CIP GENERATION PROJECT

2010 COMMUNITY BENEFITS PROGRAM

REEF FISH MONITORING PROJECT

YEAR 3 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 third annual report for this effort covering the period from December 2007 through October 2010 with a focus on the surveys completed in 2010. In 2009, only three quarterly surveys were completed with the fourth quarter field work not done due to a series of weather fronts (both here and elsewhere in the Pacific) that resulted in near-continuous high surf impinging on all or some of the field survey sites commencing in October 2009 and extending well into 2010. These events precluded the fourth quarter 2009 field work. 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 twelve 2007-2010 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 135 species of fishes encountered in the twelve 2007-2010 surveys, twenty-one species are herbivores, fifteen are planktivores, seven are omnivores, eight are coral feeders and 84 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 year (2010) 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 2007-2010 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 clearly-separable significantly greater mean number of fish species, individuals and standing crop over all other stations and (2) the means for all parameters from all other stations were not statistically separable. 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 (2007-2010) 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 34 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 2007-2010 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 2010. 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. The 2008 information was presented in Brock (2009), the "during construction" information was given in Brock (2010) and the 2010 monitoring carried out in the operation phase are given 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 third annual report which covers the commencement 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 thermal 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 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 complete data set from the four 2010 surveys is given in Appendix 1 and this information is summarized in Table 2 along with the earlier (2007-2009) 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 twelve 2007-2010 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 twelve 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 twelve 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 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 twelve recent December 2007 - October 2010 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 121 species of fishes

encountered at the sixteen sample sites. The three during plant construction surveys completed in 2009 found 106 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. In total among the twelve surveys, 135 species of fishes have been recorded at the sixteen survey sites. Sixty-five percent or 88 species encountered were in common among the twelve surveys carried out over the three years. These data suggest a reasonable level of stability in these fish communities.

Of the 135 species of fishes recorded over the twelve surveys at all sixteen sample sites, fifty-seven percent (or 50 species) are carnivores, eighteen percent (or 16 species) are herbivores, ten percent (or 9 species) are planktivores, seven percent (or 6 species) are omnivores and eight percent or seven 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) 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 species a 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. These two species dominate the planktivore biomass at this site making up a mean of 60% of the planktivore biomass over the ten surveys (May 2008 through October 2010) completed at station 16. The second most important planktivorous species at station 16 by weight is the paletail unicornfish or kala lolo (*Naso brevirostris*) which over the ten surveys of this site comprised a mean of 35% of the biomass of planktivorous fishes.

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 2007-10 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 2007-2009 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 2007-2010?" and the results are given in Table 6. Referring to Table 6, two simple facts emerge:

(1) the Kahe discharge pipe station has a significantly greater 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. Again this obviously significant greater mean number of species, 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) provides lists of all fish species seen over the twelve 2007-2010 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).

Perhaps 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 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 2007-2010 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 Hawaii 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 estiamted 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.

7. Comparative Analysis of Early HECO Biological Data to the 2007-2010 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 2007-2010 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 2007-2010 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 (2007-2010) 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 2007-2010 dataset. Despite the mean estimated standing crop (here 48 g/m^2) being greater in 2007-2009 than in 1984 (26 g/m^2), the Kruskal-Wallis ANOVA failed to find any statistically significant differences ($p>0.31$, 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 34-year period (1976-2010) 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.

7. 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 sound 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 seven of the twelve 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 survey this same depression was occupied by a ~65 cm sleeping juvenile turtle. 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 and the 24 March 2010 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.

8. 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 thirty 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 34 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 34 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 eight surveys over the December 2007 - October 2010 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 3. 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 seen per transect, the mean number of individual fish censused per transect or the mean estimated total standing crop (in g/m^2) per transect for the first 15 stations among the twelve 2007-2010 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 ($p>0.83$, 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 08	15	23.9	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
Mar 09	15	20.9	A
May 09	15	20.9	A
Apr 08	15	20.3	A

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

TABLE 3. Continued.

2. Mean Number of Individual Fish Per Transect (p>0.70, n.s.)

Date	(n)	Mean	SNK Grouping
Jul 09	15	355	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

Interpretation: There are no significant differences among the mean number of individual fish counted per transect over the twelve sample periods.

3. Mean Total Standing Crop of Fish Per Transect (g) (p>0.86, n.s.)

Date	(n)	Mean Total Biomass (g)	SNK Grouping
Dec 07	12	25,969	A
Oct 10	15	23,517	A
Jul 09	15	19,389	A
May 10	15	16,578	A
Aug 10	15	16,463	A
Apr 08	15	15,984	A
Nov 08	15	14,174	A
May 09	15	13,782	A
Mar 10	15	11,747	A
Mar 09	15	11,705	A
Aug 08	15	10,883	A
May 08	15	10,531	A

Interpretation: Despite the range in the estimated total standing crop per station over the eight 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 sampled over twelve 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
27Dec07	12	35	2	8	5	50
04Apr08	15	35	2	8	4	51
30May08	15	37	7	14	3	39
19Aug08	15	36	2	10	3	49
25Nov08	15	43	5	6	4	42
19Mar09	15	35	1	7	2	55
11May09	15	44	1	8	1	46
21Jul09	15	33	6	10	2	49
29Mar10	15	44	5	9	2	40
14May10	15	51	6	9	1	33
12Aug10	15	49	7	10	1	33
29Oct10	15	41	1	9	1	48
Grand Means		40	4	9	2	45

(Table continued on next page)

TABLE 4. Continued.

PART B: Station 16 (Outfall Pipe) Only:

Mean Percent by Weight

Date	(n)	Herbivore	Planktivore	Omnivore	Coral Feeder	Carnivore
30May08	1	8	43	2		47
19Aug08	1	3	55	1		41
25Nov08	1	10	49	1	1	39
19Mar09	1	32	34	2	>1	32
11May09	1	35	22	6		37
21Jul09	1	5	36	3		56
29Mar10	1	24	27	2		47
14May10	1	13	63	8		16
12Aug10	1	14	27	1		58
29Oct10	1	7	16	1		76
Grand Means		15	37	3	0.2	45

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 2007-2010 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	33	30.8	A
Nanakuli	36	21.8	B
Kahe	60	21.7	B
CIP	48	20.4	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 twelve 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	33	342	A
Nanakuli	36	249	B
Kahe	60	230	B
CIP	48	205	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 twelve 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	33	141	A
Nanakuli	36	86	B
CIP	48	61	B
Kahe	60	58	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 twelve periods in 2007-2010?" 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 2007-10 (p < 0.0001, Significant)

Station Group	[n]	Mean	SNK Grouping			
16 (Pipe)	10	38	A			
6 (Ko'Olina 2)	11	33		B		
5 (Ko'Olina 1)	11	32		B	C	
13 (HECO 10C)	12	29		B	C	D
12 (HECO 7E)	12	28	E		C	D
7 (HECO 1D)	11	27	E	F		D
8 (HECO 5B)	12	27	E	F		D
3 (East 3)	12	25	E	F	G	D
4 (East 4)	12	23	E	F	G	D
9 (HECO 7B)	12	22	E	F	G	
15 (Nana-2)	12	21		F	G	
10 (HECO 7C)	12	21			G	
2 (East 2)	12	19			G	H
14 (Nana-1)	12	15		I		H
1 (East 1)	12	14		I		H
11 (HECO 7D)	12	11		I		

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 Kahe Discharge Pipe which had the greatest abundance of fish species. The mean number of species found at each station is directly related to the topographical complexity present which affords shelter to fishes.

TABLE 6. Continued.

2. Mean Number of Individual Fish Censused Per Station in 2007-10 (p < 0.0001, Significant)

Station Group	[n]	Mean	Grouping			
16 (Pipe)	10	1320	A			
13 (HECO 10C)	12	450		B		
7 (HECO 1D)	11	383		B	C	
8 (HECO 5B)	12	383		B	C	
12 (HECO 7E)	12	376		B	C	
5 (Ko'Olina 1)	11	355		B	C	
4 (East 4)	12	301			C	D
6 (Ko'Olina 2)	11	288			C	D
2 (East 2)	12	223	E			D
9 (HECO 7B)	12	194	E			D
3 (East 3)	12	185	E	F		D
15 (Nana-2)	12	180	E	F		D
10 (HECO 7C)	12	156	E	F		D
14 (Nana-1)	12	117	E	F		
1 (East 1)	12	113	E	F		
11 (HECO 7D)	12	44		F		

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 2007-10. 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 2007-10 (p < 0.0001, Significant)

Station Group	[n]	Mean	Grouping			
16 (Pipe)	10	452	A			
6 (Ko'Olina 2)	11	166		B		
9 (HECO 7B)	12	148		B		
5 (Ko'Olina 1)	11	148		B		
13 (HECO 10C)	12	138		B	C	
15 (Nana-2)	12	111		B	C	D
7 (HECO 1D)	11	108		B	C	D
4 (East 4)	12	96		B	C	D
2 (East 2)	12	72		B	C	D
8 (HECO 5B)	12	46			C	D
3 (East 3)	12	42			C	D
10 (HECO 7C)	12	41			C	D
1 (East 1)	12	32				D
12 (HECO 7E)	12	31				D
11 (HECO 7D)	12	24				D
14 (Nana-1)	12	10				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 thirteen years encompassing a 33-year period (i.e., 1976-1984 and 2007-2010 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>0.35, 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
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 twelve 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.

1. Mean Number of Individual Fish Per Transect (p>0.38, n.s.)

YEAR	[n]	Mean	SNK Grouping
2008	7	303.1	A
2007	7	302.3	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 thirteen 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
CORAL PIT
Barbers Point Harbor
Honokai Hale
Gilbert
Kalaeloa
Map created with TOPO! ©2006 National Geographic
NATIONAL GEOGRAPHIC
0.0 0.5 1.0 miles
0.0 0.5 1.0 1.5 km
TN MN
10°
05/13/09

APPENDIX 1. Results of fish censuses carried out on each of four 2010 surveys carried out on 29 March, 14 May, 12 August and 29 October 2010. Data from the earlier surveys that comprise the first annual report are given in Brock (2009) and Brock (2010) provides the complete dataset for the second annual survey . 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).

