.9
P	Dascyllus albisella	9	Kahe 7-B	5	15.44			
P	Dascyllus albisella	9	Kahe 7-B	1	0.80			
P	Abudefduf abdominalis	9	Kahe 7-B	12	375.99			
P	Chromis vanderbilti	9	Kahe 7-B	9	2.84			
P	Chromis hanui	9	Kahe 7-B	1	0.75	28	395.83	19.4
		9	Kahe 7-B	61	2042.60	61	2042.60	100
C	Paracirrhites arcatus	10	Kahe 7-C	4	32.47			
C	Coris venusta	10	Kahe 7-C	1	2.55			
C	Coris venusta	10	Kahe 7-C	2	18.77			
C	Sufflamen bursa	10	Kahe 7-C	7	601.11	14	654.91	80.3
O	Melichthys vidua	10	Kahe 7-C	1	124.35			
O	Canthigaster coronata	10	Kahe 7-C	2	27.30			
O	Canthigaster jactator	10	Kahe 7-C	2	7.12	5	158.77	19.5
P	Chromis vanderbilti	10	Kahe 7-C	7	2.21	7	2.21	0.3
		10	Kahe 7-C	26	815.90	26	815.90	100
C	Plectroglyphidodon johnstonianu	11	Kahe 7-D	2	3.44			
C	Paracirrhites arcatus	11	Kahe 7-D	1	16.35			
C	Thalassoma duperrey	11	Kahe 7-D	1	3.15			
C	Zanclus cornutus	11	Kahe 7-D	2	109.80			
C	Sufflamen bursa	11	Kahe 7-D	2	171.75	8	304.49	59.1
O	Melichthys vidua	11	Kahe 7-D	1	199.03			
O	Canthigaster jactator	11	Kahe 7-D	3	10.69	4	209.72	40.7
P	Chromis vanderbilti	11	Kahe 7-D	3	0.95	3	0.95	0.2
	25-Feb-11	11	Kahe 7-D	15	515.15	15	515.15	100
C	Parupeneus pleurostigma	12	Kahe 7-E	1	13.25			
C	Parupeneus pleurostigma	12	Kahe 7-E	1	58.01			
C	Parupeneus pleurostigma	12	Kahe 7-E	2	60.88			
C	Parupeneus multifasciatus	12	Kahe 7-E	1	54.40			
C	Parupeneus multifasciatus	12	Kahe 7-E	1	155.42			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	12	Kahe 7-E	3	33.15			
C	Parupeneus multifasciatus	12	Kahe 7-E	3	9.36			
C	Parupeneus multifasciatus	12	Kahe 7-E	5	135.58			
C	Forcipiger flavissimus	12	Kahe 7-E	4	36.60			
C	Paracirrhites arcatus	12	Kahe 7-E	2	16.24			
C	Pseudocheilinus octotaenia	12	Kahe 7-E	1	35.76			
C	Thalassoma duperrey	12	Kahe 7-E	1	54.95			
C	Thalassoma duperrey	12	Kahe 7-E	2	54.78			
C	Coris venusta	12	Kahe 7-E	1	23.64			
C	Coris gaimard	12	Kahe 7-E	1	0.23			
C	Pseudojuloides cerasinus	12	Kahe 7-E	6	18.90			
C	Zanclus cornutus	12	Kahe 7-E	1	54.90			
C	Sufflamen bursa	12	Kahe 7-E	4	343.49	40	1159.55	41.9
CF	Chaetodon multicinctus	12	Kahe 7-E	4	26.63	4	26.63	1.0
H	Acanthurus nigrofuscus	12	Kahe 7-E	20	150.49			
H	Acanthurus olivaceus	12	Kahe 7-E	1	563.17			
H	Naso lituratus	12	Kahe 7-E	1	72.58			
H	Naso lituratus	12	Kahe 7-E	2	8.48			
H	Naso unicornis	12	Kahe 7-E	1	5.44	25	800.16	28.9
O	Melichthys niger	12	Kahe 7-E	1	163.34			
O	Melichthys vidua	12	Kahe 7-E	2	398.06			
O	Canthigaster coronata	12	Kahe 7-E	1	7.59			
O	Canthigaster jactator	12	Kahe 7-E	4	8.82	8	577.81	20.9
P	Chaetodon miliaris	12	Kahe 7-E	1	2.86			
P	Chromis vanderbilti	12	Kahe 7-E	151	47.70			
P	Chromis hanui	12	Kahe 7-E	12	8.96			
P	Naso brevirostris	12	Kahe 7-E	2	146.72	166	206.23	7.4
		12	Kahe 7-E	243	2770.37	243	2770.37	100
C	Lutjanus kasmira	13	Kahe 10	42	8007.17			
C	Mulloides flavolineatus	13	Kahe 10	2	730.42			
C	Parupeneus multifasciatus	13	Kahe 10	2	108.80			
C	Parupeneus multifasciatus	13	Kahe 10	3	81.35			
C	Parupeneus multifasciatus	13	Kahe 10	2	192.16			
C	Parupeneus multifasciatus	13	Kahe 10	1	235.75			
C	Cirrhitops fasciatus	13	Kahe 10	1	3.75			
C	Labroides phthirophagus	13	Kahe 10	1	0.63			
C	Thalassoma duperrey	13	Kahe 10	10	273.90			
C	Thalassoma duperrey	13	Kahe 10	2	22.33			
C	Thalassoma duperrey	13	Kahe 10	18	1746.94			
C	Thalassoma duperrey	13	Kahe 10	13	714.34			
C	Gomphosus varius	13	Kahe 10	2	45.20			
C	Stethojulis balteata	13	Kahe 10	1	35.76			
C	Macropharyngodon geoffroy	13	Kahe 10	1	18.63			
C	Anampses cuvier	13	Kahe 10	1	115.17			
C	Anampses cuvier	13	Kahe 10	1	31.59			
C	Zanclus cornutus	13	Kahe 10	3	312.47			
C	Sufflamen bursa	13	Kahe 10	3	257.62	109	12933.97	54.2
H	Acanthurus triostegus	13	Kahe 10	7	324.21			
H	Acanthurus leucopareius	13	Kahe 10	4	530.80			
H	Acanthurus nigrofuscus	13	Kahe 10	14	334.56			
H	Acanthurus nigrofuscus	13	Kahe 10	11	156.34			
H	Acanthurus olivaceus	13	Kahe 10	1	47.48			
H	Acanthurus olivaceus	13	Kahe 10	4	1046.67			
H	Acanthurus blochii	13	Kahe 10	1	29.03			
H	Acanthurus blochii	13	Kahe 10	1	56.70			
H	Naso lituratus	13	Kahe 10	1	127.73			
H	Naso lituratus	13	Kahe 10	2	411.98			
H	Naso unicornis	13	Kahe 10	9	1108.06			
H	Naso unicornis	13	Kahe 10	3	1168.27	58	5341.82	22.4
O	Stegastes fasciolatus	13	Kahe 10	10	259.80			

25-Feb-11

GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
O	Melichthys niger	13	Kahe 10	3	490.01			
O	Melichthys vidua	13	Kahe 10	1	199.03			
O	Cantherhines sandwichiensis	13	Kahe 10	2	164.10	16	1112.94	4.7
P	Dascyllus albisella	13	Kahe 10	16	49.41			
P	Abudefduf abdominalis	13	Kahe 10	124	3885.24			
P	Chromis vanderbilti	13	Kahe 10	60	18.95			
P	Chromis ovalis	13	Kahe 10	44	508.63	244	4462.23	18.7
		13	Kahe 10	427	23850.97	427	23850.97	100
C	Plectroglyphidodon imparipenni	14	Nanakuli 1	1	0.86			
C	Thalassoma duperrey	14	Nanakuli 1	3	9.45			
C	Thalassoma duperrey	14	Nanakuli 1	1	54.95			
C	Thalassoma duperrey	14	Nanakuli 1	4	44.65			
C	Thalassoma duperrey	14	Nanakuli 1	3	82.17			
C	Stethojulis balteata	14	Nanakuli 1	1	4.00			
C	Rhinecanthus rectangulus	14	Nanakuli 1	1	45.36			
C	Rhinecanthus rectangulus	14	Nanakuli 1	1	85.87	15	327.32	82.9
H	Scarus psittacus	14	Nanakuli 1	1	37.87			
H	Acanthurus nigrofuscus	14	Nanakuli 1	2	15.05	3	52.92	13.4
O	Stegastes fasciolatus	14	Nanakuli 1	1	7.39			
O	Canthigaster jactator	14	Nanakuli 1	1	3.56	2	10.95	2.8
P	Chromis vanderbilti	14	Nanakuli 1	12	3.79	12	3.79	1.0
		14	Nanakuli 1	32	394.99	32	394.99	100
C	Parupeneus multifasciatus	15	Nanakuli 2	3	163.20			
C	Parupeneus multifasciatus	15	Nanakuli 2	1	96.08			
C	Parupeneus cyclostomus	15	Nanakuli 2	1	1266.89			
C	Cheilinus rhodochrous	15	Nanakuli 2	1	938.69			
C	Thalassoma duperrey	15	Nanakuli 2	1	97.05			
C	Thalassoma duperrey	15	Nanakuli 2	3	164.85			
C	Thalassoma duperrey	15	Nanakuli 2	4	109.56			
C	Stethojulis balteata	15	Nanakuli 2	3	107.29			
C	Sufflamen bursa	15	Nanakuli 2	1	85.87	18	3029.49	65.9
CF	Chaetodon multicinctus	15	Nanakuli 2	2	13.31	2	13.31	0.3
H	Acanthurus triostegus	15	Nanakuli 2	4	400.06			
H	Acanthurus leucopareius	15	Nanakuli 2	1	132.70			
H	Acanthurus nigrofuscus	15	Nanakuli 2	15	358.46			
H	Acanthurus nigrofuscus	15	Nanakuli 2	3	162.76			
H	Acanthurus nigrofuscus	15	Nanakuli 2	13	184.77			
H	Ctenochaetus strigosus	15	Nanakuli 2	1	26.84			
H	Ctenochaetus strigosus	15	Nanakuli 2	1	7.58	38	1273.16	27.7
O	Stegastes fasciolatus	15	Nanakuli 2	8	118.11			
O	Melichthys niger	15	Nanakuli 2	1	163.34	9	281.44	6.1
P	Chromis vanderbilti	15	Nanakuli 2	2	0.63	2	0.63	0.01
		15	Nanakuli 2	69	4598.03	69	4598.03	100
C	Lutjanus kasmira	16	KAHE PIPE	205	39082.60			
C	Lutjanus kasmira	16	KAHE PIPE	35	2007.34			
C	Lutjanus kasmira	16	KAHE PIPE	151	3904.46			
C	Parupeneus multifasciatus	16	KAHE PIPE	1	155.42			
C	Forcipiger flavissimus	16	KAHE PIPE	1	9.15			
C	Pseudocheilinus octotaenia	16	KAHE PIPE	2	28.82			
C	Thalassoma duperrey	16	KAHE PIPE	30	2911.56			
C	Thalassoma duperrey	16	KAHE PIPE	30	1648.47			
C	Gomphosus varius	16	KAHE PIPE	2	22.08			
C	Gomphosus varius	16	KAHE PIPE	5	113.00			
C	Gomphosus varius	16	KAHE PIPE	1	62.03			
C	Coris gaimard	16	KAHE PIPE	1	45.99			
C	Stethojulis balteata	16	KAHE PIPE	1	35.76			
C	Halichoeres ornatissimus	16	KAHE PIPE	2	32.90			
C	Halichoeres ornatissimus	16	KAHE PIPE	1	9.52			

25-Feb-11

GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Zanclus cornutus	16	KAHE PIPE	1	54.90			
C	Sufflamen bursa	16	KAHE PIPE	4	343.49	473	50467.50	58.7
CF	Chaetodon multicinctus	16	KAHE PIPE	2	13.31	2	13.31	0.0
H	Scarus sordidus	16	KAHE PIPE	1	1427.57			
H	Scarus sordidus	16	KAHE PIPE	3	2325.21			
H	Scarus sordidus	16	KAHE PIPE	1	367.02			
H	Scarus psittacus	16	KAHE PIPE	1	79.27			
H	Scarus psittacus	16	KAHE PIPE	1	375.61			
H	Acanthurus nigrofuscus	16	KAHE PIPE	37	2007.34	44	6582.01	7.7
O	Stegastes fasciolatus	16	KAHE PIPE	21	545.59			
O	Melichthys niger	16	KAHE PIPE	5	816.68	26	1362.26	1.6
P	Chaetodon miliaris	16	KAHE PIPE	2	42.34			
P	Abudefduf abdominalis	16	KAHE PIPE	27	845.98			
P	Abudefduf vaigensis	16	KAHE PIPE	170	7964.82			
P	Chromis vanderbilti	16	KAHE PIPE	45	14.22			
P	Chromis ovalis	16	KAHE PIPE	15	299.08			
P	Chromis hanui	16	KAHE PIPE	4	2.99			
P	Naso brevirostris	16	KAHE PIPE	15	1846.77			
P	Naso brevirostris	16	KAHE PIPE	87	16594.72	365	27610.91	32.1
		16	KAHE PIPE	910	86036.01	910	86036.01	100

16 JUNE 2011 FIELD DATA

16-Jun-11

GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Plectroglyphidodon imparipennis	1	EAST - 1	1	0.86			
C	Paracirrhites arcatus	1	EAST - 1	1	8.12			
C	Thalassoma duperrey	1	EAST - 1	14	44.11			
C	Thalassoma duperrey	1	EAST - 1	15	167.45			
C	Thalassoma duperrey	1	EAST - 1	1	97.05			
C	Thalassoma duperrey	1	EAST - 1	9	494.54			
C	Thalassoma duperrey	1	EAST - 1	7	191.73			
C	Coris gaimard	1	EAST - 1	1	215.88			
C	Coris gaimard	1	EAST - 1	1	45.99			
C	Stethojulis balteata	1	EAST - 1	4	143.05			
C	Halichoeres ornatissimus	1	EAST - 1	1	9.52			
C	Plagiotremus ewaensis	1	EAST - 1	1	0.95			
C	Rhinecanthus rectangulus	1	EAST - 1	5	429.37			
C	Rhinecanthus rectangulus	1	EAST - 1	1	45.36	62	1893.99	7.7
CF	Chaetodon quadrimaculatus	1	EAST - 1	2	50.61	2	50.61	0.2
H	Acanthurus triostegus	1	EAST - 1	9	416.84			
H	Acanthurus nigrofuscus	1	EAST - 1	15	813.79			
H	Acanthurus nigrofuscus	1	EAST - 1	21	158.02			
H	Acanthurus olivaceus	1	EAST - 1	6	2359.26			
H	Acanthurus olivaceus	1	EAST - 1	4	1046.67			
H	Acanthurus olivaceus	1	EAST - 1	13	7321.21			
H	Acanthurus dussumieri	1	EAST - 1	1	112.02			
H	Acanthurus blochii	1	EAST - 1	9	7054.29			
H	Acanthurus blochii	1	EAST - 1	7	3175.16			
H	Acanthurus blochii	1	EAST - 1	1	3.63			
H	Naso unicornis	1	EAST - 1	1	38.92	87	22499.81	90.9
O	Melichthys vidua	1	EAST - 1	1	296.24			
O	Canthigaster jactator	1	EAST - 1	3	10.69	4	306.92	1.2
P	Chromis vanderbilti	1	EAST - 1	7	2.21	7	2.21	0.01
		1	EAST - 1	162	24753.54	162	24753.54	100
C	Lutjanus fulvus	2	EAST - 2	1	104.24			
C	Parupeneus multifasciatus	2	EAST - 2	1	96.08			
C	Plectroglyphidodon johnstonianu	2	EAST - 2	1	1.72			
C	Plectroglyphidodon imparipennis	2	EAST - 2	1	0.86			
C	Paracirrhites arcatus	2	EAST - 2	3	24.35			
C	Pseudocheilinus octotaenia	2	EAST - 2	1	14.41			
C	Thalassoma duperrey	2	EAST - 2	9	873.47			
C	Thalassoma duperrey	2	EAST - 2	14	769.28			
C	Thalassoma duperrey	2	EAST - 2	10	273.90			
C	Halichoeres ornatissimus	2	EAST - 2	2	50.27			
C	Rhinecanthus rectangulus	2	EAST - 2	3	257.62			
C	Sufflamen bursa	2	EAST - 2	1	85.87	47	2552.10	19.4
CF	Chaetodon quadrimaculatus	2	EAST - 2	2	50.61	2	50.61	0.4
H	Acanthurus triostegus	2	EAST - 2	5	231.58			
H	Acanthurus nigrofuscus	2	EAST - 2	9	127.91			
H	Acanthurus nigrofuscus	2	EAST - 2	2	108.50			
H	Acanthurus nigrofuscus	2	EAST - 2	39	931.98			
H	Acanthurus olivaceus	2	EAST - 2	13	7321.21			
H	Acanthurus olivaceus	2	EAST - 2	2	1553.21	70	10274.40	78.0
O	Melichthys vidua	2	EAST - 2	1	296.24			
O	Canthigaster jactator	2	EAST - 2	1	3.56	2	299.80	2.3
P	Dascyllus albisella	2	EAST - 2	2	0.16	2	0.16	0.001
		2	EAST - 2	123	13177.07	123	13177.07	100
C	Monotaxis grandoculis	3	EAST - 3	2	257.78			
C	Monotaxis grandoculis	3	EAST - 3	3	979.26			
C	Monotaxis grandoculis	3	EAST - 3	1	13.74			
C	Parupeneus multifasciatus	3	EAST - 3	4	384.33			
C	Parupeneus multifasciatus	3	EAST - 3	1	11.05			

16-Jun-11

GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	3	EAST - 3	2	471.50			
C	Plectroglyphidodon johnstonianı	3	EAST - 3	4	6.89			
C	Paracirrhites arcatus	3	EAST - 3	1	8.12			
C	Bodianus bilunulatus	3	EAST - 3	1	1462.82			
C	Thalassoma duperrey	3	EAST - 3	12	328.69			
C	Thalassoma duperrey	3	EAST - 3	10	549.49			
C	Thalassoma duperrey	3	EAST - 3	13	145.12			
C	Thalassoma duperrey	3	EAST - 3	1	97.05			
C	Gomphosus varius	3	EAST - 3	3	67.80			
C	Coris gaimard	3	EAST - 3	1	22.07			
C	Coris gaimard	3	EAST - 3	3	137.97			
C	Stethojulis balteata	3	EAST - 3	9	321.87			
C	Macropharyngodon geoffroy	3	EAST - 3	2	37.26			
C	Halichoeres ornatissimus	3	EAST - 3	2	32.90			
C	Halichoeres ornatissimus	3	EAST - 3	1	25.14			
C	Sufflamen bursa	3	EAST - 3	1	85.87	77	5446.71	10.0
CF	Chaetodon unimaculatus	3	EAST - 3	2	82.37			
CF	Chaetodon ornatissimus	3	EAST - 3	2	138.00			
CF	Chaetodon quadrimaculatus	3	EAST - 3	2	50.61			
CF	Chaetodon multicinctus	3	EAST - 3	2	26.06	8	297.04	0.5
H	Scarus perspicillatus	3	EAST - 3	2	2721.55			
H	Scarus sordidus	3	EAST - 3	1	140.01			
H	Scarus sordidus	3	EAST - 3	1	1427.57			
H	Scarus sordidus	3	EAST - 3	1	367.02			
H	Scarus psittacus	3	EAST - 3	1	14.61			
H	Scarus psittacus	3	EAST - 3	1	1437.46			
H	Scarus rubroviolaceus	3	EAST - 3	1	43.92			
H	Acanthurus nigrofuscus	3	EAST - 3	30	426.38			
H	Acanthurus nigrofuscus	3	EAST - 3	30	716.91			
H	Acanthurus olivaceus	3	EAST - 3	50	19660.50			
H	Acanthurus olivaceus	3	EAST - 3	31	17458.28			
H	Acanthurus olivaceus	3	EAST - 3	14	3663.34			
H	Ctenochaetus strigosus	3	EAST - 3	3	80.53			
H	Ctenochaetus strigosus	3	EAST - 3	1	7.58			
H	Ctenochaetus strigosus	3	EAST - 3	1	15.20			
H	Naso lituratus	3	EAST - 3	1	72.58	169	48253.45	88.4
O	Stegastes fasciolatus	3	EAST - 3	18	265.74			
O	Melichthys vidua	3	EAST - 3	1	296.24			
O	Canthigaster jactator	3	EAST - 3	2	4.41	21	566.39	1.0
		3	EAST - 3	275	54563.59	275	54563.59	100
C	Parupeneus multifasciatus	4	EAST - 4	1	54.40			
C	Forcipiger flavissimus	4	EAST - 4	1	9.15			
C	Chaetodon lunula	4	EAST - 4	2	71.99			
C	Plectroglyphidodon johnstonianı	4	EAST - 4	3	5.17			
C	Paracirrhites arcatus	4	EAST - 4	3	24.35			
C	Cirrhitops fasciatus	4	EAST - 4	1	8.23			
C	Bodianus bilunulatus	4	EAST - 4	1	75.64			
C	Bodianus bilunulatus	4	EAST - 4	1	0.52			
C	Bodianus bilunulatus	4	EAST - 4	1	1141.37			
C	Labroides phthirophagus	4	EAST - 4	4	2.51			
C	Thalassoma duperrey	4	EAST - 4	7	679.36			
C	Thalassoma duperrey	4	EAST - 4	7	22.05			
C	Thalassoma duperrey	4	EAST - 4	14	156.29			
C	Thalassoma duperrey	4	EAST - 4	9	246.51			
C	Thalassoma duperrey	4	EAST - 4	15	824.23			
C	Coris venusta	4	EAST - 4	2	47.27			
C	Coris gaimard	4	EAST - 4	1	0.23			
C	Coris gaimard	4	EAST - 4	1	2.26			
C	Stethojulis balteata	4	EAST - 4	1	14.41			
C	Stethojulis balteata	4	EAST - 4	1	72.39			
C	Macropharyngodon geoffroy	4	EAST - 4	3	17.24			

16-Jun-11

GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Halichoeres ornatissimus	4	EAST - 4	1	4.41			
C	Halichoeres ornatissimus	4	EAST - 4	1	25.14			
C	Halichoeres ornatissimus	4	EAST - 4	3	49.35			
C	Rhinecanthus rectangulus	4	EAST - 4	5	429.37			
C	Sufflamen fraenatus	4	EAST - 4	1	329.34			
C	Sufflamen fraenatus	4	EAST - 4	1	224.79	91	4537.97	28.3
H	Acanthurus nigrofuscus	4	EAST - 4	23	173.07			
H	Acanthurus nigrofuscus	4	EAST - 4	24	573.53			
H	Acanthurus nigroris	4	EAST - 4	2	15.05			
H	Acanthurus olivaceus	4	EAST - 4	16	9010.72			
H	Acanthurus dussumieri	4	EAST - 4	1	326.59			
H	Acanthurus blochii	4	EAST - 4	1	453.59	67	10552.56	65.8
O	Melichthys niger	4	EAST - 4	3	490.01			
O	Melichthys vidua	4	EAST - 4	2	398.06			
O	Canthigaster jactator	4	EAST - 4	3	10.69	8	898.75	5.6
P	Chromis vanderbilti	4	EAST - 4	174	54.97	174	54.97	0.3
		4	EAST - 4	340	16044.25	340	16044.25	100
C	Adioryx spinifer	5	Ko Olina 1	1	639.40			
C	Parupeneus multifasciatus	5	Ko Olina 1	4	108.47			
C	Parupeneus multifasciatus	5	Ko Olina 1	1	235.75			
C	Parupeneus multifasciatus	5	Ko Olina 1	1	54.40			
C	Parupeneus bifasciatus	5	Ko Olina 1	1	107.31			
C	Plectroglyphidodon johnstonianı	5	Ko Olina 1	4	6.89			
C	Paracirrhites arcatus	5	Ko Olina 1	1	8.12			
C	Labroides phthirophagus	5	Ko Olina 1	4	2.51			
C	Thalassoma duperrey	5	Ko Olina 1	12	328.69			
C	Thalassoma duperrey	5	Ko Olina 1	3	291.16			
C	Thalassoma duperrey	5	Ko Olina 1	12	659.39			
C	Thalassoma ballieui	5	Ko Olina 1	1	167.53			
C	Stethojulis balteata	5	Ko Olina 1	2	71.53			
C	Stethojulis balteata	5	Ko Olina 1	4	57.64			
C	Zanclus cornutus	5	Ko Olina 1	1	104.16			
C	Sufflamen bursa	5	Ko Olina 1	4	343.49	56	3186.41	21.5
CF	Chaetodon multicinctus	5	Ko Olina 1	4	52.12	4	52.12	0.4
H	Scarus psittacus	5	Ko Olina 1	4	317.07			
H	Scarus rubroviolaceus	5	Ko Olina 1	3	256.18			
H	Acanthurus leucopareius	5	Ko Olina 1	4	530.80			
H	Acanthurus nigrofuscus	5	Ko Olina 1	29	693.01			
H	Acanthurus nigrofuscus	5	Ko Olina 1	13	705.28			
H	Acanthurus olivaceus	5	Ko Olina 1	8	1308.13			
H	Acanthurus olivaceus	5	Ko Olina 1	3	1689.51			
H	Ctenochaetus strigosus	5	Ko Olina 1	30	805.32			
H	Ctenochaetus strigosus	5	Ko Olina 1	46	3029.79			
H	Zebrasoma flavescens	5	Ko Olina 1	1	53.28			
H	Zebrasoma flavescens	5	Ko Olina 1	1	1.69	142	9390.07	63.5
O	Stegastes fasciolatus	5	Ko Olina 1	4	59.05			
O	Melichthys niger	5	Ko Olina 1	8	1306.68			
O	Canthigaster jactator	5	Ko Olina 1	3	10.69	15	1376.42	9.3
P	Abudefduf abdominalis	5	Ko Olina 1	25	783.31			
P	Chromis vanderbilti	5	Ko Olina 1	28	8.84	53	792.16	5.4
		5	Ko Olina 1	270	14797.18	270	14797.18	100
C	Aulostomus chinensis	6	Ko Olina 2	1	210.62			
C	Aprion virescens	6	Ko Olina 2	1	202.48			
C	Plectroglyphidodon johnstonianı	6	Ko Olina 2	3	5.17			
C	Paracirrhites forsteri	6	Ko Olina 2	1	39.65			
C	Bodianus bilunulatus	6	Ko Olina 2	1	0.52			
C	Bodianus bilunulatus	6	Ko Olina 2	1	1141.37			
C	Labroides phthirophagus	6	Ko Olina 2	5	3.14			
C	Thalassoma duperrey	6	Ko Olina 2	7	679.36			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Thalassoma duperrey	6	Ko Olina 2	11	301.30			
C	Thalassoma duperrey	6	Ko Olina 2	9	494.54			
C	Gomphosus varius	6	Ko Olina 2	1	39.39			
C	Plagiotremus ewaensis	6	Ko Olina 2	1	0.95			
C	Zanclus cornutus	6	Ko Olina 2	1	104.16			
C	Sufflamen bursa	6	Ko Olina 2	1	85.87	44	3308.52	8.0
CF	Chaetodon ornatissimus	6	Ko Olina 2	2	138.00			
CF	Chaetodon quadrimaculatus	6	Ko Olina 2	4	56.89			
CF	Chaetodon multicinctus	6	Ko Olina 2	3	39.09	9	233.98	0.6
H	Scarus sordidus	6	Ko Olina 2	1	775.07			
H	Scarus sordidus	6	Ko Olina 2	3	1101.06			
H	Scarus psittacus	6	Ko Olina 2	4	151.49			
H	Scarus psittacus	6	Ko Olina 2	1	554.69			
H	Scarus rubroviolaceus	6	Ko Olina 2	1	907.18			
H	Scarus rubroviolaceus	6	Ko Olina 2	2	2721.55			
H	Scarus rubroviolaceus	6	Ko Olina 2	8	9280.07			
H	Scarus rubroviolaceus	6	Ko Olina 2	4	2695.01			
H	Acanthurus triostegus	6	Ko Olina 2	3	138.95			
H	Acanthurus leucopareius	6	Ko Olina 2	1	66.74			
H	Acanthurus leucopareius	6	Ko Olina 2	1	132.70			
H	Acanthurus nigrofuscus	6	Ko Olina 2	14	105.34			
H	Acanthurus nigrofuscus	6	Ko Olina 2	25	597.43			
H	Acanthurus nigrofuscus	6	Ko Olina 2	3	162.76			
H	Acanthurus olivaceus	6	Ko Olina 2	9	5068.53			
H	Acanthurus olivaceus	6	Ko Olina 2	23	6018.34			
H	Acanthurus dussumieri	6	Ko Olina 2	1	112.02			
H	Acanthurus blochii	6	Ko Olina 2	1	232.24			
H	Ctenochaetus strigosus	6	Ko Olina 2	10	1321.34			
H	Ctenochaetus strigosus	6	Ko Olina 2	17	1119.70			
H	Ctenochaetus strigosus	6	Ko Olina 2	8	214.75			
H	Ctenochaetus strigosus	6	Ko Olina 2	9	68.18			
H	Ctenochaetus strigosus	6	Ko Olina 2	8	6.97			
H	Zebrasoma flavescens	6	Ko Olina 2	7	372.96			
H	Naso lituratus	6	Ko Olina 2	1	205.99	165	34131.08	82.5
O	Melichthys niger	6	Ko Olina 2	17	2776.70			
O	Melichthys vidua	6	Ko Olina 2	2	398.06			
O	Canthigaster jactator	6	Ko Olina 2	4	14.25	23	3189.01	7.7
P	Chaetodon miliaris	6	Ko Olina 2	1	21.17			
P	Abudefduf abdominalis	6	Ko Olina 2	16	501.32			
P	Chromis vanderbilti	6	Ko Olina 2	17	5.37			
P	Chromis hanui	6	Ko Olina 2	6	4.48	40	532.34	1.3
		6	Ko Olina 2	281	41394.93	281	41394.93	100
C	Gymnothorax flavimarginatus	7	KAHE 1-D	1	2721.55			
C	Parupeneus multifasciatus	7	KAHE 1-D	1	96.08			
C	Parupeneus multifasciatus	7	KAHE 1-D	1	11.05			
C	Parupeneus multifasciatus	7	KAHE 1-D	1	54.40			
C	Parupeneus multifasciatus	7	KAHE 1-D	2	54.23			
C	Plectroglyphidodon johnstonianu	7	KAHE 1-D	8	13.77			
C	Plectroglyphidodon imparipennis	7	KAHE 1-D	2	1.72			
C	Paracirrhites arcatus	7	KAHE 1-D	1	8.12			
C	Cirrhitops fasciatus	7	KAHE 1-D	1	3.75			
C	Labroides phthirophagus	7	KAHE 1-D	3	1.88			
C	Pseudocheilinus octotaenia	7	KAHE 1-D	1	14.41			
C	Thalassoma duperrey	7	KAHE 1-D	30	821.71			
C	Thalassoma duperrey	7	KAHE 1-D	24	2329.25			
C	Thalassoma duperrey	7	KAHE 1-D	24	267.92			
C	Thalassoma duperrey	7	KAHE 1-D	22	1208.88			
C	Gomphosus varius	7	KAHE 1-D	13	52.30			
C	Gomphosus varius	7	KAHE 1-D	2	45.20			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Gomphosus varius	7	KAHE 1-D	20	220.83			
C	Stethojulis balteata	7	KAHE 1-D	3	107.29			
C	Halichoeres ornatissimus	7	KAHE 1-D	2	8.82			
C	Halichoeres ornatissimus	7	KAHE 1-D	1	9.52			
C	Zanclus cornutus	7	KAHE 1-D	1	104.16			
C	Rhinecanthus rectangulus	7	KAHE 1-D	1	85.87			
C	Sufflamen bursa	7	KAHE 1-D	2	90.72			
C	Sufflamen bursa	7	KAHE 1-D	2	171.75	169	8505.20	32.3
CF	Chaetodon ornatissimus	7	KAHE 1-D	2	57.06			
CF	Chaetodon multicinctus	7	KAHE 1-D	2	26.06	4	83.12	0.3
H	Scarus psittacus	7	KAHE 1-D	6	227.24			
H	Scarus psittacus	7	KAHE 1-D	15	219.21			
H	Scarus rubroviolaceus	7	KAHE 1-D	1	43.92			
H	Scarus rubroviolaceus	7	KAHE 1-D	1	2255.55			
H	Scarus rubroviolaceus	7	KAHE 1-D	1	673.75			
H	Scarus rubroviolaceus	7	KAHE 1-D	2	2320.02			
H	Acanthurus triostegus	7	KAHE 1-D	9	416.84			
H	Acanthurus nigrofuscus	7	KAHE 1-D	44	625.36			
H	Acanthurus nigrofuscus	7	KAHE 1-D	62	1481.62			
H	Acanthurus nigrofuscus	7	KAHE 1-D	15	813.79			
H	Ctenochaetus strigosus	7	KAHE 1-D	4	60.79			
H	Ctenochaetus strigosus	7	KAHE 1-D	2	53.69	162	9191.77	34.9
O	Stegastes fasciolatus	7	KAHE 1-D	4	59.05			
O	Melichthys niger	7	KAHE 1-D	40	6533.42			
O	Melichthys niger	7	KAHE 1-D	19	1893.45			
O	Canthigaster jactator	7	KAHE 1-D	3	6.62	66	8492.53	32.3
P	Chromis vanderbilti	7	KAHE 1-D	30	9.48			
P	Chromis ovalis	7	KAHE 1-D	3	17.80	33	27.27	0.1
		7	KAHE 1-D	434	26299.90	434	26299.90	100
C	Fistularia commersoni	8	KAHE 5 -B	1	45.57			
C	Parupeneus pleurostigma	8	KAHE 5 -B	1	225.63			
C	Parupeneus multifasciatus	8	KAHE 5 -B	1	11.05			
C	Parupeneus bifasciatus	8	KAHE 5 -B	1	11.60			
C	Plectroglyphidodon johnstonianı	8	KAHE 5 -B	328	115.91			
C	Paracirrhites arcatus	8	KAHE 5 -B	7	56.82			
C	Cirrhitops fasciatus	8	KAHE 5 -B	1	8.23			
C	Thalassoma duperrey	8	KAHE 5 -B	16	438.25			
C	Thalassoma duperrey	8	KAHE 5 -B	2	194.10			
C	Thalassoma duperrey	8	KAHE 5 -B	4	219.80			
C	Gomphosus varius	8	KAHE 5 -B	1	11.04			
C	Stethojulis balteata	8	KAHE 5 -B	3	107.29			
C	Macropharyngodon geoffroy	8	KAHE 5 -B	1	5.75			
C	Halichoeres ornatissimus	8	KAHE 5 -B	2	32.90			
C	Halichoeres ornatissimus	8	KAHE 5 -B	2	19.05			
C	Zanclus cornutus	8	KAHE 5 -B	4	416.63			
C	Rhinecanthus rectangulus	8	KAHE 5 -B	1	45.36			
C	Rhinecanthus rectangulus	8	KAHE 5 -B	1	85.87	377	2050.85	27.8
H	Calotomus carolinus	8	KAHE 5 -B	1	499.89			
H	Scarus psittacus	8	KAHE 5 -B	1	79.27			
H	Scarus psittacus	8	KAHE 5 -B	1	37.87			
H	Acanthurus triostegus	8	KAHE 5 -B	2	8.48			
H	Acanthurus triostegus	8	KAHE 5 -B	1	46.32			
H	Acanthurus nigrofuscus	8	KAHE 5 -B	15	358.46			
H	Acanthurus nigrofuscus	8	KAHE 5 -B	8	8.35			
H	Acanthurus nigrofuscus	8	KAHE 5 -B	20	284.25			
H	Acanthurus olivaceus	8	KAHE 5 -B	7	1831.67			
H	Acanthurus olivaceus	8	KAHE 5 -B	2	786.42			
H	Acanthurus olivaceus	8	KAHE 5 -B	3	490.55			
H	Zebrasoma flavescens	8	KAHE 5 -B	1	1.69	62	4433.21	60.1
O	Stegastes fasciolatus	8	KAHE 5 -B	3	44.29			