29 MARCH 2010 FIELD DATA

29-Mar-10

GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	1	EAST - 1	1	27.12			
C	Parupeneus multifasciatus	1	EAST - 1	3	33.15			
C	Chaetodon quadrimaculatus	1	EAST - 1	1	7.03			
C	Chromis vanderbilti	1	EAST - 1	33	10.42			
C	Cheilinus bimaculatus	1	EAST - 1	3	58.10			
C	Cheilinus bimaculatus	1	EAST - 1	9	36.89			
C	Novaculichthys taeniourus	1	EAST - 1	1	3.46			
C	Thalassoma duperrey	1	EAST - 1	20	223.27			
C	Thalassoma duperrey	1	EAST - 1	1	54.95			
C	Thalassoma duperrey	1	EAST - 1	9	246.51			
C	Thalassoma duperrey	1	EAST - 1	26	81.91			
C	Stethojulis balteata	1	EAST - 1	5	72.04			
C	Rhinecanthus rectangulus	1	EAST - 1	2	289.30			
C	Rhinecanthus rectangulus	1	EAST - 1	2	90.72			
C	Rhinecanthus rectangulus	1	EAST - 1	3	257.62	119	1492.51	24.9
CF	Plectroglyphidodon imparipennis	1	EAST - 1	1	0.86			
CF	Cantherhines dumerili	1	EAST - 1	1	623.68	2	624.55	10.4
H	Acanthurus triostegus	1	EAST - 1	19	879.99			
H	Acanthurus triostegus	1	EAST - 1	5	938.01			
H	Acanthurus olivaceus	1	EAST - 1	4	375.08			
H	Acanthurus olivaceus	1	EAST - 1	2	1126.34			
H	Naso unicornis	1	EAST - 1	2	34.39	32	3353.80	55.9
O	Melichthys niger	1	EAST - 1	1	99.66			
O	Melichthys vidua	1	EAST - 1	2	398.06			
O	Canthigaster jactator	1	EAST - 1	4	14.25	7	511.96	8.5
P	Paracirrhites arcatus	1	EAST - 1	2	16.24	2	16.24	0.3
		1	EAST - 1	162	5999.05	162	5999.05	100
C	Parupeneus multifasciatus	2	EAST - 2	1	54.40			
C	Parupeneus multifasciatus	2	EAST - 2	3	33.15			
C	Parupeneus bifasciatus	2	EAST - 2	1	29.20			
C	Parupeneus cyclostomus	2	EAST - 2	1	24.80			
C	Plectroglyphidodon johnstonianus	2	EAST - 2	1	3.03			
C	Plectroglyphidodon imparipennis	2	EAST - 2	1	0.86			
C	Paracirrhites arcatus	2	EAST - 2	6	48.71			
C	Cirrhitops fasciatus	2	EAST - 2	1	8.23			
C	Thalassoma duperrey	2	EAST - 2	4	388.21			
C	Thalassoma duperrey	2	EAST - 2	30	821.71			
C	Thalassoma duperrey	2	EAST - 2	25	1373.72			
C	Thalassoma duperrey	2	EAST - 2	24	75.61			
C	Gomphosus varius	2	EAST - 2	5	113.00			
C	Gomphosus varius	2	EAST - 2	6	66.25			
C	Stethojulis balteata	2	EAST - 2	10	357.63			
C	Halichoeres ornatissimus	2	EAST - 2	2	19.05			
C	Halichoeres ornatissimus	2	EAST - 2	1	25.14			
C	Halichoeres ornatissimus	2	EAST - 2	5	82.25			
C	Rhinecanthus rectangulus	2	EAST - 2	2	171.75			
C	Rhinecanthus rectangulus	2	EAST - 2	2	90.72	131	3787.43	56.9
CF	Cantherhines dumerili	2	EAST - 2	1	117.96			
CF	Cantherhines dumerili	2	EAST - 2	1	194.98	2	312.94	4.7
H	Calotomus carolinus	2	EAST - 2	1	339.30			
H	Scarus psittacus	2	EAST - 2	1	37.87			
H	Scarus psittacus	2	EAST - 2	4	58.46			
H	Acanthurus nigrofuscus	2	EAST - 2	73	1037.53			
H	Acanthurus nigrofuscus	2	EAST - 2	32	764.71			
H	Acanthurus olivaceus	2	EAST - 2	1	19.74			
H	Acanthurus blochii	2	EAST - 2	1	3.63	113	2261.24	34.0
O	Stegastes fasciolatus	2	EAST - 2	8	59.14			
O	Melichthys vidua	2	EAST - 2	1	199.03			

29-Mar-10

GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
O	Canthigaster jactator	2	EAST - 2	6	21.37	15	279.54	4.2
P	Chromis vanderbilti	2	EAST - 2	54	17.06	54	17.06	0.3
		2	EAST - 2	315	6658.20	315	6658.20	100
C	Gymnothorax meleagris	3	EAST - 3	1	44.70			
C	Parupeneus multifasciatus	3	EAST - 3	1	96.08			
C	Forcipiger flavissimus	3	EAST - 3	1	9.15			
C	Plectroglyphidodon johnstonianus	3	EAST - 3	4	6.89			
C	Paracirrhites arcatus	3	EAST - 3	4	32.47			
C	Labroides phthirophagus	3	EAST - 3	1	0.63			
C	Pseudocheilinus tetrataenia	3	EAST - 3	1	4.00			
C	Thalassoma duperrey	3	EAST - 3	9	246.51			
C	Thalassoma duperrey	3	EAST - 3	11	122.80			
C	Thalassoma duperrey	3	EAST - 3	7	384.64			
C	Gomphosus varius	3	EAST - 3	2	22.08			
C	Halichoeres ornatissimus	3	EAST - 3	2	50.27			
C	Zanclus cornutus	3	EAST - 3	2	208.32			
C	Sufflamen bursa	3	EAST - 3	4	343.49	50	1572.03	17.5
CF	Chaetodon unimaculatus	3	EAST - 3	2	28.45			
CF	Chaetodon ornatissimus	3	EAST - 3	2	138.00			
CF	Chaetodon quadrimaculatus	3	EAST - 3	1	25.30			
CF	Chaetodon multicinctus	3	EAST - 3	2	13.31	7	205.07	2.3
H	Scarus sordidus	3	EAST - 3	1	775.07			
H	Scarus sordidus	3	EAST - 3	2	152.03			
H	Scarus rubroviolaceus	3	EAST - 3	1	18.63			
H	Acanthurus nigrofuscus	3	EAST - 3	46	653.79			
H	Acanthurus nigrofuscus	3	EAST - 3	17	406.25			
H	Acanthurus nigrofuscus	3	EAST - 3	14	105.34			
H	Acanthurus olivaceus	3	EAST - 3	7	1831.67			
H	Acanthurus olivaceus	3	EAST - 3	4	2252.68			
H	Ctenochaetus strigosus	3	EAST - 3	10	75.76	102	6271.22	69.7
O	Stegastes fasciolatus	3	EAST - 3	10	73.92			
O	Stegastes fasciolatus	3	EAST - 3	6	88.58			
O	Melichthys niger	3	EAST - 3	3	490.01			
O	Melichthys vidua	3	EAST - 3	1	199.03			
O	Canthigaster jactator	3	EAST - 3	5	17.81	25	869.35	9.7
P	Chromis vanderbilti	3	EAST - 3	12	3.79			
P	Naso brevirostris	3	EAST - 3	1	73.36	13	77.15	0.9
		3	EAST - 3	197	8994.81	197	8994.81	100
C	Aprion virescens	4	EAST - 4	1	1133.98			
C	Parupeneus multifasciatus	4	EAST - 4	1	96.08			
C	Parupeneus multifasciatus	4	EAST - 4	5	272.00			
C	Parupeneus multifasciatus	4	EAST - 4	3	33.15			
C	Chaetodon lunula	4	EAST - 4	2	71.99			
C	Chaetodon quadrimaculatus	4	EAST - 4	4	101.22			
C	Plectroglyphidodon imparipennis	4	EAST - 4	1	0.86			
C	Chromis vanderbilti	4	EAST - 4	111	35.06			
C	Paracirrhites forsteri	4	EAST - 4	1	39.65			
C	Bodianus bilunulatus	4	EAST - 4	1	1462.82			
C	Labroides phthirophagus	4	EAST - 4	2	1.26			
C	Thalassoma duperrey	4	EAST - 4	39	1068.23			
C	Thalassoma duperrey	4	EAST - 4	4	388.21			
C	Thalassoma duperrey	4	EAST - 4	19	1044.03			
C	Thalassoma duperrey	4	EAST - 4	34	107.12			
C	Coris gaimard	4	EAST - 4	1	83.79			
C	Stethojulis balteata	4	EAST - 4	1	35.76			
C	Halichoeres ornatissimus	4	EAST - 4	1	9.52			
C	Rhinecanthus rectangulus	4	EAST - 4	2	90.72			