GRP	16-Jun-11 SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
O	Melichthys vidua	8	KAHE 5 -B	1	296.24			
O	Cantherhines sandwichiensis	8	KAHE 5 -B	1	82.05			
O	Canthigaster jactator	8	KAHE 5 -B	3	10.69	8	433.27	5.9
P	Abudefduf abdominalis	8	KAHE 5 -B	3	94.00			
P	Chromis ovalis	8	KAHE 5 -B	9	2.84			
P	Naso brevirostris	8	KAHE 5 -B	5	366.79	17	463.63	6.3
	16-Jun-11	8	KAHE 5 -B	464	7380.96	464	7380.96	100
C	Parupeneus multifasciatus	9	KAHE 7 -B	2	54.23			
C	Parupeneus multifasciatus	9	KAHE 7 -B	1	340.44			
C	Parupeneus multifasciatus	9	KAHE 7 -B	1	235.75			
C	Paracirrhites arcatus	9	KAHE 7 -B	1	3.45			
C	Thalassoma duperrey	9	KAHE 7 -B	1	97.05			
C	Thalassoma duperrey	9	KAHE 7 -B	1	3.15			
C	Coris venusta	9	KAHE 7 -B	1	9.39			
C	Coris venusta	9	KAHE 7 -B	4	10.22			
C	Sufflamen bursa	9	KAHE 7 -B	9	772.86	21	1526.54	55.9
CF	Chaetodon multicinctus	9	KAHE 7 -B	2	1.65	2	1.65	0.1
H	Acanthurus triostegus	9	KAHE 7 -B	2	92.63			
H	Acanthurus nigrofuscus	9	KAHE 7 -B	1	54.25			
H	Acanthurus nigrofuscus	9	KAHE 7 -B	1	23.90			
H	Acanthurus olivaceus	9	KAHE 7 -B	2	523.33	6	694.11	25.4
O	Melichthys vidua	9	KAHE 7 -B	2	398.06			
O	Cantherhines sandwichiensis	9	KAHE 7 -B	1	82.05			
O	Canthigaster coronata	9	KAHE 7 -B	1	13.65			
O	Canthigaster jactator	9	KAHE 7 -B	2	7.12	6	500.89	18.4
P	Chromis vanderbilti	9	KAHE 7 -B	18	5.69			
P	Chromis hanui	9	KAHE 7 -B	1	0.75	19	6.43	0.2
		9	KAHE 7 -B	54	2729.62	54	2729.62	100
C	Caranx melampygus	10	KAHE 7 -C	1	192.85			
C	Mulloides flavolineatus	10	KAHE 7 -C	1	365.21			
C	Parupeneus multifasciatus	10	KAHE 7 -C	2	310.84			
C	Parupeneus multifasciatus	10	KAHE 7 -C	1	3.12			
C	Plectroglyphidodon johnstonianı	10	KAHE 7 -C	1	1.72			
C	Paracirrhites arcatus	10	KAHE 7 -C	3	24.35			
C	Cheilio inermis	10	KAHE 7 -C	1	618.55			
C	Cheilinus bimaculatus	10	KAHE 7 -C	1	19.37			
C	Thalassoma duperrey	10	KAHE 7 -C	8	25.20			
C	Coris venusta	10	KAHE 7 -C	2	47.27			
C	Coris gaimard	10	KAHE 7 -C	3	6.77			
C	Halichoeres ornatissimus	10	KAHE 7 -C	1	4.41			
C	Zanclus cornutus	10	KAHE 7 -C	1	104.16			
C	Sufflamen bursa	10	KAHE 7 -C	7	601.11	33	2324.94	92.9
H	Scarus psittacus	10	KAHE 7 -C	1	144.94	1	144.94	5.8
O	Canthigaster jactator	10	KAHE 7 -C	3	10.69	3	10.69	0.4
P	Chromis vanderbilti	10	KAHE 7 -C	66	20.85	66	20.85	0.8
		10	KAHE 7 -C	103	2501.42	103	2501.42	100
C	Parupeneus multifasciatus	11	KAHE 7 -D	1	11.05			
C	Plectroglyphidodon johnstonianı	11	KAHE 7 -D	2	1.72			
C	Paracirrhites arcatus	11	KAHE 7 -D	1	8.12			
C	Cheilinus bimaculatus	11	KAHE 7 -D	2	0.58			
C	Thalassoma duperrey	11	KAHE 7 -D	4	12.60			
C	Coris venusta	11	KAHE 7 -D	5	12.77			
C	Coris venusta	11	KAHE 7 -D	1	9.39			
C	Coris venusta	11	KAHE 7 -D	7	1.93			
C	Halichoeres ornatissimus	11	KAHE 7 -D	1	4.41			
C	Sufflamen bursa	11	KAHE 7 -D	2	171.75	26	234.32	98.3
H	Acanthurus nigrofuscus	11	KAHE 7 -D	2	2.09	2	2.09	0.9
O	Stegastes fasciolatus	11	KAHE 7 -D	1	0.86	1	0.86	0.4

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
P	Chromis vanderbilti	11	KAHE 7 -D	13	1.22	13	1.22	0.5
		11	KAHE 7 -D	42	238.49	42	238.49	100
C	Parupeneus multifasciatus	12	KAHE 7 - E	1	27.12			
C	Parupeneus multifasciatus	12	KAHE 7 - E	20	221.03			
C	Parupeneus multifasciatus	12	KAHE 7 - E	6	18.71			
C	Parupeneus multifasciatus	12	KAHE 7 - E	2	471.50			
C	Parupeneus cyclostomus	12	KAHE 7 - E	3	1321.36			
C	Forcipiger flavissimus	12	KAHE 7 - E	1	9.15			
C	Plectroglyphidodon johnstonianu	12	KAHE 7 - E	3	2.59			
C	Paracirrhites arcatus	12	KAHE 7 - E	2	16.24			
C	Cirrhitops fasciatus	12	KAHE 7 - E	1	3.75			
C	Cheilinus bimaculatus	12	KAHE 7 - E	1	9.63			
C	Cheilinus bimaculatus	12	KAHE 7 - E	2	8.20			
C	Cheilinus bimaculatus	12	KAHE 7 - E	3	0.86			
C	Pseudocheilinus octotaenia	12	KAHE 7 - E	1	14.41			
C	Thalassoma duperrey	12	KAHE 7 - E	1	54.95			
C	Thalassoma duperrey	12	KAHE 7 - E	16	50.41			
C	Thalassoma duperrey	12	KAHE 7 - E	5	485.26			
C	Coris venusta	12	KAHE 7 - E	7	17.88			
C	Coris venusta	12	KAHE 7 - E	10	2.76			
C	Stethojulis balteata	12	KAHE 7 - E	2	28.82			
C	Macropharyngodon geoffroy	12	KAHE 7 - E	3	2.31			
C	Zanclus cornutus	12	KAHE 7 - E	1	104.16			
C	Sufflamen bursa	12	KAHE 7 - E	3	257.62			
C	Sufflamen fraenatus	12	KAHE 7 - E	1	461.25	95	3589.96	36.1
CF	Chaetodon multicinctus	12	KAHE 7 - E	4	26.63			
CF	Chaetodon multicinctus	12	KAHE 7 - E	3	2.48	7	29.11	0.3
H	Centropyge potteri	12	KAHE 7 - E	1	1.72			
H	Acanthurus nigrofuscus	12	KAHE 7 - E	17	17.74			
H	Acanthurus nigrofuscus	12	KAHE 7 - E	15	112.87			
H	Acanthurus blochii	12	KAHE 7 - E	15	6.80			
H	Ctenochaetus strigosus	12	KAHE 7 - E	23	20.04			
H	Zebrasoma flavescens	12	KAHE 7 - E	5	8.44	76	167.61	1.7
O	Melichthys vidua	12	KAHE 7 - E	4	796.12	4	796.12	8.0
P	Chaetodon miliaris	12	KAHE 7 - E	1	0.88			
P	Chromis vanderbilti	12	KAHE 7 - E	489	154.47			
P	Chromis ovalis	12	KAHE 7 - E	13	9.71			
P	Chromis hanui	12	KAHE 7 - E	16	11.95			
P	Naso hexacanthus	12	KAHE 7 - E	1	38.92			
P	Naso brevirostris	12	KAHE 7 - E	65	4768.27			
P	Naso brevirostris	12	KAHE 7 - E	2	381.49	587	5365.69	53.9
		12	KAHE 7 - E	769	9948.48	769	9948.48	100
C	Cephalopholis argus	13	KAHE 10	1	1077.13			
C	Lutjanus kasmira	13	KAHE 10	23	2529.05			
C	Mulloides flavolineatus	13	KAHE 10	9	3286.88			
C	Parupeneus multifasciatus	13	KAHE 10	2	108.80			
C	Parupeneus multifasciatus	13	KAHE 10	4	108.47			
C	Parupeneus bifasciatus	13	KAHE 10	2	58.40			
C	Parupeneus cyclostomus	13	KAHE 10	1	10.05			
C	Forcipiger flavissimus	13	KAHE 10	2	18.30			
C	Plectroglyphidodon imparipennis	13	KAHE 10	2	1.72			
C	Labroides phthirophagus	13	KAHE 10	1	0.63			
C	Thalassoma duperrey	13	KAHE 10	5	55.82			
C	Thalassoma duperrey	13	KAHE 10	8	776.42			
C	Thalassoma duperrey	13	KAHE 10	39	1068.23			
C	Thalassoma duperrey	13	KAHE 10	40	2197.96			
C	Gomphosus varius	13	KAHE 10	1	11.04			
C	Stethojulis balteata	13	KAHE 10	1	72.39			
C	Halichoeres ornatissimus	13	KAHE 10	1	16.45			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Rhinecanthus rectangulus	13	KAHE 10	1	85.87			
C	Sufflamen bursa	13	KAHE 10	3	136.09			
C	Sufflamen bursa	13	KAHE 10	2	171.75			
C	Ostracion meleagris	13	KAHE 10	1	6.76	149	11798.19	79.0
CF	Cantherhines dumerili	13	KAHE 10	2	389.95	2	389.95	2.6
H	Acanthurus triostegus	13	KAHE 10	4	185.26			
H	Acanthurus nigrofuscus	13	KAHE 10	10	142.13			
H	Acanthurus blochii	13	KAHE 10	3	87.09	17	414.48	2.8
O	Stegastes fasciolatus	13	KAHE 10	7	103.34			
O	Melichthys niger	13	KAHE 10	3	490.01			
O	Melichthys vidua	13	KAHE 10	2	398.06			
O	Cantherhines sandwichiensis	13	KAHE 10	1	196.14			
O	Canthigaster jactator	13	KAHE 10	2	7.12	15	1194.67	8.0
P	Dascyllus albisella	13	KAHE 10	14	43.24			
P	Abudefduf abdominalis	13	KAHE 10	25	783.31			
P	Chromis vanderbilti	13	KAHE 10	86	27.17			
P	Chromis ovalis	13	KAHE 10	54	40.32			
P	Chromis ovalis	13	KAHE 10	21	242.75	200	1136.79	7.6
		13	KAHE 10	383	14934.08	383	14934.08	100
C	Parupeneus multifasciatus	14	Nanakuli 1	2	22.10			
C	Parupeneus multifasciatus	14	Nanakuli 1	2	108.80			
C	Parupeneus multifasciatus	14	Nanakuli 1	1	96.08			
C	Parupeneus multifasciatus	14	Nanakuli 1	1	3.12			
C	Parupeneus multifasciatus	14	Nanakuli 1	2	54.23			
C	Plectroglyphidodon johnstonianu	14	Nanakuli 1	3	2.59			
C	Plectroglyphidodon imparipennis	14	Nanakuli 1	6	5.17			
C	Paracirrhites arcatus	14	Nanakuli 1	1	3.45			
C	Thalassoma duperrey	14	Nanakuli 1	1	27.39			
C	Thalassoma duperrey	14	Nanakuli 1	1	54.95			
C	Thalassoma duperrey	14	Nanakuli 1	11	34.66			
C	Thalassoma duperrey	14	Nanakuli 1	3	33.49			
C	Thalassoma lutescens	14	Nanakuli 1	1	63.55			
C	Thalassoma lutescens	14	Nanakuli 1	1	32.76			
C	Stethojulis balteata	14	Nanakuli 1	7	28.01			
C	Stethojulis balteata	14	Nanakuli 1	1	35.76			
C	Macropharyngodon geoffroy	14	Nanakuli 1	1	5.75			
C	Rhinecanthus rectangulus	14	Nanakuli 1	5	429.37	50	1041.23	98.8
H	Acanthurus triostegus	14	Nanakuli 1	2	0.78			
H	Acanthurus blochii	14	Nanakuli 1	2	0.91	4	1.68	0.2
P	Chromis vanderbilti	14	Nanakuli 1	34	10.74	34	10.74	1.0
		14	Nanakuli 1	88	1053.65	88	1053.65	100
C	Parupeneus multifasciatus	15	Nanakuli 2	1	11.05			
C	Parupeneus bifasciatus	15	Nanakuli 2	1	11.60			
C	Plectroglyphidodon johnstonianu	15	Nanakuli 2	1	1.72			
C	Labroides phthirophagus	15	Nanakuli 2	1	0.63			
C	Thalassoma duperrey	15	Nanakuli 2	4	219.80			
C	Thalassoma duperrey	15	Nanakuli 2	4	44.65			
C	Thalassoma duperrey	15	Nanakuli 2	3	82.17			
C	Thalassoma duperrey	15	Nanakuli 2	1	97.05			
C	Sufflamen bursa	15	Nanakuli 2	1	85.87	17	554.54	2.6
CF	Chaetodon ornatissimus	15	Nanakuli 2	2	138.00			
CF	Chaetodon multicinctus	15	Nanakuli 2	2	13.31	4	151.32	0.7
H	Acanthurus leucopareius	15	Nanakuli 2	16	1067.85			
H	Acanthurus nigrofuscus	15	Nanakuli 2	39	2115.85			
H	Acanthurus nigrofuscus	15	Nanakuli 2	42	596.93			
H	Acanthurus nigrofuscus	15	Nanakuli 2	149	3560.66			
H	Acanthurus olivaceus	15	Nanakuli 2	15	8447.55			
H	Acanthurus olivaceus	15	Nanakuli 2	14	3663.34			
H	Acanthurus blochii	15	Nanakuli 2	2	0.91			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
H	Acanthurus blochii	15	Nanakuli 2	4	622.33			
H	Ctenochaetus strigosus	15	Nanakuli 2	3	80.53			
H	Zebrasoma flavescens	15	Nanakuli 2	2	106.56	286	20262.51	93.6
O	Stegastes fasciolatus	15	Nanakuli 2	13	191.92			
O	Melichthys niger	15	Nanakuli 2	1	163.34			
O	Melichthys vidua	15	Nanakuli 2	1	199.03			
O	Cantherhines sandwichiensis	15	Nanakuli 2	1	82.05			
O	Canthigaster jactator	15	Nanakuli 2	4	14.25	20	650.59	3.0
P	Chaetodon miliaris	15	Nanakuli 2	1	21.17			
P	Chromis vanderbilti	15	Nanakuli 2	12	3.79	13	24.96	0.1
		15	Nanakuli 2	340	21643.92	340	21643.92	100
C	Adioryx lacteoguttatus	16	KAHE PIPE	9	277.79			
C	Myripristis amaenus	16	KAHE PIPE	23	1887.91			
C	Parupeneus pleurostigma	16	KAHE PIPE	8	243.51			
C	Parupeneus pleurostigma	16	KAHE PIPE	4	392.99			
C	Parupeneus multifasciatus	16	KAHE PIPE	3	466.27			
C	Forcipiger flavissimus	16	KAHE PIPE	1	9.15			
C	Chaetodon fremblii	16	KAHE PIPE	2	41.82			
C	Chaetodon lunula	16	KAHE PIPE	1	35.99			
C	Paracirrhites arcatus	16	KAHE PIPE	6	98.09			
C	Labroides phthirophagus	16	KAHE PIPE	4	2.51			
C	Thalassoma duperrey	16	KAHE PIPE	46	4464.39			
C	Thalassoma duperrey	16	KAHE PIPE	13	714.34			
C	Thalassoma purpureum	16	KAHE PIPE	1	255.50			
C	Thalassoma lutescens	16	KAHE PIPE	1	172.64			
C	Gomphosus varius	16	KAHE PIPE	7	434.20			
C	Gomphosus varius	16	KAHE PIPE	11	248.61			
C	Stethojulis balteata	16	KAHE PIPE	5	178.82			
C	Stethojulis balteata	16	KAHE PIPE	3	217.17			
C	Halichoeres ornatissimus	16	KAHE PIPE	4	65.80			
C	Zanclus cornutus	16	KAHE PIPE	2	208.32			
C	Sufflamen bursa	16	KAHE PIPE	1	45.36			
C	Sufflamen fraenatus	16	KAHE PIPE	1	224.79	156	10685.97	16.8
CF	Chaetodon multicinctus	16	KAHE PIPE	6	78.18	6	78.18	0.1
H	Centropyge potteri	16	KAHE PIPE	1	10.62			
H	Calotomus carolinus	16	KAHE PIPE	1	131.69			
H	Scarus sordidus	16	KAHE PIPE	5	1835.11			
H	Scarus sordidus	16	KAHE PIPE	19	1444.25			
H	Scarus psittacus	16	KAHE PIPE	1	79.27			
H	Scarus psittacus	16	KAHE PIPE	4	3144.61			
H	Scarus rubroviolaceus	16	KAHE PIPE	1	147.03			
H	Acanthurus nigrofuscus	16	KAHE PIPE	80	1911.76			
H	Acanthurus nigrofuscus	16	KAHE PIPE	10	542.52			
H	Acanthurus nigrofuscus	16	KAHE PIPE	65	923.83			
H	Acanthurus nigroris	16	KAHE PIPE	30	716.91			
H	Acanthurus blochii	16	KAHE PIPE	4	116.12	221	11003.72	17.3
O	Stegastes fasciolatus	16	KAHE PIPE	31	457.66			
O	Melichthys niger	16	KAHE PIPE	20	3266.71			
O	Melichthys vidua	16	KAHE PIPE	1	199.03			
O	Cantherhines sandwichiensis	16	KAHE PIPE	1	131.57			
O	Canthigaster jactator	16	KAHE PIPE	9	32.06	62	4087.03	6.4
P	Chaetodon miliaris	16	KAHE PIPE	5	105.84			
P	Dascyllus albisella	16	KAHE PIPE	15	46.32			
P	Abudefduf abdominalis	16	KAHE PIPE	61	1911.29			
P	Abudefduf vaigensis	16	KAHE PIPE	445	13943.00			
P	Chromis vanderbilti	16	KAHE PIPE	126	39.80			
P	Chromis ovalis	16	KAHE PIPE	25	18.67			
P	Chromis ovalis	16	KAHE PIPE	57	658.90			
P	Naso hexacanthus	16	KAHE PIPE	5	194.62			
P	Naso brevirostris	16	KAHE PIPE	35	2567.53			
P	Naso brevirostris	16	KAHE PIPE	96	18311.42	870	37797.39	59.4
		16	KAHE PIPE	1315	63652.28	1315	63652.28	100

29 JULY 2011 FIELD DATA

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	1	EAST - 1	1	54.40			
C	Parupeneus multifasciatus	1	EAST - 1	3	81.35			
C	Parupeneus bifasciatus	1	EAST - 1	1	3.16			
C	Plectroglyphidodon imparipennis	1	EAST - 1	1	0.86			
C	Paracirrhites arcatus	1	EAST - 1	1	16.35			
C	Thalassoma duperrey	1	EAST - 1	19	6.89			
C	Thalassoma duperrey	1	EAST - 1	18	493.03			
C	Thalassoma duperrey	1	EAST - 1	12	659.39			
C	Thalassoma duperrey	1	EAST - 1	21	234.43			
C	Thalassoma duperrey	1	EAST - 1	2	194.10			
C	Thalassoma duperrey	1	EAST - 1	24	75.61			
C	Coris venusta	1	EAST - 1	1	48.38			
C	Coris venusta	1	EAST - 1	1	9.39			
C	Stethojulis balteata	1	EAST - 1	7	100.86			
C	Stethojulis balteata	1	EAST - 1	8	286.11			
C	Rhinecanthus rectangulus	1	EAST - 1	2	171.75	122	2436.05	88.8
CF	Chaetodon multicinctus	1	EAST - 1	1	0.83	1	0.83	0.03
H	Acanthurus triostegus	1	EAST - 1	1	4.24			
H	Acanthurus triostegus	1	EAST - 1	3	1.16			
H	Acanthurus nigrofuscus	1	EAST - 1	1	23.90			
H	Acanthurus olivaceus	1	EAST - 1	3	59.23			
H	Naso lituratus	1	EAST - 1	1	4.24			
H	Naso unicornis	1	EAST - 1	1	5.44	10	98.20	3.6
O	Melichthys vidua	1	EAST - 1	1	199.03			
O	Canthigaster jactator	1	EAST - 1	3	10.69	4	209.72	7.6
		1	EAST - 1	137	2744.79	137	2744.79	100
C	Parupeneus multifasciatus	2	EAST - 2	3	163.20			
C	Parupeneus multifasciatus	2	EAST - 2	4	108.47			
C	Parupeneus cyclostomus	2	EAST - 2	1	10.05			
C	Plectroglyphidodon johnstonianu	2	EAST - 2	1	0.86			
C	Plectroglyphidodon imparipennis	2	EAST - 2	1	0.86			
C	Labroides phthirophagus	2	EAST - 2	1	0.63			
C	Thalassoma duperrey	2	EAST - 2	18	989.08			
C	Thalassoma duperrey	2	EAST - 2	20	223.27			
C	Thalassoma duperrey	2	EAST - 2	8	776.42			
C	Thalassoma duperrey	2	EAST - 2	20	547.81			
C	Gomphosus varius	2	EAST - 2	2	22.08			
C	Coris venusta	2	EAST - 2	2	47.27			
C	Coris gaimard	2	EAST - 2	2	278.26			
C	Stethojulis balteata	2	EAST - 2	3	107.29			
C	Halichoeres ornatissimus	2	EAST - 2	1	9.52			
C	Rhinecanthus rectangulus	2	EAST - 2	2	90.72			
C	Rhinecanthus rectangulus	2	EAST - 2	2	171.75			
C	Sufflamen fraenatus	2	EAST - 2	1	461.25	92	4008.79	38.6
CF	Chaetodon quadrimaculatus	2	EAST - 2	2	50.61	2	50.61	0.5
H	Calotomus carolinus	2	EAST - 2	1	499.89			
H	Acanthurus triostegus	2	EAST - 2	16	1600.23			
H	Acanthurus nigrofuscus	2	EAST - 2	25	355.32			
H	Acanthurus nigrofuscus	2	EAST - 2	30	716.91			
H	Acanthurus olivaceus	2	EAST - 2	5	2815.85			
H	Acanthurus olivaceus	2	EAST - 2	1	163.52	78	6151.72	59.3
O	Melichthys niger	2	EAST - 2	1	163.34			
O	Canthigaster jactator	2	EAST - 2	1	3.56	2	166.90	1.6
P	Chromis vanderbilti	2	EAST - 2	9	2.84	9	2.84	0.03
		2	EAST - 2	183	10380.86	183	10380.86	100
C	Gymnothorax meleagris	3	EAST - 3	1	24.76			
C	Decapterus macarellus	3	EAST - 3	1	191.63			
C	Parupeneus multifasciatus	3	EAST - 3	1	27.12			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	3	EAST - 3	2	192.16			
C	Plectroglyphidodon johnstonianu	3	EAST - 3	3	5.17			
C	Paracirrhites arcatus	3	EAST - 3	5	40.59			
C	Paracirrhites forsteri	3	EAST - 3	1	16.35			
C	Thalassoma duperrey	3	EAST - 3	2	6.30			
C	Thalassoma duperrey	3	EAST - 3	2	54.78			
C	Thalassoma duperrey	3	EAST - 3	4	219.80			
C	Thalassoma duperrey	3	EAST - 3	5	55.82			
C	Stethojulis balteata	3	EAST - 3	1	35.76			
C	Halichoeres ornatissimus	3	EAST - 3	1	25.14			
C	Sufflamen bursa	3	EAST - 3	1	85.87	30	981.24	1.1
CF	Chaetodon multicinctus	3	EAST - 3	4	52.12	4	52.12	0.1
H	Scarus rubroviolaceus	3	EAST - 3	2	2721.55			
H	Acanthurus nigrofuscus	3	EAST - 3	25	355.32			
H	Acanthurus nigrofuscus	3	EAST - 3	11	262.87			
H	Acanthurus olivaceus	3	EAST - 3	64	16746.69			
H	Acanthurus olivaceus	3	EAST - 3	108	60822.39			
H	Acanthurus blochii	3	EAST - 3	1	783.81			
H	Acanthurus blochii	3	EAST - 3	4	1814.38			
H	Ctenochaetus strigosus	3	EAST - 3	3	45.60			
H	Zebrasoma flavescens	3	EAST - 3	3	159.84	221	83712.44	96.1
O	Stegastes fasciolatus	3	EAST - 3	6	88.58			
O	Melichthys niger	3	EAST - 3	9	1470.02			
O	Melichthys vidua	3	EAST - 3	1	296.24			
O	Canthigaster jactator	3	EAST - 3	1	3.56	17	1858.40	2.1
P	Naso hexacanthus	3	EAST - 3	4	293.43			
P	Naso brevirostris	3	EAST - 3	1	190.74	5	484.18	0.6
		3	EAST - 3	277	87088.37	277	87088.37	100
C	Parupeneus multifasciatus	4	EAST - 4	4	108.47			
C	Parupeneus multifasciatus	4	EAST - 4	3	33.15			
C	Parupeneus multifasciatus	4	EAST - 4	1	54.40			
C	Parupeneus cyclostomus	4	EAST - 4	1	49.96			
C	Plectroglyphidodon imparipennis	4	EAST - 4	1	0.86			
C	Paracirrhites arcatus	4	EAST - 4	1	8.12			
C	Cirrhitops fasciatus	4	EAST - 4	1	8.23			
C	Bodianus bilunulatus	4	EAST - 4	1	1141.37			
C	Labroides phthirophagus	4	EAST - 4	2	1.26			
C	Thalassoma duperrey	4	EAST - 4	17	934.13			
C	Thalassoma duperrey	4	EAST - 4	25	684.76			
C	Thalassoma duperrey	4	EAST - 4	19	212.10			
C	Thalassoma duperrey	4	EAST - 4	5	485.26			
C	Coris venusta	4	EAST - 4	1	48.38			
C	Coris venusta	4	EAST - 4	9	84.48			
C	Coris venusta	4	EAST - 4	3	70.91			
C	Coris gaimard	4	EAST - 4	1	8.57			
C	Pseudojuloides cerasinus	4	EAST - 4	1	11.16			
C	Pseudojuloides cerasinus	4	EAST - 4	1	3.15			
C	Stethojulis balteata	4	EAST - 4	2	71.53			
C	Macropharyngodon geoffroy	4	EAST - 4	1	18.63			
C	Halichoeres ornatissimus	4	EAST - 4	1	4.41			
C	Plagiotremus ewaensis	4	EAST - 4	2	1.90			
C	Rhinecanthus rectangulus	4	EAST - 4	2	171.75			
C	Rhinecanthus rectangulus	4	EAST - 4	1	45.36			
C	Sufflamen fraenatus	4	EAST - 4	1	329.34	107	4591.64	44.1
H	Acanthurus triostegus	4	EAST - 4	1	46.32			
H	Acanthurus triostegus	4	EAST - 4	1	100.01			
H	Acanthurus nigrofuscus	4	EAST - 4	29	412.17			
H	Acanthurus nigrofuscus	4	EAST - 4	5	119.49			
H	Acanthurus olivaceus	4	EAST - 4	6	3379.02			
H	Acanthurus dussumieri	4	EAST - 4	1	326.59	43	4383.60	42.1
O	Melichthys niger	4	EAST - 4	6	980.01			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
O	Melichthys vidua	4	EAST - 4	2	398.06			
O	Canthigaster jactator	4	EAST - 4	4	14.25	12	1392.32	13.4
P	Chromis vanderbilti	4	EAST - 4	132	41.70			
P	Chromis ovalis	4	EAST - 4	5	3.73	137	45.43	0.4
		4	EAST - 4	299	10412.99	299	10412.99	100
C	Aphareus furcatus	5	Ko Olina 1	1	202.48			
C	Monotaxis grandoculis	5	Ko Olina 1	5	173.95			
C	Parupeneus multifasciatus	5	Ko Olina 1	2	54.23			
C	Plectroglyphidodon johnstonianu	5	Ko Olina 1	2	3.44			
C	Paracirrhites forsteri	5	Ko Olina 1	1	39.65			
C	Cirrhitus pinnulatus	5	Ko Olina 1	1	90.86			
C	Labroides phthirophagus	5	Ko Olina 1	3	1.88			
C	Thalassoma duperrey	5	Ko Olina 1	2	194.10			
C	Thalassoma duperrey	5	Ko Olina 1	4	44.65			
C	Thalassoma duperrey	5	Ko Olina 1	7	191.73			
C	Thalassoma duperrey	5	Ko Olina 1	11	604.44			
C	Thalassoma ballieui	5	Ko Olina 1	1	167.53			
C	Gomphosus varius	5	Ko Olina 1	1	22.60			
C	Gomphosus varius	5	Ko Olina 1	2	22.08			
C	Coris gaimard	5	Ko Olina 1	1	139.13			
C	Stethojulis balteata	5	Ko Olina 1	2	71.53			
C	Anampses cuvier	5	Ko Olina 1	1	31.59			
C	Zanclus cornutus	5	Ko Olina 1	4	416.63			
C	Sufflamen bursa	5	Ko Olina 1	3	257.62	54	2730.14	9.9
CF	Chaetodon unimaculatus	5	Ko Olina 1	4	101.22			
CF	Chaetodon quadrimaculatus	5	Ko Olina 1	2	50.61			
CF	Chaetodon multicinctus	5	Ko Olina 1	8	104.24	14	256.07	0.9
H	Scarus sordidus	5	Ko Olina 1	1	234.65			
H	Scarus sordidus	5	Ko Olina 1	1	1427.57			
H	Scarus sordidus	5	Ko Olina 1	2	152.03			
H	Scarus sordidus	5	Ko Olina 1	1	35.99			
H	Scarus psittacus	5	Ko Olina 1	1	241.42			
H	Scarus psittacus	5	Ko Olina 1	1	37.87			
H	Scarus rubroviolaceus	5	Ko Olina 1	5	426.97			
H	Scarus rubroviolaceus	5	Ko Olina 1	7	2425.53			
H	Scarus rubroviolaceus	5	Ko Olina 1	8	1862.01			
H	Scarus rubroviolaceus	5	Ko Olina 1	13	1911.33			
H	Acanthurus triostegus	5	Ko Olina 1	3	300.04			
H	Acanthurus leucopareius	5	Ko Olina 1	3	698.03			
H	Acanthurus leucopareius	5	Ko Olina 1	7	928.90			
H	Acanthurus nigrofuscus	5	Ko Olina 1	34	1844.58			
H	Acanthurus nigrofuscus	5	Ko Olina 1	35	836.40			
H	Acanthurus olivaceus	5	Ko Olina 1	6	3379.02			
H	Acanthurus olivaceus	5	Ko Olina 1	1	261.67			
H	Acanthurus blochii	5	Ko Olina 1	2	464.48			
H	Ctenochaetus strigosus	5	Ko Olina 1	43	1154.29			
H	Ctenochaetus strigosus	5	Ko Olina 1	48	3161.52			
H	Zebrasoma flavescens	5	Ko Olina 1	2	106.56			
H	Naso lituratus	5	Ko Olina 1	3	617.96			
H	Naso lituratus	5	Ko Olina 1	4	1795.77	231	24304.60	87.7
O	Stegastes fasciolatus	5	Ko Olina 1	7	103.34			
O	Melichthys niger	5	Ko Olina 1	1	163.34			
O	Canthigaster jactator	5	Ko Olina 1	3	10.69	11	277.36	1.0
P	Abudefduf abdominalis	5	Ko Olina 1	4	125.33			
P	Chromis vanderbilti	5	Ko Olina 1	19	6.00	23	131.33	0.5
		5	Ko Olina 1	333	27699.51	333	27699.51	100
C	Aulostomus chinensis	6	Ko Olina 2	1	210.62			
C	Parupeneus multifasciatus	6	Ko Olina 2	3	81.35			
C	Parupeneus bifasciatus	6	Ko Olina 2	1	553.06			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Forcipiger flavissimus	6	Ko Olina 2	2	18.30			
C	Chaetodon lunula	6	Ko Olina 2	4	143.98			
C	Paracirrhites arcatus	6	Ko Olina 2	1	8.12			
C	Cirrhitus pinnulatus	6	Ko Olina 2	1	44.59			
C	Labroides phthirophagus	6	Ko Olina 2	5	3.14			
C	Thalassoma duperrey	6	Ko Olina 2	3	291.16			
C	Thalassoma duperrey	6	Ko Olina 2	7	384.64			
C	Thalassoma duperrey	6	Ko Olina 2	3	82.17			
C	Thalassoma duperrey	6	Ko Olina 2	1	11.16			
C	Coris gaimard	6	Ko Olina 2	1	45.99			
C	Stethojulis balteata	6	Ko Olina 2	1	35.76			
C	Macropharyngodon geoffroy	6	Ko Olina 2	2	37.26			
C	Halichoeres ornatissimus	6	Ko Olina 2	1	25.14			
C	Halichoeres ornatissimus	6	Ko Olina 2	1	16.45			
C	Sufflamen bursa	6	Ko Olina 2	3	257.62			
C	Sufflamen bursa	6	Ko Olina 2	2	289.30			
C	Sufflamen fraenatus	6	Ko Olina 2	1	461.25	44	3001.05	6.4
CF	Chaetodon unimaculatus	6	Ko Olina 2	2	50.61			
CF	Chaetodon ornatissimus	6	Ko Olina 2	1	69.00			
CF	Chaetodon quadrimaculatus	6	Ko Olina 2	4	101.22			
CF	Chaetodon multicinctus	6	Ko Olina 2	4	52.12	11	272.95	0.6
H	Calotomus carolinus	6	Ko Olina 2	1	1288.03			
H	Calotomus carolinus	6	Ko Olina 2	1	707.00			
H	Calotomus carolinus	6	Ko Olina 2	1	34.69			
H	Scarus sordidus	6	Ko Olina 2	1	367.02			
H	Scarus psittacus	6	Ko Olina 2	1	554.69			
H	Scarus psittacus	6	Ko Olina 2	1	241.42			
H	Scarus psittacus	6	Ko Olina 2	1	1437.46			
H	Scarus psittacus	6	Ko Olina 2	2	158.54			
H	Scarus rubroviolaceus	6	Ko Olina 2	7	9525.44			
H	Scarus rubroviolaceus	6	Ko Olina 2	1	1814.37			
H	Acanthurus triostegus	6	Ko Olina 2	24	1111.56			
H	Acanthurus triostegus	6	Ko Olina 2	43	4300.61			
H	Acanthurus leucopareius	6	Ko Olina 2	7	1628.73			
H	Acanthurus leucopareius	6	Ko Olina 2	6	796.20			
H	Acanthurus nigrofuscus	6	Ko Olina 2	43	1027.57			
H	Acanthurus nigrofuscus	6	Ko Olina 2	24	341.11			
H	Acanthurus nigrofuscus	6	Ko Olina 2	23	1247.81			
H	Acanthurus olivaceus	6	Ko Olina 2	14	3663.34			
H	Acanthurus olivaceus	6	Ko Olina 2	12	6758.04			
H	Acanthurus dussumieri	6	Ko Olina 2	1	326.59			
H	Acanthurus dussumieri	6	Ko Olina 2	1	167.22			
H	Acanthurus blochii	6	Ko Olina 2	9	1400.24			
H	Ctenochaetus strigosus	6	Ko Olina 2	10	268.44			
H	Ctenochaetus strigosus	6	Ko Olina 2	18	1185.57	252	40351.70	86.2
O	Stegastes fasciolatus	6	Ko Olina 2	2	29.53			
O	Melichthys niger	6	Ko Olina 2	15	2450.03			
O	Canthigaster jactator	6	Ko Olina 2	4	14.25	21	2493.81	5.3
P	Abudefduf abdominalis	6	Ko Olina 2	22	689.32			
P	Chromis vanderbilti	6	Ko Olina 2	23	7.27			
P	Chromis hanui	6	Ko Olina 2	2	1.49	47	698.08	1.5
		6	Ko Olina 2	375	46817.58	375	46817.58	100
C	Myripristis amaenus	7	KAHE 1-D	7	574.58			
C	Aulostomus chinensis	7	KAHE 1-D	1	19.27			
C	Cephalopholis argus	7	KAHE 1-D	1	1355.30			
C	Parupeneus multifasciatus	7	KAHE 1-D	1	340.44			
C	Parupeneus multifasciatus	7	KAHE 1-D	1	27.12			
C	Chaetodon fremblii	7	KAHE 1-D	1	20.91			
C	Plectroglyphidodon johnstonianu	7	KAHE 1-D	2	3.44			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Plectroglyphidodon imparipennis	7	KAHE 1-D	2	1.72			
C	Bodianus bilunulatus	7	KAHE 1-D	1	648.58			
C	Labroides phthirophagus	7	KAHE 1-D	3	1.88			
C	Thalassoma duperrey	7	KAHE 1-D	10	111.63			
C	Thalassoma duperrey	7	KAHE 1-D	15	1455.78			
C	Thalassoma duperrey	7	KAHE 1-D	15	824.23			
C	Thalassoma duperrey	7	KAHE 1-D	21	575.20			
C	Gomphosus varius	7	KAHE 1-D	7	77.29			
C	Gomphosus varius	7	KAHE 1-D	6	135.61			
C	Gomphosus varius	7	KAHE 1-D	1	39.39			
C	Stethojulis balteata	7	KAHE 1-D	8	286.11			
C	Zanclus cornutus	7	KAHE 1-D	1	104.16			
C	Sufflamen bursa	7	KAHE 1-D	4	343.49	108	6946.15	34.8
H	Acanthurus nigrofuscus	7	KAHE 1-D	13	705.28			
H	Acanthurus nigrofuscus	7	KAHE 1-D	32	764.71			
H	Ctenochaetus strigosus	7	KAHE 1-D	1	65.86			
H	Ctenochaetus strigosus	7	KAHE 1-D	5	134.22	51	1670.07	8.4
O	Stegastes fasciolatus	7	KAHE 1-D	3	44.29			
O	Melichthys niger	7	KAHE 1-D	55	8983.45			
O	Melichthys niger	7	KAHE 1-D	19	1893.45			
O	Canthigaster jactator	7	KAHE 1-D	1	2.21			
O	Canthigaster rivulata	7	KAHE 1-D	1	13.65	79	10937.04	54.8
P	Abudefduf abdominalis	7	KAHE 1-D	5	156.66			
P	Chromis vanderbilti	7	KAHE 1-D	23	7.27			
P	Chromis ovalis	7	KAHE 1-D	43	255.07	71	418.99	2.1
		7	KAHE 1-D	309	19972.26	309	19972.26	100
C	Mulloides flavolineatus	8	KAHE 5 -B	2	538.68			
C	Parupeneus pleurostigma	8	KAHE 5 -B	1	58.01			
C	Parupeneus multifasciatus	8	KAHE 5 -B	5	135.58			
C	Parupeneus multifasciatus	8	KAHE 5 -B	1	54.40			
C	Parupeneus multifasciatus	8	KAHE 5 -B	1	96.08			
C	Parupeneus multifasciatus	8	KAHE 5 -B	8	88.41			
C	Plectroglyphidodon johnstonianu	8	KAHE 5 -B	3	5.17			
C	Plectroglyphidodon imparipennis	8	KAHE 5 -B	2	1.72			
C	Paracirrhites arcatus	8	KAHE 5 -B	5	40.59			
C	Paracirrhites forsteri	8	KAHE 5 -B	1	39.65			
C	Bodianus bilunulatus	8	KAHE 5 -B	1	0.52			
C	Labroides phthirophagus	8	KAHE 5 -B	1	0.63			