29-Mar-10

GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Rhinecanthus rectangulus	4	EAST - 4	3	257.62			
C	Sufflamen fraenatus	4	EAST - 4	1	329.34	237	6662.40	31.8
CF	Plectroglyphidodon johnstonianus	4	EAST - 4	1	1.72			
CF	Cantherhines dumerili	4	EAST - 4	2	235.92	3	237.64	1.1
H	Acanthurus nigrofuscus	4	EAST - 4	30	426.38			
H	Acanthurus nigrofuscus	4	EAST - 4	19	454.04			
H	Acanthurus olivaceus	4	EAST - 4	19	10700.23			
H	Acanthurus olivaceus	4	EAST - 4	4	1046.67			
H	Naso lituratus	4	EAST - 4	2	897.88	74	13525.21	64.5
O	Melichthys niger	4	EAST - 4	1	163.34			
O	Melichthys vidua	4	EAST - 4	1	199.03			
O	Melichthys vidua	4	EAST - 4	1	124.35			
O	Canthigaster jactator	4	EAST - 4	3	10.69	6	497.40	2.4
P	Paracirrhites arcatus	4	EAST - 4	4	32.47	4	32.47	0.2
		4	EAST - 4	324	20955.13	324	20955.13	100
C	Monotaxis grandoculis	5	Ko Olina 1	5	644.46			
C	Parupeneus multifasciatus	5	Ko Olina 1	1	96.08			
C	Parupeneus bifasciatus	5	Ko Olina 1	1	59.77			
C	Plectroglyphidodon johnstonianus	5	Ko Olina 1	8	13.77			
C	Paracirrhites arcatus	5	Ko Olina 1	5	40.59			
C	Labroides phthirophagus	5	Ko Olina 1	4	2.51			
C	Thalassoma duperrey	5	Ko Olina 1	9	494.54			
C	Thalassoma duperrey	5	Ko Olina 1	10	273.90			
C	Thalassoma duperrey	5	Ko Olina 1	1	97.05			
C	Thalassoma ballieui	5	Ko Olina 1	1	167.53			
C	Gomphosus varius	5	Ko Olina 1	1	22.60			
C	Coris gaimard	5	Ko Olina 1	1	83.79			
C	Anampses cuvier	5	Ko Olina 1	1	64.38			
C	Zanclus cornutus	5	Ko Olina 1	1	104.16			
C	Sufflamen bursa	5	Ko Olina 1	5	429.37	54	2594.49	10.1
CF	Chaetodon unimaculatus	5	Ko Olina 1	2	28.45			
CF	Chaetodon ornatissimus	5	Ko Olina 1	4	276.01			
CF	Chaetodon quadrimaculatus	5	Ko Olina 1	2	50.61			
CF	Chaetodon multicinctus	5	Ko Olina 1	6	78.18	14	433.24	1.7
H	Scarus sordidus	5	Ko Olina 1	1	35.99			
H	Scarus sordidus	5	Ko Olina 1	1	367.02			
H	Scarus sordidus	5	Ko Olina 1	1	76.01			
H	Scarus rubroviolaceus	5	Ko Olina 1	1	673.75			
H	Scarus rubroviolaceus	5	Ko Olina 1	1	85.39			
H	Acanthurus nigrofuscus	5	Ko Olina 1	5	71.06			
H	Acanthurus nigrofuscus	5	Ko Olina 1	33	788.60			
H	Acanthurus nigroris	5	Ko Olina 1	2	204.95			
H	Acanthurus olivaceus	5	Ko Olina 1	14	7884.38			
H	Acanthurus olivaceus	5	Ko Olina 1	7	332.34			
H	Acanthurus olivaceus	5	Ko Olina 1	3	1179.63			
H	Acanthurus olivaceus	5	Ko Olina 1	15	3925.01			
H	Acanthurus blochii	5	Ko Olina 1	1	29.03			
H	Acanthurus blochii	5	Ko Olina 1	3	696.72			
H	Ctenochaetus strigosus	5	Ko Olina 1	43	2832.19			
H	Ctenochaetus strigosus	5	Ko Olina 1	14	375.81			
H	Naso unicornis	5	Ko Olina 1	1	38.92	146	19596.83	76.2
O	Stegastes fasciolatus	5	Ko Olina 1	11	285.78			
O	Stegastes fasciolatus	5	Ko Olina 1	5	73.82			
O	Melichthys niger	5	Ko Olina 1	11	1796.69			
O	Canthigaster jactator	5	Ko Olina 1	4	14.25	31	2170.54	8.4
P	Abudefduf abdominalis	5	Ko Olina 1	12	375.99			
P	Chromis vanderbilti	5	Ko Olina 1	45	14.22			
P	Naso hexacanthus	5	Ko Olina 1	9	350.32			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
P	Naso hexacanthus	5	Ko Olina 1	1	190.74	67	931.27	3.6
		5	Ko Olina 1	312	25726.38	312	25726.38	100
C	Parupeneus multifasciatus	6	Ko Olina 2	2	192.16			
C	Parupeneus multifasciatus	6	Ko Olina 2	2	108.80			
C	Plectroglyphidodon johnstonianus	6	Ko Olina 2	4	6.89			
C	Paracirrhites arcatus	6	Ko Olina 2	4	32.47			
C	Labroides phthirophagus	6	Ko Olina 2	1	0.63			
C	Thalassoma duperrey	6	Ko Olina 2	19	1044.03			
C	Thalassoma duperrey	6	Ko Olina 2	24	657.37			
C	Thalassoma duperrey	6	Ko Olina 2	6	582.31			
C	Gomphosus varius	6	Ko Olina 2	1	11.04			
C	Gomphosus varius	6	Ko Olina 2	2	45.20			
C	Stethojulis balteata	6	Ko Olina 2	4	143.05			
C	Halichoeres ornatissimus	6	Ko Olina 2	1	16.45			
C	Halichoeres ornatissimus	6	Ko Olina 2	1	9.52			
C	Sufflamen bursa	6	Ko Olina 2	3	257.62	74	3107.55	8.8
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	2	26.06	6	214.67	0.6
H	Scarus rubroviolaceus	6	Ko Olina 2	1	85.39			
H	Scarus rubroviolaceus	6	Ko Olina 2	1	673.75			
H	Scarus rubroviolaceus	6	Ko Olina 2	1	18.63			
H	Scarus rubroviolaceus	6	Ko Olina 2	1	2721.55			
H	Scarus rubroviolaceus	6	Ko Olina 2	1	2267.96			
H	Acanthurus triostegus	6	Ko Olina 2	1	46.32			
H	Acanthurus triostegus	6	Ko Olina 2	9	900.13			
H	Acanthurus leucopareius	6	Ko Olina 2	1	132.70			
H	Acanthurus leucopareius	6	Ko Olina 2	9	2094.08			
H	Acanthurus leucopareius	6	Ko Olina 2	1	27.52			
H	Acanthurus nigrofuscus	6	Ko Olina 2	67	1601.10			
H	Acanthurus nigroris	6	Ko Olina 2	1	102.47			
H	Acanthurus olivaceus	6	Ko Olina 2	5	468.84			
H	Acanthurus olivaceus	6	Ko Olina 2	5	1966.05			
H	Acanthurus olivaceus	6	Ko Olina 2	16	9010.72			
H	Acanthurus olivaceus	6	Ko Olina 2	10	2616.67			
H	Acanthurus blochii	6	Ko Olina 2	3	1360.78			
H	Acanthurus blochii	6	Ko Olina 2	1	97.98			
H	Ctenochaetus strigosus	6	Ko Olina 2	30	805.32			
H	Ctenochaetus strigosus	6	Ko Olina 2	7	53.03			
H	Ctenochaetus strigosus	6	Ko Olina 2	13	856.24			
H	Zebrasoma flavescens	6	Ko Olina 2	6	319.68			
H	Zebrasoma veliferum	6	Ko Olina 2	3	438.69			
H	Naso lituratus	6	Ko Olina 2	2	411.98			
H	Naso lituratus	6	Ko Olina 2	2	897.88	197	29975.48	85.0
O	Stegastes fasciolatus	6	Ko Olina 2	12	177.16			
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	3	10.69	23	1601.61	4.5
P	Abudefduf abdominalis	6	Ko Olina 2	12	375.99			
P	Chromis hanui	6	Ko Olina 2	1	0.75	13	376.74	1.1
		6	Ko Olina 2	313	35276.05	313	35276.05	100
C	Myripristis amaenus	7	KAHE 1-D	1	42.40			
C	Aulostomus chinensis	7	KAHE 1-D	1	52.00			
C	Mulloides flavolineatus	7	KAHE 1-D	12	591.22			
C	Parupeneus multifasciatus	7	KAHE 1-D	1	54.40			
C	Plectroglyphidodon johnstonianus	7	KAHE 1-D	4	6.89			
C	Plectroglyphidodon imparipennis	7	KAHE 1-D	1	0.86			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Cirrhitus pinnulatus	7	KAHE 1-D	1	90.86			
C	Labroides phthirophagus	7	KAHE 1-D	2	1.26			
C	Thalassoma duperrey	7	KAHE 1-D	24	267.92			
C	Thalassoma duperrey	7	KAHE 1-D	16	1552.83			
C	Thalassoma duperrey	7	KAHE 1-D	9	246.51			
C	Thalassoma ballieui	7	KAHE 1-D	1	102.61			
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	62.03			
C	Stethojulis balteata	7	KAHE 1-D	6	214.58			
C	Sufflamen bursa	7	KAHE 1-D	3	257.62	96	3756.88	27.8
CF	Chaetodon quadrimaculatus	7	KAHE 1-D	2	50.61	2	50.61	0.4
H	Scarus sordidus	7	KAHE 1-D	2	71.99			
H	Scarus psittacus	7	KAHE 1-D	12	454.47			
H	Scarus rubroviolaceus	7	KAHE 1-D	1	43.92			
H	Acanthurus triostegus	7	KAHE 1-D	9	416.84			
H	Acanthurus triostegus	7	KAHE 1-D	16	274.67			
H	Acanthurus nigrofuscus	7	KAHE 1-D	26	369.53			
H	Acanthurus nigrofuscus	7	KAHE 1-D	33	788.60			
H	Acanthurus olivaceus	7	KAHE 1-D	7	79.25			
H	Acanthurus olivaceus	7	KAHE 1-D	6	118.46			
H	Acanthurus olivaceus	7	KAHE 1-D	4	189.91			
H	Acanthurus olivaceus	7	KAHE 1-D	1	93.77			
H	Ctenochaetus strigosus	7	KAHE 1-D	4	263.46			
H	Ctenochaetus strigosus	7	KAHE 1-D	13	348.97	134	3513.83	26.0
O	Stegastes fasciolatus	7	KAHE 1-D	5	73.82			
O	Melichthys niger	7	KAHE 1-D	37	6043.41			
O	Canthigaster jactator	7	KAHE 1-D	7	24.93			
O	Canthigaster rivulata	7	KAHE 1-D	1	13.65	50	6155.81	45.6
P	Chromis vanderbilti	7	KAHE 1-D	54	17.06	54	17.06	0.1
		7	KAHE 1-D	336	13494.20	336	13494.20	100
C	Monotaxis grandoculis	8	Kahe 5B	1	71.53			
C	Parupeneus multifasciatus	8	Kahe 5B	1	96.08			
C	Parupeneus multifasciatus	8	Kahe 5B	4	108.47			
C	Parupeneus multifasciatus	8	Kahe 5B	4	217.60			
C	Parupeneus cyclostomus	8	Kahe 5B	1	10.05			
C	Forcipiger flavissimus	8	Kahe 5B	1	9.15			
C	Plectroglyphidodon johnstonianus	8	Kahe 5B	3	5.17			
C	Plectroglyphidodon imparipennis	8	Kahe 5B	2	1.72			
C	Paracirrhites arcatus	8	Kahe 5B	3	24.35			
C	Cirrhitops fasciatus	8	Kahe 5B	1	8.23			
C	Labroides phthirophagus	8	Kahe 5B	1	0.63			
C	Thalassoma duperrey	8	Kahe 5B	5	274.74			
C	Thalassoma duperrey	8	Kahe 5B	3	291.16			
C	Thalassoma duperrey	8	Kahe 5B	17	189.78			
C	Thalassoma duperrey	8	Kahe 5B	7	191.73			
C	Gomphosus varius	8	Kahe 5B	1	39.39			
C	Macropharyngodon geoffroy	8	Kahe 5B	1	18.63			
C	Halichoeres ornatissimus	8	Kahe 5B	1	25.14			
C	Halichoeres ornatissimus	8	Kahe 5B	1	16.45			
C	Halichoeres ornatissimus	8	Kahe 5B	2	19.05			
C	Zanclus cornutus	8	Kahe 5B	4	416.63			
C	Rhinecanthus rectangulus	8	Kahe 5B	4	343.49			
C	Alutera scripta	8	Kahe 5B	1	2404.50	69	4783.65	42.5
H	Scarus sordidus	8	Kahe 5B	1	234.65			
H	Acanthurus leucopareius	8	Kahe 5B	2	265.40			
H	Acanthurus nigrofuscus	8	Kahe 5B	29	693.01			
H	Acanthurus nigrofuscus	8	Kahe 5B	27	383.74			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
H	Acanthurus olivaceus	8	Kahe 5B	3	1689.51			
H	Acanthurus olivaceus	8	Kahe 5B	5	1308.34			
H	Acanthurus blochii	8	Kahe 5B	1	29.03			
H	Naso lituratus	8	Kahe 5B	1	205.99			
H	Naso unicornis	8	Kahe 5B	1	525.26			
H	Naso unicornis	8	Kahe 5B	1	73.36			
H	Naso unicornis	8	Kahe 5B	1	278.71	72	5686.99	50.5
O	Stegastes fasciolatus	8	Kahe 5B	7	103.34			
O	Melichthys vidua	8	Kahe 5B	2	398.06			
O	Cantherhines sandwichiensis	8	Kahe 5B	1	82.05			
O	Canthigaster jactator	8	Kahe 5B	5	17.81	15	601.26	5.3
P	Chromis vanderbilti	8	Kahe 5B	105	33.17			
P	Naso brevirostris	8	Kahe 5B	4	155.70	109	188.87	1.7
		8	Kahe 5B	265	11260.78	265	11260.78	100
C	Decapterus macarellus	9	Kahe 7B	6	781.67			
C	Parupeneus pleurostigma	9	Kahe 7B	1	58.01			
C	Parupeneus multifasciatus	9	Kahe 7B	2	108.80			
C	Parupeneus multifasciatus	9	Kahe 7B	3	81.35			
C	Parupeneus multifasciatus	9	Kahe 7B	3	707.24			
C	Paracirrhites forsteri	9	Kahe 7B	1	39.65			
C	Thalassoma duperrey	9	Kahe 7B	3	33.49			
C	Thalassoma duperrey	9	Kahe 7B	4	219.80			
C	Thalassoma duperrey	9	Kahe 7B	2	54.78			
C	Thalassoma duperrey	9	Kahe 7B	1	97.05			
C	Stethojulis balteata	9	Kahe 7B	3	107.29			
C	Halichoeres ornatissimus	9	Kahe 7B	2	32.90			
C	Halichoeres ornatissimus	9	Kahe 7B	1	25.14			
C	Sufflamen bursa	9	Kahe 7B	4	343.49	36	2690.66	73.5
CF	Chaetodon multicinctus	9	Kahe 7B	4	26.63	4	26.63	0.7
H	Acanthurus nigrofuscus	9	Kahe 7B	2	108.50			
H	Acanthurus nigrofuscus	9	Kahe 7B	6	85.28			
H	Acanthurus olivaceus	9	Kahe 7B	1	163.52			
H	Acanthurus olivaceus	9	Kahe 7B	4	375.08			
H	Naso lituratus	9	Kahe 7B	2	29.80			
H	Naso unicornis	9	Kahe 7B	5	85.97	20	848.14	23.2
O	Canthigaster coronata	9	Kahe 7B	1	3.56			
O	Canthigaster jactator	9	Kahe 7B	2	7.12	3	10.69	0.3
P	Dascyllus albisella	9	Kahe 7B	1	3.09			
P	Chromis vanderbilti	9	Kahe 7B	15	4.74			
P	Chromis hanui	9	Kahe 7B	3	2.24			
P	Naso brevirostris	9	Kahe 7B	1	73.36	20	83.42	2.3
		9	Kahe 7B	83	3659.54	83	3659.54	100.0000009
C	Parupeneus multifasciatus	10	Kahe 7C	1	155.42			
C	Paracirrhites arcatus	10	Kahe 7C	3	24.35			
C	Cheilinus bimaculatus	10	Kahe 7C	2	8.20			
C	Zanclus cornutus	10	Kahe 7C	1	54.90			
C	Sufflamen bursa	10	Kahe 7C	5	429.37			
C	Sufflamen fraenatus	10	Kahe 7C	1	85.87	13	758.11	38.2
H	Acanthurus triostegus	10	Kahe 7C	4	185.26			
H	Acanthurus triostegus	10	Kahe 7C	3	300.04			
H	Acanthurus olivaceus	10	Kahe 7C	4	189.91			
H	Naso unicornis	10	Kahe 7C	1	123.12	12	798.33	40.2
O	Melichthys vidua	10	Kahe 7C	2	398.06			
O	Canthigaster coronata	10	Kahe 7C	2	15.18			
O	Canthigaster jactator	10	Kahe 7C	3	10.69	7	423.93	21.3
P	Chromis vanderbilti	10	Kahe 7C	21	6.63	21	6.63	0.3
		10	Kahe 7C	53	1987.00	53	1987.00	100

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	11 e	7D (short)	2	54.23			
C	Parupeneus multifasciatus	11 e	7D (short)	1	96.08			
C	Parupeneus multifasciatus	11 e	7D (short)	2	108.80			
C	Plectroglyphidodon johnstonianus	11 e	7D (short)	2	3.44			
C	Paracirrhites arcatus	11 e	7D (short)	1	8.12			
C	Cheilinus bimaculatus	11 e	7D (short)	1	4.10			
C	Thalassoma duperrey	11 e	7D (short)	1	27.39			
C	Sufflamen bursa	11 e	7D (short)	3	257.62	13	559.78	94.7
H	Acanthurus nigrofuscus	11 e	7D (short)	1	7.52	1	7.52	1.3
O	Canthigaster coronata	11 e	7D (short)	3	10.69			
O	Canthigaster jactator	11 e	7D (short)	3	10.69	6	21.37	3.6
P	Chromis vanderbilti	11 e	7D (short)	8	2.53	8	2.53	0.4
		11 e	7D (short)	28	591.21	28	591.21	100
C	Aulostomus chinensis	12	Kahe 7E	1	112.28			
C	Parupeneus multifasciatus	12	Kahe 7E	1	96.08			
C	Parupeneus multifasciatus	12	Kahe 7E	14	379.63			
C	Parupeneus bifasciatus	12	Kahe 7E	9	104.37			
C	Paracirrhites arcatus	12	Kahe 7E	4	32.47			
C	Pseudocheilinus octotaenia	12	Kahe 7E	1	14.41			
C	Thalassoma duperrey	12	Kahe 7E	5	274.74			
C	Thalassoma duperrey	12	Kahe 7E	2	194.10			
C	Thalassoma duperrey	12	Kahe 7E	2	54.78			
C	Coris gaimard	12	Kahe 7E	1	83.79			
C	Pseudojuloides cerasinus	12	Kahe 7E	2	22.33			
C	Macropharyngodon geoffroy	12	Kahe 7E	1	10.98			
C	Zanclus cornutus	12	Kahe 7E	4	416.63			
C	Sufflamen bursa	12	Kahe 7E	6	515.24			
C	Sufflamen fraenatus	12	Kahe 7E	1	144.65	54	2456.49	22.6
CF	Chaetodon multicinctus	12	Kahe 7E	6	39.94	6	39.94	0.4
H	Calotomus carolinus	12	Kahe 7E	1	72.28			
H	Acanthurus triostegus	12	Kahe 7E	1	46.32			
H	Acanthurus nigrofuscus	12	Kahe 7E	19	142.97			
H	Acanthurus nigrofuscus	12	Kahe 7E	1	14.21			
H	Naso unicornis	12	Kahe 7E	1	525.26	23	801.04	7.4
O	Melichthys niger	12	Kahe 7E	9	1470.02			
O	Melichthys vidua	12	Kahe 7E	1	199.03			
O	Canthigaster coronata	12	Kahe 7E	1	7.59			
O	Canthigaster jactator	12	Kahe 7E	1	3.56	12	1680.20	15.4
P	Chromis vanderbilti	12	Kahe 7E	99	31.27			
P	Naso hexacanthus	12	Kahe 7E	8	586.86			
P	Naso brevirostris	12	Kahe 7E	43	5294.08	150	5912.21	54.3
		12	Kahe 7E	245	10889.88	245	10889.88	100
C	Adioryx xantherythrus	13	HECO-10	12	380.08			
C	Aulostomus chinensis	13	HECO-10	1	68.53			
C	Cephalopholis argus	13	HECO-10	1	638.29			
C	Cephalopholis argus	13	HECO-10	1	1355.30			
C	Monotaxis grandoculis	13	HECO-10	1	71.53			
C	Mulloides flavolineatus	13	HECO-10	9	3286.88			
C	Parupeneus multifasciatus	13	HECO-10	4	217.60			
C	Parupeneus multifasciatus	13	HECO-10	2	54.23			
C	Parupeneus multifasciatus	13	HECO-10	2	310.84			
C	Parupeneus bifasciatus	13	HECO-10	1	59.77			
C	Forcipiger flavissimus	13	HECO-10	1	9.15			
C	Forcipiger flavissimus	13	HECO-10	2	10.27			
C	Chaetodon fremblii	13	HECO-10	1	20.91			
C	Plectroglyphidodon johnstonianus	13	HECO-10	1	1.72			
C	Paracirrhites arcatus	13	HECO-10	3	24.35			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Cirrhitops fasciatus	13	HECO-10	1	8.23			
C	Labroides phthirophagus	13	HECO-10	2	1.26			
C	Thalassoma duperrey	13	HECO-10	20	547.81			
C	Thalassoma duperrey	13	HECO-10	7	384.64			
C	Thalassoma duperrey	13	HECO-10	5	485.26			
C	Thalassoma ballieui	13	HECO-10	1	57.46			
C	Stethojulis balteata	13	HECO-10	4	143.05			
C	Stethojulis balteata	13	HECO-10	2	144.78			
C	Halichoeres ornatissimus	13	HECO-10	1	25.14			
C	Zanclus cornutus	13	HECO-10	1	104.16			
C	Sufflamen bursa	13	HECO-10	3	257.62	89	8668.85	62.4
CF	Chaetodon multicinctus	13	HECO-10	4	52.12	4	52.12	0.4
H	Calotomus carolinus	13	HECO-10	1	72.28			
H	Acanthurus triostegus	13	HECO-10	2	34.33			
H	Acanthurus nigrofuscus	13	HECO-10	9	215.07			
H	Acanthurus nigrofuscus	13	HECO-10	28	397.96			
H	Acanthurus nigrofuscus	13	HECO-10	1	7.52			
H	Acanthurus olivaceus	13	HECO-10	2	94.95			
H	Acanthurus blochii	13	HECO-10	1	12.25			
H	Zebrasoma flavescens	13	HECO-10	1	53.28			
H	Naso lituratus	13	HECO-10	1	14.90			
H	Naso unicornis	13	HECO-10	3	1575.77	49	2478.32	17.8
O	Stegastes fasciolatus	13	HECO-10	11	162.40			
O	Melichthys niger	13	HECO-10	4	653.34	15	815.74	5.9
P	Dascyllus albisella	13	HECO-10	9	27.79			
P	Abudefduf abdominalis	13	HECO-10	48	1503.96			
P	Chromis vanderbilti	13	HECO-10	70	22.11			
P	Chromis ovalis	13	HECO-10	28	323.67	155	1877.54	13.5
		13	HECO-10	312	13892.57	312	13892.57	100
C	Parupeneus multifasciatus	14	Nanakuli 1	2	54.23			
C	Parupeneus multifasciatus	14	Nanakuli 1	1	96.08			
C	Parupeneus multifasciatus	14	Nanakuli 1	1	54.40			
C	Plectroglyphidodon imparipennis	14	Nanakuli 1	2	1.72			
C	Thalassoma duperrey	14	Nanakuli 1	7	191.73			
C	Thalassoma duperrey	14	Nanakuli 1	17	189.78			
C	Thalassoma duperrey	14	Nanakuli 1	14	44.11			
C	Thalassoma duperrey	14	Nanakuli 1	4	219.80			
C	Plagiotremus ewaensis	14	Nanakuli 1	1	0.95			
C	Rhinecanthus rectangulus	14	Nanakuli 1	1	85.87	50	938.68	65.0
CF	Chaetodon quadrimaculatus	14	Nanakuli 1	2	28.45	2	28.45	2.0
H	Scarus rubroviolaceus	14	Nanakuli 1	1	85.39			
H	Acanthurus nigrofuscus	14	Nanakuli 1	17	127.92			
H	Acanthurus nigrofuscus	14	Nanakuli 1	1	23.90			
H	Acanthurus nigrofuscus	14	Nanakuli 1	15	213.19	34	450.40	31.2
O	Canthigaster jactator	14	Nanakuli 1	2	7.12			
O	Canthigaster rivulata	14	Nanakuli 1	2	15.18	4	22.31	1.5
P	Chromis vanderbilti	14	Nanakuli 1	11	3.47	11	3.47	0.2
		14	Nanakuli 1	101	1443.30	101	1443.30	100
C	Gymnothorax eurostus	15	Nanakuli 2	1	68.06			
C	Monotaxis grandoculis	15	Nanakuli 2	1	326.42			
C	Parupeneus multifasciatus	15	Nanakuli 2	4	217.60			
C	Parupeneus multifasciatus	15	Nanakuli 2	1	96.08			
C	Parupeneus multifasciatus	15	Nanakuli 2	4	108.47			
C	Forcipiger flavissimus	15	Nanakuli 2	2	18.30			
C	Chaetodon ephippium	15	Nanakuli 2	1	48.39			
C	Paracirrhites forsteri	15	Nanakuli 2	1	39.65			
C	Thalassoma duperrey	15	Nanakuli 2	6	582.31			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Thalassoma duperrey	15	Nanakuli 2	1	27.39			
C	Thalassoma duperrey	15	Nanakuli 2	3	164.85			
C	Thalassoma ballieui	15	Nanakuli 2	1	102.61			
C	Gomphosus varius	15	Nanakuli 2	1	22.60			
C	Halichoeres ornatissimus	15	Nanakuli 2	1	16.45			
C	Sufflamen bursa	15	Nanakuli 2	1	85.87			
C	Sufflamen fraenatus	15	Nanakuli 2	1	461.25			
C	Arothron meleagris	15	Nanakuli 2	1	692.94	31	3079.25	20.0
CF	Chaetodon ornatissimus	15	Nanakuli 2	2	138.00			
CF	Chaetodon quadrimaculatus	15	Nanakuli 2	2	50.61	4	188.61	1.2
H	Acanthurus triostegus	15	Nanakuli 2	8	800.11			
H	Acanthurus triostegus	15	Nanakuli 2	4	185.26			
H	Acanthurus leucopareius	15	Nanakuli 2	2	265.40			
H	Acanthurus nigrofuscus	15	Nanakuli 2	21	298.47			
H	Acanthurus nigrofuscus	15	Nanakuli 2	29	693.01			
H	Acanthurus nigrofuscus	15	Nanakuli 2	9	488.27			
H	Acanthurus nigrofuscus	15	Nanakuli 2	4	30.10			
H	Acanthurus olivaceus	15	Nanakuli 2	3	785.00			
H	Acanthurus olivaceus	15	Nanakuli 2	14	7884.38			
H	Ctenochaetus strigosus	15	Nanakuli 2	6	91.19			
H	Zebrasoma flavescens	15	Nanakuli 2	1	9.48	101	11530.69	75.0
O	Stegastes fasciolatus	15	Nanakuli 2	5	73.82			
O	Melichthys niger	15	Nanakuli 2	3	490.01			
O	Canthigaster jactator	15	Nanakuli 2	5	17.81	13	581.63	3.8
		15	Nanakuli 2	149	15380.18	149	15380.18	100
C	Aulostomus chinensis	16	KAHE PIPE	1	27.72			
C	Decapterus macarellus	16	KAHE PIPE	150	28745.03			
C	Mulloides vanicolensis	16	KAHE PIPE	65	14775.60			
C	Parupeneus multifasciatus	16	KAHE PIPE	1	155.42			
C	Forcipiger flavissimus	16	KAHE PIPE	2	18.30			
C	Chaetodon fremblii	16	KAHE PIPE	1	20.91			
C	Paracirrhites arcatus	16	KAHE PIPE	4	32.47			
C	Labroides phthirophagus	16	KAHE PIPE	5	3.14			
C	Thalassoma duperrey	16	KAHE PIPE	71	1944.72			
C	Thalassoma duperrey	16	KAHE PIPE	64	3516.73			
C	Thalassoma duperrey	16	KAHE PIPE	15	1455.78			
C	Gomphosus varius	16	KAHE PIPE	8	88.33			
C	Gomphosus varius	16	KAHE PIPE	3	67.80			
C	Halichoeres ornatissimus	16	KAHE PIPE	4	38.09			
C	Zanclus cornutus	16	KAHE PIPE	5	520.79			
C	Sufflamen bursa	16	KAHE PIPE	9	772.86			
C	Alutera scripta	16	KAHE PIPE	1	466.46	409	52650.16	46.9
H	Scarus sordidus	16	KAHE PIPE	2	1550.14			
H	Scarus sordidus	16	KAHE PIPE	14	3285.08			
H	Scarus sordidus	16	KAHE PIPE	76	5777.01			
H	Scarus sordidus	16	KAHE PIPE	35	4900.21			
H	Scarus psittacus	16	KAHE PIPE	1	554.69			
H	Scarus rubroviolaceus	16	KAHE PIPE	1	85.39			
H	Acanthurus nigrofuscus	16	KAHE PIPE	27	383.74			
H	Acanthurus nigrofuscus	16	KAHE PIPE	87	2079.04			
H	Acanthurus nigroris	16	KAHE PIPE	65	1553.31			
H	Acanthurus nigroris	16	KAHE PIPE	22	312.68			
H	Acanthurus olivaceus	16	KAHE PIPE	15	5898.15	345	26379.45	23.5
O	Stegastes fasciolatus	16	KAHE PIPE	20	519.60			
O	Melichthys niger	16	KAHE PIPE	8	1306.68			
O	Melichthys vidua	16	KAHE PIPE	3	597.09			
O	Canthigaster jactator	16	KAHE PIPE	7	24.93	38	2448.31	2.2
P	Chaetodon miliaris	16	KAHE PIPE	4	49.99			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
P	Chromis vanderbilti	16	KAHE PIPE	88	27.80			
P	Chromis ovalis	16	KAHE PIPE	23	136.43			
P	Naso brevirostris	16	KAHE PIPE	27	7525.09			
P	Naso brevirostris	16	KAHE PIPE	20	778.49			
P	Naso brevirostris	16	KAHE PIPE	18	7009.60			
P	Naso brevirostris	16	KAHE PIPE	55	4034.69			
P	Naso brevirostris	16	KAHE PIPE	65	8002.68			
P	Abudefduf vaigensis	16	KAHE PIPE	100	3133.26	400	30698.02	27.4
		16	KAHE PIPE	1192	112175.95	1192	112175.95	100