C	Thalassoma duperrey	8	KAHE 5 -B	10	273.90			
C	Thalassoma duperrey	8	KAHE 5 -B	8	439.59			
C	Thalassoma duperrey	8	KAHE 5 -B	2	194.10			
C	Thalassoma duperrey	8	KAHE 5 -B	16	178.61			
C	Gomphosus varius	8	KAHE 5 -B	1	39.39			
C	Gomphosus varius	8	KAHE 5 -B	2	22.08			
C	Coris gaimard	8	KAHE 5 -B	1	8.57			
C	Stethojulis balteata	8	KAHE 5 -B	4	143.05			
C	Macropharyngodon geoffroy	8	KAHE 5 -B	2	11.50			
C	Macropharyngodon geoffroy	8	KAHE 5 -B	1	18.63			
C	Halichoeres ornatissimus	8	KAHE 5 -B	1	25.14			
C	Halichoeres ornatissimus	8	KAHE 5 -B	4	65.80			
C	Zanclus cornutus	8	KAHE 5 -B	3	312.47			
C	Rhinecanthus rectangulus	8	KAHE 5 -B	1	85.87			
C	Sufflamen bursa	8	KAHE 5 -B	1	85.87	88	2964.03	38.8
CF	Chaetodon ornatissimus	8	KAHE 5 -B	4	276.01	4	276.01	3.6
H	Calotomus carolinus	8	KAHE 5 -B	1	218.67			
H	Scarus psittacus	8	KAHE 5 -B	1	79.27			
H	Scarus psittacus	8	KAHE 5 -B	1	554.69			
H	Acanthurus triostegus	8	KAHE 5 -B	3	138.95			
H	Acanthurus nigrofuscus	8	KAHE 5 -B	2	108.50			
H	Acanthurus nigrofuscus	8	KAHE 5 -B	4	56.85			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
H	Acanthurus nigrofuscus	8	KAHE 5 -B	15	112.87			
H	Acanthurus nigrofuscus	8	KAHE 5 -B	15	358.46			
H	Acanthurus olivaceus	8	KAHE 5 -B	1	563.17			
H	Acanthurus olivaceus	8	KAHE 5 -B	4	1046.67			
H	Naso unicornis	8	KAHE 5 -B	1	5.44	48	3243.53	42.4
O	Melichthys vidua	8	KAHE 5 -B	1	199.03			
O	Canthigaster jactator	8	KAHE 5 -B	2	7.12	3	206.15	2.7
P	Chaetodon ephippium	8	KAHE 5 -B	1	48.39			
P	Chaetodon miliaris	8	KAHE 5 -B	2	42.34			
P	Chromis vanderbilti	8	KAHE 5 -B	637	201.22			
P	Chromis hanui	8	KAHE 5 -B	2	1.49			
P	Naso hexacanthus	8	KAHE 5 -B	6	233.55			
P	Naso brevirostris	8	KAHE 5 -B	11	428.17	659	955.16	12.5
		8	KAHE 5 -B	802	7644.88	802	7644.88	100
C	Decapterus macarellus	9	KAHE 7 -B	350	45597.68			
C	Mulloides vanicolensis	9	KAHE 7 -B	1	331.38			
C	Mulloides vanicolensis	9	KAHE 7 -B	3	1392.72			
C	Parupeneus multifasciatus	9	KAHE 7 -B	2	471.50			
C	Parupeneus multifasciatus	9	KAHE 7 -B	2	22.10			
C	Chaetodon fremblii	9	KAHE 7 -B	1	20.91			
C	Paracirrhites arcatus	9	KAHE 7 -B	1	8.12			
C	Thalassoma duperrey	9	KAHE 7 -B	2	194.10			
C	Thalassoma duperrey	9	KAHE 7 -B	2	22.33			
C	Thalassoma duperrey	9	KAHE 7 -B	1	54.95			
C	Coris venusta	9	KAHE 7 -B	2	18.77			
C	Stethojulis balteata	9	KAHE 7 -B	9	321.87			
C	Zanclus cornutus	9	KAHE 7 -B	2	208.32			
C	Sufflamen bursa	9	KAHE 7 -B	4	343.49	382	49008.24	86.0
CF	Pervagor spilosoma	9	KAHE 7 -B	1	16.22	1	16.22	0.03
H	Calotomus carolinus	9	KAHE 7 -B	1	218.67			
H	Acanthurus triostegus	9	KAHE 7 -B	23	2300.33			
H	Acanthurus nigrofuscus	9	KAHE 7 -B	1	23.90			
H	Acanthurus olivaceus	9	KAHE 7 -B	9	5068.53			
H	Ctenochaetus strigosus	9	KAHE 7 -B	1	0.87			
H	Naso unicornis	9	KAHE 7 -B	2	10.87	37	7623.17	13.4
O	Melichthys vidua	9	KAHE 7 -B	1	199.03			
O	Cantherhines sandwichiensis	9	KAHE 7 -B	1	82.05	2	281.08	0.5
P	Dascyllus albisella	9	KAHE 7 -B	5	15.44			
P	Chromis vanderbilti	9	KAHE 7 -B	45	14.22			
P	Chromis hanui	9	KAHE 7 -B	5	3.73	55	33.39	0.1
		9	KAHE 7 -B	477	56962.10	477	56962.10	100
C	Parupeneus multifasciatus	10	KAHE 7 -C	9	28.07			
C	Parupeneus multifasciatus	10	KAHE 7 -C	10	110.52			
C	Parupeneus multifasciatus	10	KAHE 7 -C	1	27.12			
C	Plectroglyphidodon johnstonianu	10	KAHE 7 -C	3	2.59			
C	Bodianus bilunulatus	10	KAHE 7 -C	1	4.42			
C	Thalassoma duperrey	10	KAHE 7 -C	1	0.36			
C	Coris venusta	10	KAHE 7 -C	6	15.33			
C	Zanclus cornutus	10	KAHE 7 -C	2	208.32			
C	Sufflamen bursa	10	KAHE 7 -C	6	515.24	39	911.95	98.1
H	Acanthurus nigrofuscus	10	KAHE 7 -C	1	1.04	1	1.04	0.1
O	Canthigaster coronata	10	KAHE 7 -C	1	7.59			
O	Canthigaster jactator	10	KAHE 7 -C	2	4.41	3	12.00	1.3
P	Chromis vanderbilti	10	KAHE 7 -C	15	4.74	15	4.74	0.5
		10	KAHE 7 -C	58	929.74	58	929.74	100
C	Parupeneus multifasciatus	11	KAHE 7 -D	3	33.15			
C	Plectroglyphidodon johnstonianu	11	KAHE 7 -D	2	1.72			
C	Paracirrhites arcatus	11	KAHE 7 -D	1	8.12			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Cheilinus bimaculatus	11	KAHE 7 -D	2	8.20			
C	Thalassoma duperrey	11	KAHE 7 -D	8	10.27			
C	Thalassoma duperrey	11	KAHE 7 -D	3	9.45			
C	Coris venusta	11	KAHE 7 -D	1	9.39			
C	Coris venusta	11	KAHE 7 -D	3	3.04			
C	Plagiotremus ewaensis	11	KAHE 7 -D	2	1.90	25	85.25	89.9
H	Acanthurus nigrofuscus	11	KAHE 7 -D	1	1.04	1	1.04	1.1
P	Chromis vanderbilti	11	KAHE 7 -D	27	8.53	27	8.53	9.0
		11	KAHE 7 -D	53	94.83	53	94.83	100
C	Apogon kallopterus	12	KAHE 7 - E	3	12.55			
C	Caranx melampygus	12	KAHE 7 - E	1	680.39			
C	Parupeneus pleurostigma	12	KAHE 7 - E	17	133.03			
C	Parupeneus multifasciatus	12	KAHE 7 - E	13	40.55			
C	Parupeneus multifasciatus	12	KAHE 7 - E	16	176.83			
C	Parupeneus multifasciatus	12	KAHE 7 - E	3	81.35			
C	Parupeneus multifasciatus	12	KAHE 7 - E	2	108.80			
C	Parupeneus cyclostomus	12	KAHE 7 - E	1	218.58			
C	Parupeneus cyclostomus	12	KAHE 7 - E	1	49.96			
C	Chaetodon fremblii	12	KAHE 7 - E	1	6.61			
C	Plectroglyphidodon johnstonianu	12	KAHE 7 - E	3	2.59			
C	Paracirrhites arcatus	12	KAHE 7 - E	2	16.24			
C	Cirrhitops fasciatus	12	KAHE 7 - E	2	7.50			
C	Labroides phthirophagus	12	KAHE 7 - E	1	0.63			
C	Thalassoma duperrey	12	KAHE 7 - E	3	82.17			
C	Thalassoma duperrey	12	KAHE 7 - E	2	109.90			
C	Thalassoma duperrey	12	KAHE 7 - E	2	194.10			
C	Coris venusta	12	KAHE 7 - E	1	2.55			
C	Pseudojuloides cerasinus	12	KAHE 7 - E	3	9.45			
C	Pseudojuloides cerasinus	12	KAHE 7 - E	1	27.39			
C	Zanclus cornutus	12	KAHE 7 - E	1	104.16			
C	Sufflamen bursa	12	KAHE 7 - E	3	257.62	82	2322.94	52.7
CF	Chaetodon multicinctus	12	KAHE 7 - E	4	3.31			
CF	Chaetodon multicinctus	12	KAHE 7 - E	4	26.63	8	29.93	0.7
H	Centropyge potteri	12	KAHE 7 - E	1	1.72			
H	Acanthurus nigrofuscus	12	KAHE 7 - E	24	25.05			
H	Acanthurus nigrofuscus	12	KAHE 7 - E	8	60.20			
H	Acanthurus olivaceus	12	KAHE 7 - E	1	5.73			
H	Acanthurus blochii	12	KAHE 7 - E	2	7.26			
H	Ctenochaetus strigosus	12	KAHE 7 - E	6	5.23			
H	Zebrasoma flavescens	12	KAHE 7 - E	3	5.06			
H	Naso unicornis	12	KAHE 7 - E	1	5.44	46	115.68	2.6
O	Melichthys niger	12	KAHE 7 - E	6	980.01			
O	Melichthys vidua	12	KAHE 7 - E	4	796.12			
O	Cantherhines sandwichiensis	12	KAHE 7 - E	1	82.05			
O	Canthigaster coronata	12	KAHE 7 - E	1	3.56			
O	Canthigaster jactator	12	KAHE 7 - E	3	6.62	15	1868.36	42.4
P	Chaetodon kleini	12	KAHE 7 - E	2	13.12			
P	Chromis vanderbilti	12	KAHE 7 - E	134	42.33			
P	Chromis hanui	12	KAHE 7 - E	9	6.72			
P	Naso brevirostris	12	KAHE 7 - E	1	5.44	146	67.60	1.5
		12	KAHE 7 - E	297	4404.51	297	4404.51	100
C	Aulostomus chinensis	13	KAHE 10	1	88.50			
C	Mulloides flavolineatus	13	KAHE 10	1	365.21			
C	Parupeneus pleurostigma	13	KAHE 10	1	30.44			
C	Parupeneus multifasciatus	13	KAHE 10	3	33.15			
C	Parupeneus bifasciatus	13	KAHE 10	1	59.77			
C	Parupeneus cyclostomus	13	KAHE 10	1	24.80			
C	Plectroglyphidodon johnstonianu	13	KAHE 10	1	1.72			
C	Plectroglyphidodon imparipennis	13	KAHE 10	3	2.59			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Paracirrhites arcatus	13	KAHE 10	4	32.47			
C	Paracirrhites forsteri	13	KAHE 10	1	39.65			
C	Cirrhitops fasciatus	13	KAHE 10	1	3.75			
C	Labroides phthirophagus	13	KAHE 10	2	1.26			
C	Thalassoma duperrey	13	KAHE 10	15	824.23			
C	Thalassoma duperrey	13	KAHE 10	12	1164.62			
C	Thalassoma duperrey	13	KAHE 10	15	410.86			
C	Gomphosus varius	13	KAHE 10	1	22.60			
C	Stethojulis balteata	13	KAHE 10	6	214.58			
C	Stethojulis balteata	13	KAHE 10	8	115.27			
C	Halichoeres ornatissimus	13	KAHE 10	1	25.14			
C	Halichoeres ornatissimus	13	KAHE 10	1	4.41			
C	Sufflamen bursa	13	KAHE 10	4	343.49			
C	Ostracion meleagris	13	KAHE 10	1	6.76	84	3815.26	53.3
CF	Chaetodon multicinctus	13	KAHE 10	2	26.06	2	26.06	0.4
H	Acanthurus nigrofuscus	13	KAHE 10	17	406.25			
H	Acanthurus nigrofuscus	13	KAHE 10	11	156.34			
H	Acanthurus nigroris	13	KAHE 10	1	102.47			
H	Acanthurus olivaceus	13	KAHE 10	1	261.67			
H	Acanthurus blochii	13	KAHE 10	1	3.63			
H	Acanthurus blochii	13	KAHE 10	1	29.03	32	959.39	13.4
O	Stegastes fasciolatus	13	KAHE 10	5	73.82			
O	Melichthys niger	13	KAHE 10	1	163.34			
O	Melichthys vidua	13	KAHE 10	2	398.06			
O	Cantherhines sandwichiensis	13	KAHE 10	1	82.05			
O	Canthigaster jactator	13	KAHE 10	4	14.25	13	731.51	10.2
P	Dascyllus albisella	13	KAHE 10	19	58.68			
P	Abudefduf abdominalis	13	KAHE 10	17	532.65			
P	Abudefduf vaigensis	13	KAHE 10	7	219.33			
P	Chromis vanderbilti	13	KAHE 10	52	16.43			
P	Chromis ovalis	13	KAHE 10	35	404.59			
P	Chromis ovalis	13	KAHE 10	66	391.50	196	1623.17	22.7
		13	KAHE 10	327	7155.40	327	7155.40	100
C	Parupeneus multifasciatus	14	Nanakuli 1	5	55.26			
C	Parupeneus multifasciatus	14	Nanakuli 1	7	189.82			
C	Parupeneus multifasciatus	14	Nanakuli 1	1	54.40			
C	Plectroglyphidodon imparipennis	14	Nanakuli 1	3	2.59			
C	Thalassoma duperrey	14	Nanakuli 1	2	109.90			
C	Thalassoma duperrey	14	Nanakuli 1	1	97.05			
C	Thalassoma duperrey	14	Nanakuli 1	4	109.56			
C	Thalassoma duperrey	14	Nanakuli 1	8	89.31			
C	Stethojulis balteata	14	Nanakuli 1	6	86.45			
C	Stethojulis balteata	14	Nanakuli 1	1	35.76			
C	Macropharyngodon geoffroy	14	Nanakuli 1	1	5.75			
C	Rhinecanthus rectangulus	14	Nanakuli 1	1	85.87	40	921.72	93.2
H	Calotomus carolinus	14	Nanakuli 1	1	13.46			
H	Acanthurus triostegus	14	Nanakuli 1	8	33.90			
H	Acanthurus triostegus	14	Nanakuli 1	1	0.39			
H	Acanthurus blochii	14	Nanakuli 1	1	3.63	11	51.38	5.2
O	Stegastes fasciolatus	14	Nanakuli 1	1	7.39			
O	Canthigaster jactator	14	Nanakuli 1	2	4.41	3	11.80	1.2
P	Chromis vanderbilti	14	Nanakuli 1	13	4.11	13	4.11	0.4
		14	Nanakuli 1	67	989.01	67	989.01	100
C	Cephalopholis argus	15	Nanakuli 2	1	471.73			
C	Monotaxis grandoculis	15	Nanakuli 2	1	34.79			
C	Parupeneus multifasciatus	15	Nanakuli 2	1	54.40			
C	Parupeneus multifasciatus	15	Nanakuli 2	3	81.35			
C	Chaetodon lunula	15	Nanakuli 2	2	71.99			
C	Plectroglyphidodon johnstonianu	15	Nanakuli 2	1	1.72			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Thalassoma duperrey	15	Nanakuli 2	2	194.10			
C	Thalassoma duperrey	15	Nanakuli 2	7	384.64			
C	Thalassoma duperrey	15	Nanakuli 2	7	78.14			
C	Thalassoma duperrey	15	Nanakuli 2	5	136.95			
C	Gomphosus varius	15	Nanakuli 2	1	11.04			
C	Stethojulis balteata	15	Nanakuli 2	2	71.53			
C	Halichoeres ornatissimus	15	Nanakuli 2	1	9.52			
C	Zanclus cornutus	15	Nanakuli 2	1	104.16			
C	Sufflamen bursa	15	Nanakuli 2	1	85.87	36	1791.94	10.9
H	Scarus sordidus	15	Nanakuli 2	2	27.46			
H	Acanthurus triostegus	15	Nanakuli 2	15	1500.21			
H	Acanthurus leucopareius	15	Nanakuli 2	8	1861.40			
H	Acanthurus leucopareius	15	Nanakuli 2	5	663.50			
H	Acanthurus leucopareius	15	Nanakuli 2	3	200.22			
H	Acanthurus nigrofuscus	15	Nanakuli 2	18	430.15			
H	Acanthurus olivaceus	15	Nanakuli 2	16	9010.72			
H	Ctenochaetus strigosus	15	Nanakuli 2	3	80.53			
H	Zebrasoma flavescens	15	Nanakuli 2	1	1.69	71	13775.89	84.1
O	Stegastes fasciolatus	15	Nanakuli 2	1	14.76			
O	Melichthys niger	15	Nanakuli 2	3	490.01			
O	Melichthys vidua	15	Nanakuli 2	1	296.24			
O	Canthigaster jactator	15	Nanakuli 2	1	2.21	6	803.21	4.9
		15	Nanakuli 2	113	16371.05	113	16371.05	100
C	Myripristis amaenus	16	KAHE PIPE	19	805.66			
C	Decapterus macarellus	16	KAHE PIPE	4	766.53			
C	Lutjanus kasmira	16	KAHE PIPE	145	27643.79			
C	Mulloides flavolineatus	16	KAHE PIPE	14	5112.93			
C	Mulloides vanicolensis	16	KAHE PIPE	56	18557.00			
C	Mulloides vanicolensis	16	KAHE PIPE	13	1176.99			
C	Parupeneus pleurostigma	16	KAHE PIPE	1	58.01			
C	Parupeneus multifasciatus	16	KAHE PIPE	5	480.41			
C	Parupeneus multifasciatus	16	KAHE PIPE	2	54.23			
C	Parupeneus cyclostomus	16	KAHE PIPE	1	10.05			
C	Forcipiger flavissimus	16	KAHE PIPE	2	18.30			
C	Chaetodon lunula	16	KAHE PIPE	2	71.99			
C	Plectroglyphidodon johnstonianu	16	KAHE PIPE	3	5.17			
C	Paracirrhites arcatus	16	KAHE PIPE	1	16.35			
C	Cirrhitops fasciatus	16	KAHE PIPE	1	3.75			
C	Labroides phthirophagus	16	KAHE PIPE	5	3.14			
C	Thalassoma duperrey	16	KAHE PIPE	18	493.03			
C	Thalassoma duperrey	16	KAHE PIPE	12	659.39			
C	Thalassoma duperrey	16	KAHE PIPE	32	3105.66			
C	Gomphosus varius	16	KAHE PIPE	5	310.15			
C	Coris gaimard	16	KAHE PIPE	1	83.79			
C	Coris gaimard	16	KAHE PIPE	2	17.13			
C	Stethojulis balteata	16	KAHE PIPE	5	178.82			
C	Anampses chrysocephalus	16	KAHE PIPE	1	2.63			
C	Halichoeres ornatissimus	16	KAHE PIPE	1	4.41			
C	Zanclus cornutus	16	KAHE PIPE	3	312.47			
C	Sufflamen bursa	16	KAHE PIPE	2	171.75			
C	Alutera scripta	16	KAHE PIPE	1	1192.64	357	61316.15	70.3
CF	Chaetodon multicinctus	16	KAHE PIPE	2	13.31	2	13.31	0.02
H	Scarus psittacus	16	KAHE PIPE	1	1437.46			
H	Scarus psittacus	16	KAHE PIPE	5	396.34			
H	Acanthurus nigrofuscus	16	KAHE PIPE	36	860.29			
H	Ctenochaetus strigosus	16	KAHE PIPE	8	214.75			
H	Ctenochaetus strigosus	16	KAHE PIPE	5	329.32	55	3238.17	3.7
O	Stegastes fasciolatus	16	KAHE PIPE	3	44.29			
O	Melichthys niger	16	KAHE PIPE	1	163.34			
O	Melichthys vidua	16	KAHE PIPE	1	199.03			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
O	Cantherhines sandwichiensis	16	KAHE PIPE	1	46.04			
O	Canthigaster jactator	16	KAHE PIPE	4	14.25	10	466.94	0.5
P	Dascyllus albisella	16	KAHE PIPE	21	64.85			
P	Abudefduf abdominalis	16	KAHE PIPE	65	2036.62			
P	Abudefduf vaigensis	16	KAHE PIPE	125	3916.57			
P	Chromis vanderbilti	16	KAHE PIPE	33	10.42			
P	Chromis ovalis	16	KAHE PIPE	68	403.36			
P	Naso brevirostris	16	KAHE PIPE	32	1245.58			
P	Naso brevirostris	16	KAHE PIPE	31	2274.10			
P	Naso brevirostris	16	KAHE PIPE	38	4678.49			
P	Naso brevirostris	16	KAHE PIPE	27	7525.09	440	22155.08	25.4
		16	KAHE PIPE	864	87189.66	864	87189.66	100