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Plectroglyphidodon imparipennis	1	EAST - 1	2	1.72			
C	Paracirrhites arcatus	1	EAST - 1	1	8.12			
C	Thalassoma duperrey	1	EAST - 1	18	200.94			
C	Thalassoma duperrey	1	EAST - 1	3	82.17			
C	Thalassoma duperrey	1	EAST - 1	2	194.10			
C	Thalassoma duperrey	1	EAST - 1	7	384.64			
C	Thalassoma duperrey	1	EAST - 1	17	53.56			
C	Pseudojuloides cerasinus	1	EAST - 1	1	3.15			
C	Stethojulis balteata	1	EAST - 1	4	57.64			
C	Halichoeres ornatissimus	1	EAST - 1	1	4.41			
C	Rhinecanthus rectangulus	1	EAST - 1	1	144.65	57	1135.10	37.4
H	Acanthurus triostegus	1	EAST - 1	6	600.09			
H	Acanthurus nigrofuscus	1	EAST - 1	2	47.79			
H	Acanthurus nigrofuscus	1	EAST - 1	4	217.01			
H	Acanthurus nigroris	1	EAST - 1	1	54.25			
H	Acanthurus olivaceus	1	EAST - 1	2	187.54			
H	Acanthurus olivaceus	1	EAST - 1	6	284.86			
H	Naso lituratus	1	EAST - 1	2	145.17			
H	Naso unicornis	1	EAST - 1	1	123.12	24	1659.83	54.7
O	Stegastes fasciolatus	1	EAST - 1	1	14.76			
O	Melichthys vidua	1	EAST - 1	1	199.03			
O	Canthigaster coronata	1	EAST - 1	2	15.18			
O	Canthigaster jactator	1	EAST - 1	2	7.12	6	236.10	7.8
P	Chromis vanderbilti	1	EAST - 1	7	2.21	7	2.21	0.1
		1	EAST - 1	94	3033.24	94	3033.24	100
C	Parupeneus multifasciatus	2	EAST - 2	1	96.08			
C	Plectroglyphidodon johnstonianus	2	EAST - 2	3	2.59			
C	Plectroglyphidodon imparipennis	2	EAST - 2	3	2.59			
C	Paracirrhites arcatus	2	EAST - 2	1	8.12			
C	Paracirrhites forsteri	2	EAST - 2	1	39.65			
C	Thalassoma duperrey	2	EAST - 2	9	246.51			
C	Thalassoma duperrey	2	EAST - 2	3	33.49			
C	Thalassoma duperrey	2	EAST - 2	2	194.10			
C	Thalassoma duperrey	2	EAST - 2	9	494.54			
C	Pseudojuloides cerasinus	2	EAST - 2	1	3.15			
C	Stethojulis balteata	2	EAST - 2	1	35.76			
C	Halichoeres ornatissimus	2	EAST - 2	1	9.52			
C	Plagiotremus ewaensis	2	EAST - 2	1	0.95			
C	Rhinecanthus rectangulus	2	EAST - 2	2	171.75	38	1338.80	48.0
CF	Chaetodon quadrimaculatus	2	EAST - 2	2	50.61			
CF	Cantherhines dumerili	2	EAST - 2	1	301.33	3	351.94	12.6
H	Acanthurus nigrofuscus	2	EAST - 2	32	764.71			
H	Acanthurus nigrofuscus	2	EAST - 2	10	142.13	42	906.83	32.5
O	Stegastes fasciolatus	2	EAST - 2	1	7.39			
O	Melichthys niger	2	EAST - 2	1	163.34			
O	Canthigaster jactator	2	EAST - 2	6	21.37	8	192.10	6.9
		2	EAST - 2	91	2789.67	91	2789.67	100
C	Parupeneus multifasciatus	3	EAST - 3	1	54.40			
C	Parupeneus multifasciatus	3	EAST - 3	2	192.16			
C	Forcipiger flavissimus	3	EAST - 3	2	18.30			
C	Plectroglyphidodon johnstonianus	3	EAST - 3	2	6.06			
C	Paracirrhites arcatus	3	EAST - 3	4	32.47			
C	Pseudocheilinus octotaenia	3	EAST - 3	4	143.05			
C	Thalassoma duperrey	3	EAST - 3	12	328.69			
C	Thalassoma duperrey	3	EAST - 3	13	714.34			
C	Thalassoma duperrey	3	EAST - 3	10	970.52			
C	Coris gaimard	3	EAST - 3	1	22.07			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Stethojulis balteata	3	EAST - 3	1	35.76			
C	Macropharyngodon geoffroy	3	EAST - 3	2	21.96			
C	Halichoeres ornatissimus	3	EAST - 3	3	75.41			
C	Halichoeres ornatissimus	3	EAST - 3	1	4.41			
C	Halichoeres ornatissimus	3	EAST - 3	5	82.25			
C	Sufflamen bursa	3	EAST - 3	4	343.49	67	3045.35	24.1
CF	Chaetodon ornatissimus	3	EAST - 3	2	273.78			
CF	Chaetodon multicinctus	3	EAST - 3	2	26.06	4	299.84	2.4
H	Scarus rubroviolaceus	3	EAST - 3	3	256.18			
H	Acanthurus nigrofuscus	3	EAST - 3	28	669.12			
H	Acanthurus nigrofuscus	3	EAST - 3	15	213.19			
H	Acanthurus olivaceus	3	EAST - 3	10	5631.70			
H	Acanthurus olivaceus	3	EAST - 3	3	1179.63			
H	Acanthurus blochii	3	EAST - 3	1	783.81			
H	Ctenochaetus strigosus	3	EAST - 3	3	45.60			
H	Zebrasoma flavescens	3	EAST - 3	1	92.87	64	8872.10	70.1
O	Stegastes fasciolatus	3	EAST - 3	6	88.58			
O	Stegastes fasciolatus	3	EAST - 3	5	129.90			
O	Melichthys vidua	3	EAST - 3	1	199.03			
O	Canthigaster jactator	3	EAST - 3	4	14.25	16	431.76	3.4
P	Chromis vanderbilti	3	EAST - 3	9	2.84	9	2.84	0.02
		3	EAST - 3	160	12651.89	160	12651.89	100
C	Parupeneus multifasciatus	4	EAST - 4	1	54.40			
C	Plectroglyphidodon johnstonianus	4	EAST - 4	3	5.17			
C	Paracirrhites arcatus	4	EAST - 4	8	64.94			
C	Paracirrhites forsteri	4	EAST - 4	1	39.65			
C	Thalassoma duperrey	4	EAST - 4	11	1067.57			
C	Thalassoma duperrey	4	EAST - 4	17	934.13			
C	Thalassoma duperrey	4	EAST - 4	22	602.59			
C	Thalassoma duperrey	4	EAST - 4	12	133.96			
C	Coris gaimard	4	EAST - 4	1	8.57			
C	Stethojulis balteata	4	EAST - 4	4	143.05			
C	Halichoeres ornatissimus	4	EAST - 4	1	25.14			
C	Halichoeres ornatissimus	4	EAST - 4	1	16.45			
C	Rhinecanthus rectangulus	4	EAST - 4	1	85.87	83	3181.48	18.7
CF	Chaetodon quadrimaculatus	4	EAST - 4	2	50.61			
CF	Cantherhines dumerili	4	EAST - 4	1	301.33			
CF	Cantherhines dumerili	4	EAST - 4	3	353.88	6	705.82	4.1
H	Acanthurus nigrofuscus	4	EAST - 4	21	298.47			
H	Acanthurus nigrofuscus	4	EAST - 4	40	955.88			
H	Acanthurus olivaceus	4	EAST - 4	15	8447.55			
H	Acanthurus olivaceus	4	EAST - 4	9	2355.00	85	12056.91	70.7
O	Melichthys niger	4	EAST - 4	4	653.34			
O	Melichthys vidua	4	EAST - 4	2	398.06	6	1051.40	6.2
P	Chromis vanderbilti	4	EAST - 4	146	46.12	146	46.12	0.3
		4	EAST - 4	326	17041.73	326	17041.73	100
C	Monotaxis grandoculis	5	Ko Olina 1	1	71.53			
C	Parupeneus multifasciatus	5	Ko Olina 1	1	96.08			
C	Parupeneus multifasciatus	5	Ko Olina 1	1	235.75			
C	Parupeneus multifasciatus	5	Ko Olina 1	2	108.80			
C	Parupeneus bifasciatus	5	Ko Olina 1	1	107.31			
C	Parupeneus cyclostomus	5	Ko Olina 1	1	88.57			
C	Parupeneus cyclostomus	5	Ko Olina 1	1	24.80			
C	Chaetodon trifasciatus	5	Ko Olina 1	2	44.71			
C	Plectroglyphidodon johnstonianus	5	Ko Olina 1	8	13.77			
C	Paracirrhites arcatus	5	Ko Olina 1	1	8.12			
C	Labroides phthirophagus	5	Ko Olina 1	1	0.63			
C	Thalassoma duperrey	5	Ko Olina 1	11	301.30			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Thalassoma duperrey	5	Ko Olina 1	7	78.14			
C	Thalassoma duperrey	5	Ko Olina 1	12	659.39			
C	Gomphosus varius	5	Ko Olina 1	2	124.06			
C	Gomphosus varius	5	Ko Olina 1	1	11.04			
C	Coris gaimard	5	Ko Olina 1	1	215.88			
C	Coris gaimard	5	Ko Olina 1	1	8.57			
C	Anampses cuvier	5	Ko Olina 1	1	115.17			
C	Zanclus cornutus	5	Ko Olina 1	2	208.32			
C	Sufflamen bursa	5	Ko Olina 1	2	171.75			
C	Ostracion meleagris	5	Ko Olina 1	1	6.76	61	2700.43	5.6
CF	Chaetodon unimaculatus	5	Ko Olina 1	4	101.22			
CF	Chaetodon ornatissimus	5	Ko Olina 1	2	273.78			
CF	Chaetodon multicinctus	5	Ko Olina 1	2	45.11	8	420.11	0.9
H	Calotomus carolinus	5	Ko Olina 1	2	263.37			
H	Scarus sordidus	5	Ko Olina 1	2	152.03			
H	Scarus psittacus	5	Ko Olina 1	6	475.61			
H	Scarus psittacus	5	Ko Olina 1	4	579.76			
H	Scarus rubroviolaceus	5	Ko Olina 1	1	85.39			
H	Acanthurus triostegus	5	Ko Olina 1	2	92.63			
H	Acanthurus leucopareius	5	Ko Olina 1	4	110.06			
H	Acanthurus leucopareius	5	Ko Olina 1	3	698.03			
H	Acanthurus leucopareius	5	Ko Olina 1	5	663.50			
H	Acanthurus nigrofuscus	5	Ko Olina 1	25	597.43			
H	Acanthurus nigrofuscus	5	Ko Olina 1	19	1030.80			
H	Acanthurus olivaceus	5	Ko Olina 1	34	8896.68			
H	Acanthurus olivaceus	5	Ko Olina 1	36	14155.56			
H	Acanthurus olivaceus	5	Ko Olina 1	20	1875.38			
H	Acanthurus olivaceus	5	Ko Olina 1	9	5068.53			
H	Acanthurus blochii	5	Ko Olina 1	1	453.59			
H	Acanthurus blochii	5	Ko Olina 1	2	113.40			
H	Ctenochaetus strigosus	5	Ko Olina 1	67	1798.54			
H	Ctenochaetus strigosus	5	Ko Olina 1	71	4676.41			
H	Zebrasoma flavescens	5	Ko Olina 1	5	47.42			
H	Zebrasoma flavescens	5	Ko Olina 1	5	130.15	323	41964.27	86.7
O	Stegastes fasciolatus	5	Ko Olina 1	16	415.68			
O	Melichthys niger	5	Ko Olina 1	5	816.68			
O	Melichthys niger	5	Ko Olina 1	2	712.35			
O	Canthigaster jactator	5	Ko Olina 1	1	3.56			
O	Canthigaster jactator	5	Ko Olina 1	3	6.62	27	1954.89	4.0
P	Abudefduf abdominalis	5	Ko Olina 1	41	1284.64			
P	Chromis vanderbilti	5	Ko Olina 1	50	15.79			
P	Naso hexacanthus	5	Ko Olina 1	1	73.36	92	1373.79	2.8
		5	Ko Olina 1	511	48413.49	511	48413.49	100
C	Cephalopholis argus	6	Ko Olina 2	1	471.73			
C	Decapterus macarellus	6	Ko Olina 2	9	1724.70			
C	Parupeneus multifasciatus	6	Ko Olina 2	1	96.08			
C	Parupeneus multifasciatus	6	Ko Olina 2	1	11.05			
C	Parupeneus bifasciatus	6	Ko Olina 2	1	553.06			
C	Chaetodon lunula	6	Ko Olina 2	1	70.30			
C	Plectroglyphidodon johnstonianus	6	Ko Olina 2	2	3.44			
C	Plectroglyphidodon imparipennis	6	Ko Olina 2	2	1.72			
C	Paracirrhites arcatus	6	Ko Olina 2	2	16.24			
C	Paracirrhites forsteri	6	Ko Olina 2	1	16.35			
C	Labroides phthirophagus	6	Ko Olina 2	2	1.26			
C	Labroides phthirophagus	6	Ko Olina 2	1	1.49			
C	Thalassoma duperrey	6	Ko Olina 2	2	194.10			
C	Thalassoma duperrey	6	Ko Olina 2	14	383.47			
C	Thalassoma duperrey	6	Ko Olina 2	6	66.98			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Thalassoma duperrey	6	Ko Olina 2	7	384.64			
C	Stethojulis balteata	6	Ko Olina 2	1	35.76			
C	Halichoeres ornatissimus	6	Ko Olina 2	2	19.05			
C	Zanclus cornutus	6	Ko Olina 2	2	208.32			
C	Sufflamen bursa	6	Ko Olina 2	2	171.75			
C	Ostracion meleagris	6	Ko Olina 2	1	6.76	61	4438.24	13.5
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	8	240.73	0.7
H	Scarus psittacus	6	Ko Olina 2	1	375.61			
H	Scarus rubroviolaceus	6	Ko Olina 2	2	170.79			
H	Scarus rubroviolaceus	6	Ko Olina 2	6	6960.05			
H	Scarus rubroviolaceus	6	Ko Olina 2	2	3672.76			
H	Acanthurus triostegus	6	Ko Olina 2	3	300.04			
H	Acanthurus leucopareius	6	Ko Olina 2	1	232.68			
H	Acanthurus leucopareius	6	Ko Olina 2	1	132.70			
H	Acanthurus nigrofuscus	6	Ko Olina 2	29	693.01			
H	Acanthurus nigrofuscus	6	Ko Olina 2	1	54.25			
H	Acanthurus nigroris	6	Ko Olina 2	1	267.35			
H	Acanthurus nigroris	6	Ko Olina 2	2	204.95			
H	Acanthurus olivaceus	6	Ko Olina 2	1	47.48			
H	Acanthurus olivaceus	6	Ko Olina 2	10	2616.67			
H	Acanthurus olivaceus	6	Ko Olina 2	10	5631.70			
H	Acanthurus olivaceus	6	Ko Olina 2	8	1308.13			
H	Acanthurus blochii	6	Ko Olina 2	2	113.40			
H	Acanthurus blochii	6	Ko Olina 2	5	489.88			
H	Ctenochaetus strigosus	6	Ko Olina 2	20	536.88			
H	Ctenochaetus strigosus	6	Ko Olina 2	19	1251.43			
H	Ctenochaetus strigosus	6	Ko Olina 2	4	60.79			
H	Zebrasoma flavescens	6	Ko Olina 2	5	82.66			
H	Zebrasoma flavescens	6	Ko Olina 2	1	1.69			
H	Zebrasoma flavescens	6	Ko Olina 2	1	53.28			
H	Zebrasoma veliferum	6	Ko Olina 2	2	292.46			
H	Naso lituratus	6	Ko Olina 2	1	622.36			
H	Naso lituratus	6	Ko Olina 2	2	623.23	140	26796.22	81.6
O	Melichthys niger	6	Ko Olina 2	4	653.34			
O	Melichthys vidua	6	Ko Olina 2	1	199.03			
O	Canthigaster jactator	6	Ko Olina 2	3	10.69			
O	Canthigaster jactator	6	Ko Olina 2	1	2.21	9	865.26	2.6
P	Abudefduf abdominalis	6	Ko Olina 2	16	501.32			
P	Chromis vanderbilti	6	Ko Olina 2	6	1.90			
P	Chromis hanui	6	Ko Olina 2	1	0.75	23	503.96	1.5
		6	Ko Olina 2	241	32844.42	241	32844.42	100
C	Aulostomus chinensis	7	KAHE 1-D	1	140.29			
C	Mulloides vanicolensis	7	KAHE 1-D	31	4596.41			
C	Parupeneus cyclostomus	7	KAHE 1-D	1	88.57			
C	Plectroglyphidodon johnstonianus	7	KAHE 1-D	6	10.33			
C	Plectroglyphidodon imparipennis	7	KAHE 1-D	2	1.72			
C	Cirrhitus pinnulatus	7	KAHE 1-D	1	90.86			
C	Labroides phthirophagus	7	KAHE 1-D	1	1.49			
C	Thalassoma duperrey	7	KAHE 1-D	23	629.98			
C	Thalassoma duperrey	7	KAHE 1-D	36	3493.87			
C	Thalassoma duperrey	7	KAHE 1-D	29	1593.52			
C	Thalassoma ballieui	7	KAHE 1-D	1	102.61			
C	Gomphosus varius	7	KAHE 1-D	8	88.33			
C	Gomphosus varius	7	KAHE 1-D	6	135.61			
C	Gomphosus varius	7	KAHE 1-D	1	62.03			
C	Stethojulis balteata	7	KAHE 1-D	2	71.53	149	11107.15	49.0