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	1	EAST - 1	1	11.05			
C	Parupeneus multifasciatus	1	EAST - 1	1	235.75			
C	Plectroglyphidodon imparipennis	1	EAST - 1	1	0.86			
C	Paracirrhites arcatus	1	EAST - 1	1	8.12			
C	Thalassoma duperrey	1	EAST - 1	9	246.51			
C	Thalassoma duperrey	1	EAST - 1	12	659.39			
C	Thalassoma duperrey	1	EAST - 1	23	256.75			
C	Thalassoma duperrey	1	EAST - 1	9	873.47			
C	Coris gaimard	1	EAST - 1	1	22.07			
C	Stethojulis balteata	1	EAST - 1	7	100.86			
C	Stethojulis balteata	1	EAST - 1	1	35.76	66	2450.60	7.6
CF	Chaetodon multicinctus	1	EAST - 1	2	13.31	2	13.31	0.04
H	Acanthurus triostegus	1	EAST - 1	29	2900.41			
H	Acanthurus nigrofuscus	1	EAST - 1	4	30.10			
H	Acanthurus nigrofuscus	1	EAST - 1	27	1464.82			
H	Acanthurus nigrofuscus	1	EAST - 1	8	191.18			
H	Acanthurus olivaceus	1	EAST - 1	6	3379.02			
H	Acanthurus olivaceus	1	EAST - 1	7	5436.23			
H	Acanthurus dussumieri	1	EAST - 1	14	10045.38			
H	Acanthurus dussumieri	1	EAST - 1	4	2257.42			
H	Acanthurus blochii	1	EAST - 1	5	3919.05			
H	Acanthurus blochii	1	EAST - 1	1	29.03			
H	Naso lituratus	1	EAST - 1	1	36.34			
H	Naso lituratus	1	EAST - 1	1	72.58			
H	Naso unicornis	1	EAST - 1	1	38.92	108	29800.50	92.3
O	Canthigaster jactator	1	EAST - 1	3	10.69	3	10.69	0.03
		1	EAST - 1	179	32275.0967	179	32275.097	100
C	Cephalopholis argus	2	EAST - 2	1	638.29			
C	Lutjanus fulvus	2	EAST - 2	1	525.17			
C	Parupeneus multifasciatus	2	EAST - 2	1	54.40			
C	Parupeneus multifasciatus	2	EAST - 2	1	27.12			
C	Parupeneus multifasciatus	2	EAST - 2	1	96.08			
C	Plectroglyphidodon imparipennis	2	EAST - 2	1	0.86			
C	Paracirrhites arcatus	2	EAST - 2	2	16.24			
C	Bodianus bilunulatus	2	EAST - 2	1	1141.37			
C	Thalassoma duperrey	2	EAST - 2	28	766.93			
C	Thalassoma duperrey	2	EAST - 2	5	485.26			
C	Thalassoma duperrey	2	EAST - 2	25	1373.72			
C	Thalassoma duperrey	2	EAST - 2	20	223.27			
C	Coris gaimard	2	EAST - 2	1	22.07			
C	Coris gaimard	2	EAST - 2	1	83.79			
C	Stethojulis balteata	2	EAST - 2	3	107.29			
C	Rhinecanthus rectangulus	2	EAST - 2	2	90.72			
C	Rhinecanthus rectangulus	2	EAST - 2	1	85.87	95	5738.46	10.9
CF	Chaetodon unimaculatus	2	EAST - 2	2	82.37			
CF	Chaetodon ornatissimus	2	EAST - 2	2	138.00			
CF	Chaetodon quadrimaculatus	2	EAST - 2	6	151.82	10	372.20	0.7
H	Acanthurus triostegus	2	EAST - 2	37	3700.53			
H	Acanthurus leucopareius	2	EAST - 2	16	2123.20			
H	Acanthurus nigrofuscus	2	EAST - 2	28	397.96			
H	Acanthurus nigrofuscus	2	EAST - 2	21	1139.30			
H	Acanthurus nigrofuscus	2	EAST - 2	68	1625.00			
H	Acanthurus olivaceus	2	EAST - 2	6	4659.63			
H	Acanthurus olivaceus	2	EAST - 2	54	30411.19			
H	Acanthurus blochii	2	EAST - 2	5	1653.35			
H	Acanthurus blochii	2	EAST - 2	1	56.70			
H	Naso unicornis	2	EAST - 2	1	525.26	237	46292.12	88.0
O	Stegastes fasciolatus	2	EAST - 2	1	14.76			
O	Melichthys vidua	2	EAST - 2	1	199.03			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
O	Canthigaster jactator	2	EAST - 2	4	14.25	6	228.04	0.4
		2	EAST - 2	348	52630.8159	348	52630.816	100
C	Cephalopholis argus	3	EAST - 3	1	147.34			
C	Monotaxis grandoculis	3	EAST - 3	1	71.53			
C	Parupeneus multifasciatus	3	EAST - 3	1	54.40			
C	Parupeneus multifasciatus	3	EAST - 3	1	27.12			
C	Parupeneus bifasciatus	3	EAST - 3	1	59.77			
C	Forcipiger flavissimus	3	EAST - 3	3	27.45			
C	Plectroglyphidodon johnstonianu	3	EAST - 3	4	6.89			
C	Paracirrhites arcatus	3	EAST - 3	1	8.12			
C	Bodianus bilunulatus	3	EAST - 3	1	648.58			
C	Labroides phthirophagus	3	EAST - 3	1	0.63			
C	Thalassoma duperrey	3	EAST - 3	1	97.05			
C	Thalassoma duperrey	3	EAST - 3	10	273.90			
C	Thalassoma duperrey	3	EAST - 3	10	111.63			
C	Thalassoma duperrey	3	EAST - 3	9	494.54			
C	Gomphosus varius	3	EAST - 3	1	11.04			
C	Coris gaimard	3	EAST - 3	1	318.06			
C	Coris gaimard	3	EAST - 3	1	83.79			
C	Stethojulis balteata	3	EAST - 3	2	71.53			
C	Halichoeres ornatissimus	3	EAST - 3	1	9.52			
C	Zanclus cornutus	3	EAST - 3	1	104.16			
C	Sufflamen bursa	3	EAST - 3	2	171.75			
C	Sufflamen fraenatus	3	EAST - 3	1	224.79			
C	Sufflamen fraenatus	3	EAST - 3	1	623.45	56	3647.04	4.8
CF	Chaetodon unimaculatus	3	EAST - 3	2	50.61			
CF	Chaetodon ornatissimus	3	EAST - 3	4	276.01			
CF	Chaetodon quadrimaculatus	3	EAST - 3	3	75.91			
CF	Chaetodon multicinctus	3	EAST - 3	2	26.06			
CF	Cantherhines dumerili	3	EAST - 3	1	117.96	12	546.55	0.7
H	Calotomus carolinus	3	EAST - 3	2	26.93			
H	Scarus perspicillatus	3	EAST - 3	1	1836.38			
H	Scarus sordidus	3	EAST - 3	2	734.04			
H	Scarus psittacus	3	EAST - 3	1	14.61			
H	Scarus psittacus	3	EAST - 3	4	5749.85			
H	Scarus psittacus	3	EAST - 3	1	144.94			
H	Scarus psittacus	3	EAST - 3	1	375.61			
H	Scarus psittacus	3	EAST - 3	3	237.80			
H	Scarus rubroviolaceus	3	EAST - 3	5	3368.77			
H	Scarus rubroviolaceus	3	EAST - 3	1	346.50			
H	Scarus rubroviolaceus	3	EAST - 3	1	43.92			
H	Scarus rubroviolaceus	3	EAST - 3	3	441.08			
H	Scarus rubroviolaceus	3	EAST - 3	7	8120.06			
H	Acanthurus leucopareius	3	EAST - 3	1	232.68			
H	Acanthurus leucopareius	3	EAST - 3	1	132.70			
H	Acanthurus nigrofuscus	3	EAST - 3	38	908.09			
H	Acanthurus nigrofuscus	3	EAST - 3	22	312.68			
H	Acanthurus olivaceus	3	EAST - 3	75	42237.77			
H	Acanthurus olivaceus	3	EAST - 3	1	47.48			
H	Acanthurus olivaceus	3	EAST - 3	13	3401.67			
H	Acanthurus dussumieri	3	EAST - 3	1	238.09			
H	Ctenochaetus strigosus	3	EAST - 3	1	65.86			
H	Ctenochaetus strigosus	3	EAST - 3	17	128.79			
H	Ctenochaetus strigosus	3	EAST - 3	20	536.88			
H	Zebrasoma flavescens	3	EAST - 3	4	213.12			
H	Naso lituratus	3	EAST - 3	1	205.99	227	70102.28	92.5
O	Stegastes fasciolatus	3	EAST - 3	16	236.21			
O	Melichthys niger	3	EAST - 3	4	653.34			
O	Melichthys vidua	3	EAST - 3	3	597.09			
O	Canthigaster jactator	3	EAST - 3	2	7.12	25	1493.77	2.0
		3	EAST - 3	320	75789.6361	320	75789.636	100