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
CF	Chaetodon quadrimaculatus	7	KAHE 1-D	1	7.03			
CF	Chaetodon quadrimaculatus	7	KAHE 1-D	2	50.61			
CF	Chaetodon multicinctus	7	KAHE 1-D	2	13.31			
CF	Chaetodon multicinctus	7	KAHE 1-D	1	13.03			
CF	Exallias brevis	7	KAHE 1-D	1	29.55	7	113.53	0.5
H	Scarus perspicillatus	7	KAHE 1-D	4	74.54			
H	Scarus perspicillatus	7	KAHE 1-D	2	87.84			
H	Scarus rubroviolaceus	7	KAHE 1-D	1	346.50			
H	Acanthurus nigrofuscus	7	KAHE 1-D	45	1075.37			
H	Ctenochaetus strigosus	7	KAHE 1-D	24	644.25			
H	Ctenochaetus strigosus	7	KAHE 1-D	3	197.59	79	2426.09	10.7
O	Stegastes fasciolatus	7	KAHE 1-D	4	59.05			
O	Stegastes fasciolatus	7	KAHE 1-D	4	103.92			
O	Melichthys niger	7	KAHE 1-D	53	8656.78			
O	Canthigaster jactator	7	KAHE 1-D	1	2.21			
O	Canthigaster jactator	7	KAHE 1-D	1	7.59			
O	Canthigaster jactator	7	KAHE 1-D	2	7.12	65	8836.68	39.0
P	Chromis vanderbilti	7	KAHE 1-D	69	21.80			
P	Chromis ovalis	7	KAHE 1-D	26	154.23	95	176.02	0.8
		7	KAHE 1-D	395	22659.47	395	22659.47	100
C	Saurida gracilis	8	KAHE 5 -B	1	51.93			
C	Parupeneus multifasciatus	8	KAHE 5 -B	1	27.12			
C	Parupeneus multifasciatus	8	KAHE 5 -B	1	54.40			
C	Plectroglyphidodon johnstonianus	8	KAHE 5 -B	2	3.44			
C	Paracirrhites arcatus	8	KAHE 5 -B	2	16.24			
C	Cirrhitops fasciatus	8	KAHE 5 -B	1	8.23			
C	Thalassoma duperrey	8	KAHE 5 -B	1	156.99			
C	Thalassoma duperrey	8	KAHE 5 -B	3	291.16			
C	Thalassoma duperrey	8	KAHE 5 -B	2	109.90			
C	Thalassoma duperrey	8	KAHE 5 -B	9	246.51			
C	Thalassoma duperrey	8	KAHE 5 -B	15	167.45			
C	Gomphosus varius	8	KAHE 5 -B	1	62.03			
C	Gomphosus varius	8	KAHE 5 -B	1	22.60			
C	Gomphosus varius	8	KAHE 5 -B	1	11.04			
C	Coris gaimard	8	KAHE 5 -B	1	45.99			
C	Stethojulis balteata	8	KAHE 5 -B	2	71.53			
C	Anampses cuvier	8	KAHE 5 -B	1	115.17			
C	Halichoeres ornatissimus	8	KAHE 5 -B	3	49.35			
C	Halichoeres ornatissimus	8	KAHE 5 -B	4	38.09			
C	Zanclus cornutus	8	KAHE 5 -B	1	54.90			
C	Rhinecanthus rectangulus	8	KAHE 5 -B	1	144.65			
C	Rhinecanthus rectangulus	8	KAHE 5 -B	1	85.87			
C	Sufflamen bursa	8	KAHE 5 -B	3	257.62	58	2092.20	13.0
CF	Chaetodon multicinctus	8	KAHE 5 -B	4	26.63	4	26.63	0.2
H	Scarus sordidus	8	KAHE 5 -B	1	1427.57			
H	Scarus sordidus	8	KAHE 5 -B	1	775.07			
H	Acanthurus nigrofuscus	8	KAHE 5 -B	35	836.40			
H	Acanthurus nigrofuscus	8	KAHE 5 -B	5	271.26			
H	Acanthurus nigrofuscus	8	KAHE 5 -B	14	198.98			
H	Acanthurus nigroris	8	KAHE 5 -B	4	56.85			
H	Acanthurus olivaceus	8	KAHE 5 -B	10	5631.70			
H	Acanthurus olivaceus	8	KAHE 5 -B	10	2616.67			
H	Acanthurus olivaceus	8	KAHE 5 -B	7	656.38			
H	Naso unicornis	8	KAHE 5 -B	1	123.12	88	12594.00	78.4
O	Stegastes fasciolatus	8	KAHE 5 -B	3	44.29			
O	Melichthys vidua	8	KAHE 5 -B	3	597.09			
O	Melichthys vidua	8	KAHE 5 -B	2	248.69			
O	Cantherhines sandwichiensis	8	KAHE 5 -B	1	131.57			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
O	Canthigaster jactator	8	KAHE 5 -B	1	7.59	10	1029.23	6.4
P	Chromis vanderbilti	8	KAHE 5 -B	195	61.60			
P	Naso brevirostris	8	KAHE 5 -B	5	194.62			
P	Naso brevirostris	8	KAHE 5 -B	1	73.36	201	329.58	2.1
		8	KAHE 5 -B	361	16071.64	361	16071.64	100
C	Decapterus macarellus	9	KAHE 7 -B	1	618.55			
C	Mulloides flavolineatus	9	KAHE 7 -B	34	21030.72			
C	Parupeneus multifasciatus	9	KAHE 7 -B	1	27.12			
C	Parupeneus multifasciatus	9	KAHE 7 -B	1	235.75			
C	Paracirrhites arcatus	9	KAHE 7 -B	2	16.24			
C	Paracirrhites forsteri	9	KAHE 7 -B	1	39.65			
C	Cirrhitops fasciatus	9	KAHE 7 -B	1	3.75			
C	Thalassoma duperrey	9	KAHE 7 -B	1	27.39			
C	Thalassoma duperrey	9	KAHE 7 -B	1	54.95			
C	Thalassoma purpureum	9	KAHE 7 -B	4	43.01			
C	Coris gaimard	9	KAHE 7 -B	1	449.84			
C	Halichoeres ornatissimus	9	KAHE 7 -B	1	4.41			
C	Zanclus cornutus	9	KAHE 7 -B	1	104.16			
C	Sufflamen bursa	9	KAHE 7 -B	4	343.49	54	22999.01	72.4
CF	Chaetodon ornatissimus	9	KAHE 7 -B	2	57.06			
CF	Chaetodon multicinctus	9	KAHE 7 -B	4	26.63	6	83.69	0.3
H	Acanthurus triostegus	9	KAHE 7 -B	6	600.09			
H	Acanthurus nigrofuscus	9	KAHE 7 -B	1	54.25			
H	Acanthurus nigrofuscus	9	KAHE 7 -B	3	71.69			
H	Acanthurus olivaceus	9	KAHE 7 -B	3	281.31			
H	Acanthurus olivaceus	9	KAHE 7 -B	23	6018.34			
H	Acanthurus olivaceus	9	KAHE 7 -B	1	163.52			
H	Acanthurus blochii	9	KAHE 7 -B	2	195.95			
H	Naso lituratus	9	KAHE 7 -B	1	205.99			
H	Naso unicornis	9	KAHE 7 -B	1	17.19	41	7608.33	24.0
O	Melichthys vidua	9	KAHE 7 -B	1	199.03			
O	Canthigaster coronata	9	KAHE 7 -B	1	7.59			
O	Canthigaster jactator	9	KAHE 7 -B	2	7.12	4	213.75	0.7
P	Dascyllus albisella	9	KAHE 7 -B	3	9.26			
P	Chromis vanderbilti	9	KAHE 7 -B	34	10.74			
P	Chromis ovalis	9	KAHE 7 -B	19	112.70			
P	Chromis hanui	9	KAHE 7 -B	1	0.75			
P	Naso brevirostris	9	KAHE 7 -B	3	220.07			
P	Naso brevirostris	9	KAHE 7 -B	2	34.39			
P	Naso brevirostris	9	KAHE 7 -B	12	467.09	74	855.01	2.7
		9	KAHE 7 -B	179	31759.78	179	31759.78	100
C	Parupeneus pleurostigma	10	KAHE 7 -C	1	58.01			
C	Parupeneus multifasciatus	10	KAHE 7 -C	3	163.20			
C	Parupeneus multifasciatus	10	KAHE 7 -C	5	480.41			
C	Parupeneus multifasciatus	10	KAHE 7 -C	1	235.75			
C	Parupeneus multifasciatus	10	KAHE 7 -C	1	155.42			
C	Parupeneus cyclostomus	10	KAHE 7 -C	1	88.57			
C	Plectroglyphidodon johnstonianus	10	KAHE 7 -C	1	0.86			
C	Paracirrhites arcatus	10	KAHE 7 -C	3	24.35			
C	Thalassoma duperrey	10	KAHE 7 -C	1	54.95			
C	Thalassoma duperrey	10	KAHE 7 -C	1	27.39			
C	Thalassoma duperrey	10	KAHE 7 -C	3	291.16			
C	Coris venusta	10	KAHE 7 -C	1	23.64			
C	Coris venusta	10	KAHE 7 -C	1	9.39			
C	Stethojulis balteata	10	KAHE 7 -C	1	35.76			
C	Sufflamen bursa	10	KAHE 7 -C	1	144.65			
C	Sufflamen bursa	10	KAHE 7 -C	5	429.37			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Ostracion meleagris	10	KAHE 7 -C	1	6.76	31	2229.63	20.4
CF	Chaetodon multicinctus	10	KAHE 7 -C	2	26.06	2	26.06	0.2
H	Acanthurus triostegus	10	KAHE 7 -C	3	300.04			
H	Acanthurus triostegus	10	KAHE 7 -C	1	46.32			
H	Acanthurus nigrofuscus	10	KAHE 7 -C	9	215.07			
H	Acanthurus nigrofuscus	10	KAHE 7 -C	3	162.76			
H	Acanthurus olivaceus	10	KAHE 7 -C	10	3932.10			
H	Acanthurus olivaceus	10	KAHE 7 -C	2	187.54			
H	Acanthurus olivaceus	10	KAHE 7 -C	3	785.00			
H	Acanthurus blochii	10	KAHE 7 -C	1	97.98			
H	Naso lituratus	10	KAHE 7 -C	1	36.34			
H	Naso lituratus	10	KAHE 7 -C	1	14.90	34	5778.04	52.9
O	Melichthys vidua	10	KAHE 7 -C	1	199.03			
O	Canthigaster coronata	10	KAHE 7 -C	2	15.18			
O	Canthigaster coronata	10	KAHE 7 -C	1	22.05			
O	Canthigaster jactator	10	KAHE 7 -C	1	7.59			
O	Canthigaster jactator	10	KAHE 7 -C	1	3.56	6	247.42	2.3
P	Dascyllus albisella	10	KAHE 7 -C	3	9.26			
P	Naso brevirostris	10	KAHE 7 -C	15	583.87			
P	Naso brevirostris	10	KAHE 7 -C	28	2054.02	46	2647.15	24.2
		10	KAHE 7 -C	119	10928.31	119	10928.31	100
C	Parupeneus multifasciatus	11	KAHE 7 -D	2	108.80			
C	Plectroglyphidodon johnstonianus	11	KAHE 7 -D	4	3.45			
C	Plectroglyphidodon imparipennis	11	KAHE 7 -D	1	0.86			
C	Paracirrhites arcatus	11	KAHE 7 -D	2	16.24			
C	Thalassoma duperrey	11	KAHE 7 -D	2	109.90			
C	Thalassoma duperrey	11	KAHE 7 -D	2	54.78			
C	Thalassoma duperrey	11	KAHE 7 -D	2	22.33			
C	Sufflamen bursa	11	KAHE 7 -D	1	85.87			
C	Sufflamen bursa	11	KAHE 7 -D	1	144.65	17	546.87	63.2
O	Melichthys vidua	11	KAHE 7 -D	1	296.24			
O	Canthigaster jactator	11	KAHE 7 -D	1	7.59			
O	Canthigaster jactator	11	KAHE 7 -D	2	7.12	4	310.95	36.0
P	Chromis vanderbilti	11	KAHE 7 -D	22	6.95	22	6.95	0.8
		11	KAHE 7 -D	43	864.78	43	864.78	100
C	Aulostomus chinensis	12	KAHE 7 - E	1	88.50			
C	Parupeneus multifasciatus	12	KAHE 7 - E	7	189.82			
C	Parupeneus multifasciatus	12	KAHE 7 - E	2	22.10			
C	Parupeneus multifasciatus	12	KAHE 7 - E	7	380.80			
C	Paracirrhites arcatus	12	KAHE 7 - E	2	16.24			
C	Thalassoma duperrey	12	KAHE 7 - E	2	194.10			
C	Thalassoma duperrey	12	KAHE 7 - E	5	136.95			
C	Thalassoma duperrey	12	KAHE 7 - E	3	164.85			
C	Coris venusta	12	KAHE 7 - E	1	48.38			
C	Coris venusta	12	KAHE 7 - E	1	23.64			
C	Pseudojuloides cerasinus	12	KAHE 7 - E	9	28.35			
C	Stethojulis balteata	12	KAHE 7 - E	5	178.82			
C	Stethojulis balteata	12	KAHE 7 - E	1	14.41			
C	Macropharyngodon geoffroy	12	KAHE 7 - E	2	37.26			
C	Macropharyngodon geoffroy	12	KAHE 7 - E	2	11.50			
C	Zanclus cornutus	12	KAHE 7 - E	3	312.47			
C	Sufflamen bursa	12	KAHE 7 - E	6	515.24	59	2363.42	23.2
CF	Chaetodon multicinctus	12	KAHE 7 - E	5	33.28			
CF	Pervagor melanocephalus	12	KAHE 7 - E	1	16.22			
CF	Cantherhines dumerili	12	KAHE 7 - E	1	65.10	7	114.60	1.1
H	Calotomus carolinus	12	KAHE 7 - E	1	34.69			
H	Acanthurus nigrofuscus	12	KAHE 7 - E	18	135.44			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
H	Acanthurus nigrofuscus	12	KAHE 7 - E	12	170.55			
H	Naso lituratus	12	KAHE 7 - E	1	311.61			
H	Naso lituratus	12	KAHE 7 - E	1	622.36			
H	Naso unicornis	12	KAHE 7 - E	1	123.12			
H	Naso unicornis	12	KAHE 7 - E	2	1763.10	36	3160.87	31.0
O	Melichthys niger	12	KAHE 7 - E	12	1960.03			
O	Melichthys vidua	12	KAHE 7 - E	2	398.06			
O	Melichthys vidua	12	KAHE 7 - E	2	248.69			
O	Canthigaster coronata	12	KAHE 7 - E	2	15.18			
O	Canthigaster coronata	12	KAHE 7 - E	1	22.05			
O	Canthigaster jactator	12	KAHE 7 - E	1	7.59			
O	Canthigaster jactator	12	KAHE 7 - E	2	4.41			
O	Canthigaster jactator	12	KAHE 7 - E	5	17.81	27	2673.82	26.2
P	Chaetodon kleini	12	KAHE 7 - E	2	13.12			
P	Chromis vanderbilti	12	KAHE 7 - E	119	37.59			
P	Chromis hanui	12	KAHE 7 - E	2	1.49			
P	Naso brevirostris	12	KAHE 7 - E	47	1829.45	170	1881.65	18.5
		12	KAHE 7 - E	299	10194.37	299	10194.37	100
C	Lutjanus kasmira	13	KAHE 10	3	77.57			
C	Monotaxis grandoculis	13	KAHE 10	3	1432.59			
C	Monotaxis grandoculis	13	KAHE 10	6	1272.38			
C	Mulloides flavolineatus	13	KAHE 10	6	781.67			
C	Parupeneus multifasciatus	13	KAHE 10	1	155.42			
C	Parupeneus multifasciatus	13	KAHE 10	2	108.80			
C	Parupeneus multifasciatus	13	KAHE 10	2	54.23			
C	Forcipiger flavissimus	13	KAHE 10	4	36.60			
C	Plectroglyphidodon johnstonianus	13	KAHE 10	1	0.86			
C	Plectroglyphidodon imparipennis	13	KAHE 10	1	0.86			
C	Paracirrhites arcatus	13	KAHE 10	2	16.24			
C	Paracirrhites forsteri	13	KAHE 10	1	16.35			
C	Labroides phthirophagus	13	KAHE 10	1	0.63			
C	Thalassoma duperrey	13	KAHE 10	7	78.14			
C	Thalassoma duperrey	13	KAHE 10	7	679.36			
C	Thalassoma duperrey	13	KAHE 10	8	439.59			
C	Thalassoma duperrey	13	KAHE 10	9	246.51			
C	Coris gaimard	13	KAHE 10	1	8.57			
C	Zanclus cornutus	13	KAHE 10	1	54.90			
C	Sufflamen bursa	13	KAHE 10	3	257.62	69	5718.90	50.5
CF	Chaetodon multicinctus	13	KAHE 10	2	26.06	2	26.06	0.2
H	Calotomus carolinus	13	KAHE 10	1	72.28			
H	Acanthurus nigrofuscus	13	KAHE 10	3	42.64			
H	Acanthurus nigrofuscus	13	KAHE 10	6	143.38			
H	Acanthurus olivaceus	13	KAHE 10	5	468.84			
H	Acanthurus blochii	13	KAHE 10	3	87.09			
H	Ctenochaetus strigosus	13	KAHE 10	1	65.86			
H	Naso lituratus	13	KAHE 10	1	14.90			
H	Naso lituratus	13	KAHE 10	1	72.58			
H	Naso unicornis	13	KAHE 10	1	73.36	22	1040.94	9.2
O	Stegastes fasciolatus	13	KAHE 10	3	44.29			
O	Stegastes fasciolatus	13	KAHE 10	5	129.90			
O	Melichthys vidua	13	KAHE 10	2	398.06			
O	Canthigaster jactator	13	KAHE 10	1	3.56	11	575.81	5.1
P	Dascyllus albisella	13	KAHE 10	23	71.03			
P	Abudefduf abdominalis	13	KAHE 10	28	877.31			
P	Chromis vanderbilti	13	KAHE 10	64	20.22			
P	Chromis ovalis	13	KAHE 10	109	646.56			
P	Naso hexacanthus	13	KAHE 10	19	739.56			
P	Naso hexacanthus	13	KAHE 10	18	1320.44			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
P	Naso brevirostris	13	KAHE 10	4	293.43	265	3968.56	35.0
		13	KAHE 10	369	11330.28	369	11330.28	100
C	Plectroglyphidodon imparipennis	14	Nanakuli 1	3	2.59			
C	Thalassoma duperrey	14	Nanakuli 1	1	27.39			
C	Thalassoma duperrey	14	Nanakuli 1	5	55.82			
C	Thalassoma duperrey	14	Nanakuli 1	1	54.95			
C	Stethojulis balteata	14	Nanakuli 1	2	28.82			
C	Macropharyngodon geoffroy	14	Nanakuli 1	1	5.75			
C	Rhinecanthus rectangulus	14	Nanakuli 1	1	45.36			
C	Ostracion meleagris	14	Nanakuli 1	1	6.76	15	227.43	70.1
H	Acanthurus triostegus	14	Nanakuli 1	1	17.17			
H	Acanthurus nigrofuscus	14	Nanakuli 1	1	54.25	2	71.42	22.0
O	Canthigaster jactator	14	Nanakuli 1	1	3.56			
O	Canthigaster rivulata	14	Nanakuli 1	1	22.05	2	25.61	7.9
		14	Nanakuli 1	19	324.47	19	324.47	100
C	Monotaxis grandoculis	15	Nanakuli 2	2	27.47			
C	Parupeneus multifasciatus	15	Nanakuli 2	2	54.23			
C	Parupeneus multifasciatus	15	Nanakuli 2	2	471.50			
C	Parupeneus multifasciatus	15	Nanakuli 2	3	288.24			
C	Forcipiger flavissimus	15	Nanakuli 2	2	18.30			
C	Paracirrhites forsteri	15	Nanakuli 2	1	39.65			
C	Bodianus bilunulatus	15	Nanakuli 2	1	133.12			
C	Thalassoma duperrey	15	Nanakuli 2	2	54.78			
C	Thalassoma duperrey	15	Nanakuli 2	4	219.80			
C	Thalassoma duperrey	15	Nanakuli 2	3	33.49			
C	Thalassoma duperrey	15	Nanakuli 2	5	485.26			
C	Gomphosus varius	15	Nanakuli 2	1	11.04			
C	Stethojulis balteata	15	Nanakuli 2	1	35.76			
C	Macropharyngodon geoffroy	15	Nanakuli 2	1	18.63			
C	Halichoeres ornatissimus	15	Nanakuli 2	1	16.45			
C	Sufflamen bursa	15	Nanakuli 2	1	85.87			
C	Sufflamen bursa	15	Nanakuli 2	1	144.65	33	2138.25	7.7
CF	Chaetodon ornatissimus	15	Nanakuli 2	2	138.00	2	138.00	0.5
H	Calotomus carolinus	15	Nanakuli 2	1	499.89			
H	Acanthurus triostegus	15	Nanakuli 2	3	138.95			
H	Acanthurus leucopareius	15	Nanakuli 2	42	5573.41			
H	Acanthurus leucopareius	15	Nanakuli 2	7	1628.73			
H	Acanthurus nigrofuscus	15	Nanakuli 2	22	312.68			
H	Acanthurus nigrofuscus	15	Nanakuli 2	8	191.18			
H	Acanthurus nigrofuscus	15	Nanakuli 2	13	97.82			
H	Acanthurus olivaceus	15	Nanakuli 2	27	15205.60			
H	Acanthurus dussumieri	15	Nanakuli 2	3	979.78			
H	Acanthurus blochii	15	Nanakuli 2	1	330.67			
H	Ctenochaetus strigosus	15	Nanakuli 2	6	91.19			
H	Zebrasoma flavescens	15	Nanakuli 2	2	106.56	135	25156.46	90.6
O	Stegastes fasciolatus	15	Nanakuli 2	4	59.05			
O	Stegastes fasciolatus	15	Nanakuli 2	11	81.31			
O	Melichthys niger	15	Nanakuli 2	1	163.34			
O	Canthigaster jactator	15	Nanakuli 2	1	2.21			
O	Canthigaster jactator	15	Nanakuli 2	1	3.56			
O	Canthigaster rivulata	15	Nanakuli 2	1	22.05	19	331.52	1.2
P	Chromis vanderbilti	15	Nanakuli 2	12	3.79	12	3.79	0.01
		15	Nanakuli 2	201	27768.02	201	27768.02	100
C	Decapterus macarellus	16	KAHE PIPE	7	1885.39			
C	Lutjanus kasmira	16	KAHE PIPE	28	1605.87			
C	Monotaxis grandoculis	16	KAHE PIPE	1	22.60			