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Gymnothorax meleagris	4	EAST - 4	1	24.76			
C	Parupeneus multifasciatus	4	EAST - 4	3	163.20			
C	Parupeneus multifasciatus	4	EAST - 4	1	11.05			
C	Parupeneus multifasciatus	4	EAST - 4	1	155.42			
C	Parupeneus cyclostomus	4	EAST - 4	2	49.59			
C	Plectroglyphidodon johnstonianu	4	EAST - 4	2	3.44			
C	Paracirrhites arcatus	4	EAST - 4	3	24.35			
C	Labroides phthirophagus	4	EAST - 4	2	1.26			
C	Thalassoma duperrey	4	EAST - 4	30	821.71			
C	Thalassoma duperrey	4	EAST - 4	26	290.24			
C	Thalassoma duperrey	4	EAST - 4	26	1428.67			
C	Thalassoma duperrey	4	EAST - 4	4	388.21			
C	Pseudojuloides cerasinus	4	EAST - 4	1	11.16			
C	Macropharyngodon geoffroy	4	EAST - 4	1	18.63			
C	Halichoeres ornatissimus	4	EAST - 4	1	9.52			
C	Halichoeres ornatissimus	4	EAST - 4	1	16.45			
C	Halichoeres ornatissimus	4	EAST - 4	1	25.14			
C	Plagiotremus ewaensis	4	EAST - 4	1	2.43			
C	Rhinecanthus rectangulus	4	EAST - 4	3	257.62			
C	Sufflamen fraenatus	4	EAST - 4	1	224.79			
C	Sufflamen fraenatus	4	EAST - 4	1	623.45			
C	Ostracion meleagris	4	EAST - 4	1	6.76	113	4557.87	13.7
CF	Cantherhines dumerili	4	EAST - 4	1	194.98	1	194.98	0.6
H	Acanthurus triostegus	4	EAST - 4	7	700.10			
H	Acanthurus nigrofuscus	4	EAST - 4	25	355.32			
H	Acanthurus nigrofuscus	4	EAST - 4	21	158.02			
H	Acanthurus nigrofuscus	4	EAST - 4	28	669.12			
H	Acanthurus olivaceus	4	EAST - 4	9	3538.89			
H	Acanthurus olivaceus	4	EAST - 4	4	2.77			
H	Acanthurus olivaceus	4	EAST - 4	37	20837.30			
H	Acanthurus dussumieri	4	EAST - 4	1	326.59			
H	Acanthurus blochii	4	EAST - 4	1	453.59			
H	Ctenochaetus strigosus	4	EAST - 4	1	26.84	134	27068.54	81.3
O	Stegastes fasciolatus	4	EAST - 4	1	14.76			
O	Melichthys niger	4	EAST - 4	5	816.68			
O	Melichthys vidua	4	EAST - 4	3	597.09			
O	Canthigaster jactator	4	EAST - 4	2	7.12	11	1435.65	4.3
P	Chromis vanderbilti	4	EAST - 4	101	31.91	101	31.91	0.1
		4	EAST - 4	360	33288.9497	360	33288.95	100
C	Monotaxis grandoculis	5	Ko Olina 1	2	257.78			
C	Parupeneus multifasciatus	5	Ko Olina 1	1	96.08			
C	Parupeneus multifasciatus	5	Ko Olina 1	1	27.12			
C	Parupeneus bifasciatus	5	Ko Olina 1	1	29.20			
C	Parupeneus cyclostomus	5	Ko Olina 1	1	88.57			
C	Plectroglyphidodon johnstonianu	5	Ko Olina 1	1	1.72			
C	Paracirrhites arcatus	5	Ko Olina 1	1	8.12			
C	Labroides phthirophagus	5	Ko Olina 1	2	1.26			
C	Thalassoma duperrey	5	Ko Olina 1	5	485.26			
C	Thalassoma duperrey	5	Ko Olina 1	18	493.03			
C	Thalassoma duperrey	5	Ko Olina 1	19	1044.03			
C	Thalassoma duperrey	5	Ko Olina 1	20	223.27			
C	Gomphosus varius	5	Ko Olina 1	1	39.39			
C	Coris gaimard	5	Ko Olina 1	1	8.57			
C	Stethojulis balteata	5	Ko Olina 1	2	71.53			
C	Stethojulis balteata	5	Ko Olina 1	1	72.39			
C	Sufflamen bursa	5	Ko Olina 1	3	257.62	80	3204.93	13.2
CF	Chaetodon unimaculatus	5	Ko Olina 1	2	50.61			
CF	Chaetodon quadrimaculatus	5	Ko Olina 1	1	25.30			
CF	Chaetodon multicinctus	5	Ko Olina 1	2	26.06	5	101.97	0.4

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
H	Calotomus carolinus	5	Ko Olina 1	1	13.46			
H	Scarus sordidus	5	Ko Olina 1	2	152.03			
H	Cirripectes vanderbilti	5	Ko Olina 1	1	7.25			
H	Acanthurus triostegus	5	Ko Olina 1	18	1800.26			
H	Acanthurus nigrofuscus	5	Ko Olina 1	25	1356.31			
H	Acanthurus nigrofuscus	5	Ko Olina 1	35	836.40			
H	Acanthurus olivaceus	5	Ko Olina 1	10	1635.16			
H	Acanthurus olivaceus	5	Ko Olina 1	17	9573.89			
H	Acanthurus dussumieri	5	Ko Olina 1	1	70.54			
H	Acanthurus blochii	5	Ko Olina 1	1	56.70			
H	Ctenochaetus strigosus	5	Ko Olina 1	20	536.88			
H	Ctenochaetus strigosus	5	Ko Olina 1	40	2634.60			
H	Ctenochaetus strigosus	5	Ko Olina 1	5	660.67			
H	Naso lituratus	5	Ko Olina 1	1	205.99			
H	Naso lituratus	5	Ko Olina 1	1	622.36	178	20162.50	82.9
O	Stegastes fasciolatus	5	Ko Olina 1	23	339.55			
O	Melichthys niger	5	Ko Olina 1	2	496.06			
O	Canthigaster jactator	5	Ko Olina 1	6	13.23	31	848.85	3.5
P	Chromis vanderbilti	5	Ko Olina 1	26	8.21	26	8.21	0.03
		5	Ko Olina 1	320	24326.4577	320	24326.458	100
C	Mulloides vanicolensis	6	Ko Olina 2	8	2651.00			
C	Parupeneus multifasciatus	6	Ko Olina 2	1	54.40			
C	Forcipiger flavissimus	6	Ko Olina 2	1	9.15			
C	Chaetodon lunula	6	Ko Olina 2	2	71.99			
C	Paracirrhites arcatus	6	Ko Olina 2	4	32.47			
C	Labroides phthirophagus	6	Ko Olina 2	2	1.26			
C	Thalassoma duperrey	6	Ko Olina 2	5	55.82			
C	Thalassoma duperrey	6	Ko Olina 2	8	439.59			
C	Thalassoma duperrey	6	Ko Olina 2	4	109.56			
C	Thalassoma duperrey	6	Ko Olina 2	1	97.05			
C	Halichoeres ornatissimus	6	Ko Olina 2	1	16.45			
C	Zanclus cornutus	6	Ko Olina 2	2	208.32			
C	Sufflamen bursa	6	Ko Olina 2	2	171.75			
C	Sufflamen fraenatus	6	Ko Olina 2	1	144.65	42	4063.45	10.8
CF	Chaetodon unimaculatus	6	Ko Olina 2	4	101.22			
CF	Chaetodon ornatissimus	6	Ko Olina 2	2	138.00			
CF	Chaetodon quadrimaculatus	6	Ko Olina 2	2	50.61			
CF	Chaetodon multicinctus	6	Ko Olina 2	4	52.12	12	341.95	0.9
H	Scarus psittacus	6	Ko Olina 2	3	4312.39			
H	Scarus psittacus	6	Ko Olina 2	2	751.22			
H	Acanthurus triostegus	6	Ko Olina 2	88	8801.25			
H	Acanthurus triostegus	6	Ko Olina 2	4	750.41			
H	Acanthurus leucopareius	6	Ko Olina 2	8	1861.40			
H	Acanthurus nigrofuscus	6	Ko Olina 2	34	812.50			
H	Acanthurus olivaceus	6	Ko Olina 2	5	1308.34			
H	Acanthurus olivaceus	6	Ko Olina 2	15	8447.55			
H	Acanthurus blochii	6	Ko Olina 2	7	685.83			
H	Ctenochaetus strigosus	6	Ko Olina 2	4	263.46			
H	Ctenochaetus strigosus	6	Ko Olina 2	15	1982.01			
H	Ctenochaetus strigosus	6	Ko Olina 2	9	241.60			
H	Zebrasoma flavescens	6	Ko Olina 2	20	1065.60			
H	Zebrasoma flavescens	6	Ko Olina 2	3	278.61			
H	Naso lituratus	6	Ko Olina 2	1	448.94	218	32011.10	85.0
O	Stegastes fasciolatus	6	Ko Olina 2	3	44.29			
O	Melichthys niger	6	Ko Olina 2	3	744.09			
O	Melichthys vidua	6	Ko Olina 2	1	296.24			
O	Canthigaster jactator	6	Ko Olina 2	5	11.03	12	1095.65	2.9
P	Abudefduf abdominalis	6	Ko Olina 2	5	156.66			
P	Chromis hanui	6	Ko Olina 2	2	1.49	7	158.16	0.4
		6	Ko Olina 2	291	37670.3056	291	37670.306	100

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Fistularia commersoni	7	KAHE 1-D	1	14.94			
C	Parupeneus multifasciatus	7	KAHE 1-D	2	22.10			
C	Parupeneus multifasciatus	7	KAHE 1-D	1	54.40			
C	Parupeneus multifasciatus	7	KAHE 1-D	1	27.12			
C	Plectroglyphidodon johnstonianu	7	KAHE 1-D	3	5.17			
C	Plectroglyphidodon imparipennis	7	KAHE 1-D	1	0.86			
C	Labroides phthirophagus	7	KAHE 1-D	2	1.26			
C	Thalassoma duperrey	7	KAHE 1-D	5	55.82			
C	Thalassoma duperrey	7	KAHE 1-D	6	164.34			
C	Thalassoma duperrey	7	KAHE 1-D	8	776.42			
C	Thalassoma duperrey	7	KAHE 1-D	11	604.44			
C	Gomphosus varius	7	KAHE 1-D	4	44.17			
C	Gomphosus varius	7	KAHE 1-D	2	78.79			
C	Gomphosus varius	7	KAHE 1-D	2	124.06			
C	Stethojulis balteata	7	KAHE 1-D	1	35.76			
C	Stethojulis balteata	7	KAHE 1-D	2	28.82			
C	Zanclus cornutus	7	KAHE 1-D	2	208.32			
C	Rhinecanthus rectangulus	7	KAHE 1-D	1	19.92			
C	Sufflamen bursa	7	KAHE 1-D	3	257.62			
C	Sufflamen bursa	7	KAHE 1-D	2	90.72			
C	Ostracion meleagris	7	KAHE 1-D	1	6.76	61	2621.80	19.2
CF	Chaetodon ornatissimus	7	KAHE 1-D	2	138.00			
CF	Chaetodon quadrimaculatus	7	KAHE 1-D	2	28.45			
CF	Chaetodon multicinctus	7	KAHE 1-D	2	26.06	6	192.51	1.4
H	Scarus psittacus	7	KAHE 1-D	23	336.13			
H	Scarus psittacus	7	KAHE 1-D	8	302.98			
H	Acanthurus triostegus	7	KAHE 1-D	8	137.33			
H	Acanthurus nigrofuscus	7	KAHE 1-D	40	955.88			
H	Acanthurus olivaceus	7	KAHE 1-D	3	59.23			
H	Acanthurus olivaceus	7	KAHE 1-D	8	45.86			
H	Ctenochaetus strigosus	7	KAHE 1-D	9	241.60			
H	Ctenochaetus strigosus	7	KAHE 1-D	3	22.73			
H	Ctenochaetus strigosus	7	KAHE 1-D	1	65.86	103	2167.60	15.8
O	Stegastes fasciolatus	7	KAHE 1-D	5	73.82			
O	Melichthys niger	7	KAHE 1-D	51	8330.11			
O	Melichthys vidua	7	KAHE 1-D	1	199.03			
O	Cantherhines sandwichiensis	7	KAHE 1-D	2	92.07			
O	Canthigaster jactator	7	KAHE 1-D	3	6.62	62	8701.64	63.6
P	Chromis vanderbilti	7	KAHE 1-D	12	3.79	12	3.79	0.03
		7	KAHE 1-D	244	13687.3428	244	13687.343	100
C	Apogon kallopterus	8	KAHE 5 -B	1	34.17			
C	Parupeneus multifasciatus	8	KAHE 5 -B	2	54.23			
C	Parupeneus multifasciatus	8	KAHE 5 -B	4	217.60			
C	Parupeneus multifasciatus	8	KAHE 5 -B	5	480.41			
C	Plectroglyphidodon johnstonianu	8	KAHE 5 -B	6	10.33			
C	Plectroglyphidodon imparipennis	8	KAHE 5 -B	3	2.59			
C	Paracirrhites arcatus	8	KAHE 5 -B	1	16.35			
C	Paracirrhites arcatus	8	KAHE 5 -B	3	49.05			
C	Labroides phthirophagus	8	KAHE 5 -B	1	0.63			
C	Thalassoma duperrey	8	KAHE 5 -B	1	97.05			
C	Thalassoma duperrey	8	KAHE 5 -B	7	191.73			
C	Thalassoma duperrey	8	KAHE 5 -B	9	100.47			
C	Thalassoma duperrey	8	KAHE 5 -B	5	274.74			
C	Gomphosus varius	8	KAHE 5 -B	3	118.18			
C	Coris venusta	8	KAHE 5 -B	5	118.18			
C	Coris venusta	8	KAHE 5 -B	2	96.76			
C	Stethojulis balteata	8	KAHE 5 -B	1	35.76			
C	Halichoeres ornatissimus	8	KAHE 5 -B	2	32.90			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Halichoeres ornatissimus	8	KAHE 5 -B	2	50.27			
C	Zanclus cornutus	8	KAHE 5 -B	2	208.32			
C	Rhinecanthus rectangulus	8	KAHE 5 -B	1	85.87			
C	Sufflamen bursa	8	KAHE 5 -B	3	257.62			
C	Sufflamen bursa	8	KAHE 5 -B	1	144.65	70	2677.87	41.3
CF	Chaetodon multicinctus	8	KAHE 5 -B	4	26.63			
CF	Pervagor melanocephalus	8	KAHE 5 -B	3	48.65	7	75.28	1.2
H	Acanthurus nigrofuscus	8	KAHE 5 -B	11	82.77			
H	Acanthurus nigrofuscus	8	KAHE 5 -B	15	358.46			
H	Acanthurus nigrofuscus	8	KAHE 5 -B	19	270.04			
H	Acanthurus olivaceus	8	KAHE 5 -B	3	17.20			
H	Acanthurus olivaceus	8	KAHE 5 -B	3	490.55			
H	Acanthurus olivaceus	8	KAHE 5 -B	2	523.33			
H	Acanthurus olivaceus	8	KAHE 5 -B	2	1126.34			
H	Naso lituratus	8	KAHE 5 -B	1	14.90			
H	Naso lituratus	8	KAHE 5 -B	1	4.24			
H	Naso lituratus	8	KAHE 5 -B	1	36.34	58	2924.17	45.1
O	Stegastes fasciolatus	8	KAHE 5 -B	4	59.05			
O	Melichthys vidua	8	KAHE 5 -B	1	199.03			
O	Cantherhines sandwichiensis	8	KAHE 5 -B	1	82.05			
O	Canthigaster jactator	8	KAHE 5 -B	2	7.12	8	347.26	5.4
P	Chromis vanderbilti	8	KAHE 5 -B	160	50.54			
P	Chromis ovalis	8	KAHE 5 -B	35	207.61			
P	Naso hexacanthus	8	KAHE 5 -B	2	77.85			
P	Naso brevirostris	8	KAHE 5 -B	3	116.77	200	452.78	7.0
		8	KAHE 5 -B	343	6477.3498	343	6477.3498	100
C	Parupeneus multifasciatus	9	KAHE 7 -B	3	33.15			
C	Parupeneus multifasciatus	9	KAHE 7 -B	7	380.80			
C	Parupeneus multifasciatus	9	KAHE 7 -B	2	192.16			
C	Parupeneus multifasciatus	9	KAHE 7 -B	1	27.12			
C	Parupeneus multifasciatus	9	KAHE 7 -B	1	235.75			
C	Chaetodon fremblii	9	KAHE 7 -B	1	20.91			
C	Labroides phthirophagus	9	KAHE 7 -B	1	0.19			
C	Novaculichthys taeniourus	9	KAHE 7 -B	1	64.38			
C	Thalassoma duperrey	9	KAHE 7 -B	4	44.65			
C	Thalassoma duperrey	9	KAHE 7 -B	3	291.16			
C	Thalassoma duperrey	9	KAHE 7 -B	3	164.85			
C	Thalassoma duperrey	9	KAHE 7 -B	2	54.78			
C	Coris venusta	9	KAHE 7 -B	2	47.27			
C	Stethojulis balteata	9	KAHE 7 -B	1	35.76			
C	Halichoeres ornatissimus	9	KAHE 7 -B	1	9.52			
C	Zanclus cornutus	9	KAHE 7 -B	1	54.90			
C	Zanclus cornutus	9	KAHE 7 -B	1	24.04			
C	Sufflamen bursa	9	KAHE 7 -B	1	85.87			
C	Sufflamen bursa	9	KAHE 7 -B	1	144.65			
C	Sufflamen fraenatus	9	KAHE 7 -B	1	85.87	38	1997.79	34.2
CF	Chaetodon multicinctus	9	KAHE 7 -B	4	26.63	4	26.63	0.5
H	Acanthurus nigrofuscus	9	KAHE 7 -B	1	54.25			
H	Acanthurus nigrofuscus	9	KAHE 7 -B	4	30.10			
H	Acanthurus nigrofuscus	9	KAHE 7 -B	2	47.79			
H	Acanthurus olivaceus	9	KAHE 7 -B	2	523.33			
H	Acanthurus olivaceus	9	KAHE 7 -B	5	2815.85			
H	Ctenochaetus strigosus	9	KAHE 7 -B	1	7.58			
H	Naso lituratus	9	KAHE 7 -B	1	36.34			
H	Naso lituratus	9	KAHE 7 -B	2	16.93			
H	Naso unicornis	9	KAHE 7 -B	2	34.39			
H	Naso unicornis	9	KAHE 7 -B	5	27.18	25	3593.75	61.5
O	Melichthys vidua	9	KAHE 7 -B	1	199.03			
O	Canthigaster coronata	9	KAHE 7 -B	2	15.18			
O	Canthigaster jactator	9	KAHE 7 -B	1	3.56	4	217.77	3.7

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
P	Chaetodon miliaris	9	KAHE 7 -B	1	0.88			
P	Dascyllus albisella	9	KAHE 7 -B	2	1.61			
P	Chromis vanderbilti	9	KAHE 7 -B	28	8.84	31	11.34	0.2
		9	KAHE 7 -B	102	5847.2741	102	5847.2741	100
C	Parupeneus multifasciatus	10	KAHE 7 -C	2	192.16			
C	Parupeneus multifasciatus	10	KAHE 7 -C	1	11.05			
C	Parupeneus multifasciatus	10	KAHE 7 -C	7	189.82			
C	Parupeneus multifasciatus	10	KAHE 7 -C	1	235.75			
C	Paracirrhites arcatus	10	KAHE 7 -C	5	40.59			
C	Bodianus bilunulatus	10	KAHE 7 -C	1	75.64			
C	Cheilinus bimaculatus	10	KAHE 7 -C	1	4.10			
C	Cheilinus bimaculatus	10	KAHE 7 -C	1	9.63			
C	Novaculichthys taeniourus	10	KAHE 7 -C	1	64.38			
C	Thalassoma duperrey	10	KAHE 7 -C	4	12.60			
C	Thalassoma duperrey	10	KAHE 7 -C	1	97.05			
C	Thalassoma duperrey	10	KAHE 7 -C	2	22.33			
C	Coris venusta	10	KAHE 7 -C	1	23.64			
C	Halichoeres ornatissimus	10	KAHE 7 -C	1	4.41			
C	Sufflamen bursa	10	KAHE 7 -C	5	429.37			
C	Sufflamen bursa	10	KAHE 7 -C	2	289.30			
C	Sufflamen fraenatus	10	KAHE 7 -C	1	329.34	37	2031.15	53.3
CF	Chaetodon unimaculatus	10	KAHE 7 -C	2	28.45			
CF	Chaetodon multicinctus	10	KAHE 7 -C	2	26.06			
CF	Chaetodon multicinctus	10	KAHE 7 -C	2	13.31	6	67.82	1.8
H	Calotomus carolinus	10	KAHE 7 -C	1	72.28			
H	Scarus psittacus	10	KAHE 7 -C	2	75.75			
H	Acanthurus nigrofuscus	10	KAHE 7 -C	1	14.21			
H	Acanthurus olivaceus	10	KAHE 7 -C	1	47.48			
H	Acanthurus olivaceus	10	KAHE 7 -C	1	563.17			
H	Acanthurus olivaceus	10	KAHE 7 -C	4	654.07			
H	Naso unicornis	10	KAHE 7 -C	2	34.39			
H	Naso unicornis	10	KAHE 7 -C	1	38.92			
H	Naso unicornis	10	KAHE 7 -C	2	10.87	15	1511.14	39.6
O	Cantherhines sandwichiensis	10	KAHE 7 -C	2	164.10			
O	Canthigaster coronata	10	KAHE 7 -C	3	22.77			
O	Canthigaster jactator	10	KAHE 7 -C	2	7.12			
O	Canthigaster jactator	10	KAHE 7 -C	1	2.21	8	196.20	5.1
P	Chromis vanderbilti	10	KAHE 7 -C	19	6.00	19	6.00	0.2
		10	KAHE 7 -C	85	3812.3150	85	3812.315	100
C	Decapterus macarellus	11	KAHE 7 -D	3	808.02			
C	Parupeneus pleurostigma	11	KAHE 7 -D	1	98.25			
C	Parupeneus multifasciatus	11	KAHE 7 -D	2	54.23			
C	Parupeneus multifasciatus	11	KAHE 7 -D	2	22.10			
C	Parupeneus multifasciatus	11	KAHE 7 -D	1	54.40			
C	Parupeneus multifasciatus	11	KAHE 7 -D	1	235.75			
C	Parupeneus multifasciatus	11	KAHE 7 -D	3	288.24			
C	Plectroglyphidodon johnstonianu	11	KAHE 7 -D	2	1.72			
C	Thalassoma duperrey	11	KAHE 7 -D	1	97.05			
C	Coris venusta	11	KAHE 7 -D	1	23.64			
C	Pseudojuloides cerasinus	11	KAHE 7 -D	2	22.33			
C	Sufflamen bursa	11	KAHE 7 -D	1	85.87	20	1791.61	85.8
H	Acanthurus olivaceus	11	KAHE 7 -D	1	47.48			
H	Naso lituratus	11	KAHE 7 -D	2	29.80			
H	Naso unicornis	11	KAHE 7 -D	1	17.19	4	94.47	4.5
O	Melichthys vidua	11	KAHE 7 -D	1	199.03			
O	Canthigaster jactator	11	KAHE 7 -D	1	3.56	2	202.59	9.7
		11	KAHE 7 -D	26	2088.6707	26	2088.6707	100

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Gymnothorax meleagris	12	KAHE 7 - E	1	233.92			
C	Aulostomus chinensis	12	KAHE 7 - E	1	12.84			
C	Fistularia commersoni	12	KAHE 7 - E	1	45.57			
C	Mulloides flavolineatus	12	KAHE 7 - E	1	365.21			
C	Parupeneus multifasciatus	12	KAHE 7 - E	6	66.31			
C	Parupeneus multifasciatus	12	KAHE 7 - E	2	54.23			
C	Parupeneus multifasciatus	12	KAHE 7 - E	10	31.19			
C	Parupeneus multifasciatus	12	KAHE 7 - E	1	96.08			
C	Parupeneus cyclostomus	12	KAHE 7 - E	1	10.05			
C	Forcipiger flavissimus	12	KAHE 7 - E	4	36.60			
C	Chaetodon fremblii	12	KAHE 7 - E	1	12.46			
C	Plectroglyphidodon johnstonianu	12	KAHE 7 - E	3	2.59			
C	Paracirrhites arcatus	12	KAHE 7 - E	6	48.71			
C	Cirrhitops fasciatus	12	KAHE 7 - E	1	3.75			
C	Cheilinus bimaculatus	12	KAHE 7 - E	1	4.10			
C	Thalassoma duperrey	12	KAHE 7 - E	2	54.78			
C	Thalassoma duperrey	12	KAHE 7 - E	1	97.05			
C	Thalassoma duperrey	12	KAHE 7 - E	2	109.90			
C	Thalassoma duperrey	12	KAHE 7 - E	4	44.65			
C	Gomphosus varius	12	KAHE 7 - E	1	22.60			
C	Gomphosus varius	12	KAHE 7 - E	1	11.04			
C	Gomphosus varius	12	KAHE 7 - E	1	62.03			
C	Pseudojuloides cerasinus	12	KAHE 7 - E	6	37.92			
C	Stethojulis balteata	12	KAHE 7 - E	1	35.76			
C	Macropharyngodon geoffroy	12	KAHE 7 - E	2	21.96			
C	Sufflamen bursa	12	KAHE 7 - E	2	171.75			
C	Sufflamen bursa	12	KAHE 7 - E	2	39.85			
C	Sufflamen fraenatus	12	KAHE 7 - E	1	329.34	66	2062.22	43.8
CF	Chaetodon multicinctus	12	KAHE 7 - E	8	53.25	8	53.25	1.1
H	Calotomus carolinus	12	KAHE 7 - E	1	22.36			
H	Scarus psittacus	12	KAHE 7 - E	3	237.80			
H	Scarus psittacus	12	KAHE 7 - E	5	73.07			
H	Scarus psittacus	12	KAHE 7 - E	3	113.62			
H	Acanthurus nigrofuscus	12	KAHE 7 - E	24	180.59			
H	Acanthurus nigrofuscus	12	KAHE 7 - E	2	28.43			
H	Acanthurus olivaceus	12	KAHE 7 - E	1	393.21			
H	Acanthurus olivaceus	12	KAHE 7 - E	1	47.48			
H	Ctenochaetus strigosus	12	KAHE 7 - E	4	30.30			
H	Naso lituratus	12	KAHE 7 - E	5	21.19			
H	Naso lituratus	12	KAHE 7 - E	2	29.80			
H	Naso unicornis	12	KAHE 7 - E	2	34.39			
H	Naso unicornis	12	KAHE 7 - E	3	16.31			
H	Naso unicornis	12	KAHE 7 - E	1	190.74	57	1419.29	30.2
O	Melichthys niger	12	KAHE 7 - E	2	326.67			
O	Melichthys vidua	12	KAHE 7 - E	3	597.09			
O	Cantherhines sandwichiensis	12	KAHE 7 - E	1	46.04			
O	Canthigaster coronata	12	KAHE 7 - E	2	15.18			
O	Canthigaster jactator	12	KAHE 7 - E	4	8.82	12	993.80	21.1
P	Chromis vanderbilti	12	KAHE 7 - E	535	169.00			
P	Chromis hanui	12	KAHE 7 - E	13	9.71	548	178.71	3.8
		12	KAHE 7 - E	691	4707.2667	691	4707.2667	100
C	Aulostomus chinensis	13	KAHE 10	1	12.84			
C	Aulostomus chinensis	13	KAHE 10	1	210.62			
C	Lutjanus kasmira	13	KAHE 10	50	1292.87			
C	Mulloides flavolineatus	13	KAHE 10	325	8401.91			
C	Mulloides vanicolensis	13	KAHE 10	500	45268.67			
C	Parupeneus multifasciatus	13	KAHE 10	1	3.12			
C	Parupeneus multifasciatus	13	KAHE 10	5	480.41			
C	Parupeneus bifasciatus	13	KAHE 10	1	11.60			
C	Chaetodon fremblii	13	KAHE 10	1	20.91			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Plectroglyphidodon johnstonianu	13	KAHE 10	2	1.72			
C	Plectroglyphidodon imparipennis	13	KAHE 10	3	2.59			
C	Paracirrhites arcatus	13	KAHE 10	4	32.47			
C	Cirrhitops fasciatus	13	KAHE 10	1	15.63			
C	Labroides phthirophagus	13	KAHE 10	3	1.88			
C	Thalassoma duperrey	13	KAHE 10	11	604.44			
C	Thalassoma duperrey	13	KAHE 10	5	55.82			
C	Thalassoma duperrey	13	KAHE 10	5	485.26			
C	Thalassoma duperrey	13	KAHE 10	7	191.73			
C	Gomphosus varius	13	KAHE 10	1	62.03			
C	Coris venusta	13	KAHE 10	1	9.39			
C	Halichoeres ornatissimus	13	KAHE 10	1	16.45			
C	Halichoeres ornatissimus	13	KAHE 10	1	25.14			
C	Zanclus cornutus	13	KAHE 10	1	54.90			
C	Sufflamen bursa	13	KAHE 10	1	45.36			
C	Sufflamen fraenatus	13	KAHE 10	2	658.68	934	57966.41	91.3
H	Acanthurus triostegus	13	KAHE 10	7	120.17			
H	Acanthurus leucopareius	13	KAHE 10	1	27.52			
H	Acanthurus nigrofuscus	13	KAHE 10	3	42.64			
H	Acanthurus olivaceus	13	KAHE 10	1	163.52			
H	Acanthurus olivaceus	13	KAHE 10	1	93.77			
H	Acanthurus olivaceus	13	KAHE 10	3	59.23			
H	Acanthurus blochii	13	KAHE 10	3	36.74			
H	Naso lituratus	13	KAHE 10	2	8.48			
H	Naso lituratus	13	KAHE 10	2	72.69	23	624.74	1.0
O	Stegastes fasciolatus	13	KAHE 10	9	132.87			
O	Melichthys niger	13	KAHE 10	4	653.34			
O	Melichthys vidua	13	KAHE 10	2	398.06			
O	Canthigaster jactator	13	KAHE 10	3	10.69	18	1194.96	1.9
P	Chaetodon miliaris	13	KAHE 10	4	49.99			
P	Dascyllus albisella	13	KAHE 10	21	64.85			
P	Abudefduf abdominalis	13	KAHE 10	35	1096.64			
P	Abudefduf vaigensis	13	KAHE 10	65	2036.62			
P	Chromis vanderbilti	13	KAHE 10	75	23.69			
P	Chromis ovalis	13	KAHE 10	78	462.68	278	3734.47	5.9
		13	KAHE 10	1253	63520.5861	1253	63520.586	100
C	Parupeneus multifasciatus	14	Nanakuli 1	2	108.80			
C	Parupeneus multifasciatus	14	Nanakuli 1	2	54.23			
C	Parupeneus multifasciatus	14	Nanakuli 1	1	11.05			
C	Plectroglyphidodon imparipennis	14	Nanakuli 1	7	6.03			
C	Thalassoma duperrey	14	Nanakuli 1	1	27.39			
C	Thalassoma duperrey	14	Nanakuli 1	2	22.33			
C	Thalassoma lutescens	14	Nanakuli 1	1	32.76			
C	Rhinecanthus rectangulus	14	Nanakuli 1	3	257.62			
C	Rhinecanthus rectangulus	14	Nanakuli 1	1	45.36	20	565.58	42.6
H	Scarus psittacus	14	Nanakuli 1	1	37.87			
H	Acanthurus triostegus	14	Nanakuli 1	5	231.58			
H	Acanthurus triostegus	14	Nanakuli 1	1	17.17			
H	Acanthurus nigrofuscus	14	Nanakuli 1	7	379.77			
H	Acanthurus olivaceus	14	Nanakuli 1	4	78.97	18	745.36	56.2
O	Canthigaster coronata	14	Nanakuli 1	1	7.59			
O	Canthigaster jactator	14	Nanakuli 1	2	7.12	3	14.72	1.1
P	Chromis vanderbilti	14	Nanakuli 1	3	0.95	3	0.95	0.1
		14	Nanakuli 1	44	1326.5946	44	1326.5946	100
C	Parupeneus multifasciatus	15	Nanakuli 2	2	192.16			
C	Parupeneus multifasciatus	15	Nanakuli 2	1	54.40			
C	Parupeneus multifasciatus	15	Nanakuli 2	2	54.23			
C	Plectroglyphidodon johnstonianu	15	Nanakuli 2	1	0.86			
C	Cirrhitops fasciatus	15	Nanakuli 2	1	15.63			
C	Gomphosus varius	15	Nanakuli 2	1	11.04			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Coris venusta	15	Nanakuli 2	1	48.38			
C	Stethojulis balteata	15	Nanakuli 2	3	107.29			
C	Macropharyngodon geoffroy	15	Nanakuli 2	1	10.98			
C	Halichoeres ornatissimus	15	Nanakuli 2	1	25.14			
C	Sufflamen bursa	15	Nanakuli 2	2	171.75	16	691.86	21.2
CF	Chaetodon ornatissimus	15	Nanakuli 2	2	138.00			
CF	Chaetodon multicinctus	15	Nanakuli 2	7	46.60	9	184.60	5.7
H	Acanthurus nigrofuscus	15	Nanakuli 2	10	142.13			
H	Acanthurus nigrofuscus	15	Nanakuli 2	9	67.72			
H	Acanthurus nigrofuscus	15	Nanakuli 2	10	238.97			
H	Acanthurus olivaceus	15	Nanakuli 2	3	1179.63			
H	Ctenochaetus strigosus	15	Nanakuli 2	7	106.39			
H	Ctenochaetus strigosus	15	Nanakuli 2	3	80.53	42	1815.37	55.7
O	Stegastes fasciolatus	15	Nanakuli 2	5	73.82			
O	Melichthys niger	15	Nanakuli 2	3	490.01	8	563.82	17.3
P	Chromis vanderbilti	15	Nanakuli 2	10	3.16	10	3.16	0.1
		15	Nanakuli 2	85	3258.8098	85	3258.8098	100
C	Saurida gracilis	16	KAHE PIPE	1	83.87			
C	Lutjanus kasmira	16	KAHE PIPE	12	688.23			
C	Mulloides vanicolensis	16	KAHE PIPE	150	13580.60			
C	Mulloides vanicolensis	16	KAHE PIPE	75	34818.09			
C	Mulloides vanicolensis	16	KAHE PIPE	180	40917.04			
C	Parupeneus multifasciatus	16	KAHE PIPE	1	96.08			
C	Chaetodon auriga	16	KAHE PIPE	1	48.39			
C	Plectroglyphidodon johnstonianu	16	KAHE PIPE	4	6.89			
C	Paracirrhites arcatus	16	KAHE PIPE	4	65.39			
C	Thalassoma duperrey	16	KAHE PIPE	30	2911.56			
C	Thalassoma duperrey	16	KAHE PIPE	25	1373.72			
C	Thalassoma duperrey	16	KAHE PIPE	17	465.64			
C	Thalassoma duperrey	16	KAHE PIPE	5	55.82			
C	Gomphosus varius	16	KAHE PIPE	3	33.12			
C	Coris flavovittata	16	KAHE PIPE	1	83.79			
C	Zanclus cornutus	16	KAHE PIPE	1	54.90			
C	Zanclus cornutus	16	KAHE PIPE	1	104.16			
C	Sufflamen bursa	16	KAHE PIPE	5	429.37			
C	Sufflamen bursa	16	KAHE PIPE	1	19.92			
C	Sufflamen fraenatus	16	KAHE PIPE	1	85.87			
C	Ostracion meleagris	16	KAHE PIPE	1	6.76	519	95929.22	70.4
CF	Chaetodon multicinctus	16	KAHE PIPE	4	52.12	4	52.12	0.04
H	Scarus sordidus	16	KAHE PIPE	5	179.97			
H	Scarus sordidus	16	KAHE PIPE	3	2325.21			
H	Scarus sordidus	16	KAHE PIPE	4	304.05			
H	Scarus sordidus	16	KAHE PIPE	4	938.60			
H	Scarus sordidus	16	KAHE PIPE	2	2855.14			
H	Scarus sordidus	16	KAHE PIPE	14	5138.30			
H	Acanthurus nigrofuscus	16	KAHE PIPE	13	310.66			
H	Acanthurus nigrofuscus	16	KAHE PIPE	13	705.28			
H	Acanthurus nigrofuscus	16	KAHE PIPE	4	30.10			
H	Ctenochaetus strigosus	16	KAHE PIPE	7	187.91			
H	Ctenochaetus strigosus	16	KAHE PIPE	5	329.32	74	13304.54	9.8
O	Stegastes fasciolatus	16	KAHE PIPE	11	162.40			
O	Melichthys vidua	16	KAHE PIPE	4	279.68			
O	Cantherhines sandwichiensis	16	KAHE PIPE	2	164.10			
O	Canthigaster jactator	16	KAHE PIPE	2	7.12	19	613.30	0.4
P	Chaetodon miliaris	16	KAHE PIPE	2	42.34			
P	Abudefduf vaigensis	16	KAHE PIPE	397	12439.03			
P	Chromis vanderbilti	16	KAHE PIPE	87	27.48			
P	Chromis ovalis	16	KAHE PIPE	140	830.45			
P	Naso hexacanthus	16	KAHE PIPE	7	1950.95			
P	Naso hexacanthus	16	KAHE PIPE	3	1575.77			
P	Naso brevirostris	16	KAHE PIPE	57	7017.73			
P	Naso brevirostris	16	KAHE PIPE	9	2508.36	702	26392.12	19.4
		16	KAHE PIPE	1318	136291.3060	1318	136291.31	100