14-May-10

GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	16	KAHE PIPE	1	96.08			
C	Parupeneus multifasciatus	16	KAHE PIPE	1	235.75			
C	Forcipiger flavissimus	16	KAHE PIPE	1	9.15			
C	Chaetodon fremblii	16	KAHE PIPE	2	41.82			
C	Chaetodon lunula	16	KAHE PIPE	6	215.96			
C	Paracirrhites arcatus	16	KAHE PIPE	2	16.24			
C	Paracirrhites arcatus	16	KAHE PIPE	9	147.14			
C	Paracirrhites forsteri	16	KAHE PIPE	3	118.94			
C	Labroides phthirophagus	16	KAHE PIPE	3	4.46			
C	Labroides phthirophagus	16	KAHE PIPE	1	0.19			
C	Pseudocheilinus octotaenia	16	KAHE PIPE	1	14.41			
C	Thalassoma duperrey	16	KAHE PIPE	31	849.10			
C	Thalassoma duperrey	16	KAHE PIPE	35	3396.82			
C	Thalassoma duperrey	16	KAHE PIPE	40	2197.96			
C	Thalassoma purpureum	16	KAHE PIPE	1	525.30			
C	Gomphosus varius	16	KAHE PIPE	5	113.00			
C	Gomphosus varius	16	KAHE PIPE	4	248.12			
C	Gomphosus varius	16	KAHE PIPE	1	11.04			
C	Macropharyngodon geoffroy	16	KAHE PIPE	2	11.50			
C	Halichoeres ornatissimus	16	KAHE PIPE	3	28.57			
C	Halichoeres ornatissimus	16	KAHE PIPE	7	115.15			
C	Zanclus cornutus	16	KAHE PIPE	2	208.32			
C	Sufflamen bursa	16	KAHE PIPE	2	171.75	199	12290.61	15.7
H	Scarus sordidus	16	KAHE PIPE	5	700.03			
H	Scarus sordidus	16	KAHE PIPE	1	544.57			
H	Scarus sordidus	16	KAHE PIPE	3	4282.71			
H	Scarus psittacus	16	KAHE PIPE	1	1437.46			
H	Scarus psittacus	16	KAHE PIPE	25	1981.70			
H	Acanthurus nigrofuscus	16	KAHE PIPE	34	812.50			
H	Ctenochaetus strigosus	16	KAHE PIPE	10	658.65	79	10417.62	13.3
O	Stegastes fasciolatus	16	KAHE PIPE	18	467.64			
O	Melichthys niger	16	KAHE PIPE	33	5390.07			
O	Melichthys vidua	16	KAHE PIPE	2	248.69			
O	Canthigaster jactator	16	KAHE PIPE	8	17.64			
O	Canthigaster jactator	16	KAHE PIPE	4	14.25			
O	Canthigaster jactator	16	KAHE PIPE	5	37.95	70	6176.25	7.9
P	Chaetodon miliaris	16	KAHE PIPE	8	169.34			
P	Dascyllus albisella	16	KAHE PIPE	23	71.03			
P	Abudefduf abdominalis	16	KAHE PIPE	527	16512.27			
P	Chromis vanderbilti	16	KAHE PIPE	87	27.48			
P	Chromis ovalis	16	KAHE PIPE	179	2069.18			
P	Naso brevirostris	16	KAHE PIPE	60	2335.47			
P	Naso brevirostris	16	KAHE PIPE	70	8618.27			
P	Naso brevirostris	16	KAHE PIPE	115	8436.16			
P	Abudefduf vaigensis	16	KAHE PIPE	350	10966.4	1419	49205.6	63
		16	KAHE PIPE	1767	78090.09	1767	78090.09	100

12 AUGUST 2010 FIELD DATA

12-Aug-10

GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	1	EAST - 1	5	777.11			
C	Parupeneus multifasciatus	1	EAST - 1	14	4766.20			
C	Parupeneus multifasciatus	1	EAST - 1	4	942.99			
C	Parupeneus cyclostomus	1	EAST - 1	1	218.58			
C	Plectroglyphidodon imparipennis	1	EAST - 1	1	0.86			
C	Paracirrhites arcatus	1	EAST - 1	1	8.12			
C	Thalassoma duperrey	1	EAST - 1	4	388.21			
C	Thalassoma duperrey	1	EAST - 1	3	9.45			
C	Thalassoma duperrey	1	EAST - 1	25	279.08			
C	Thalassoma duperrey	1	EAST - 1	21	575.20			
C	Coris venusta	1	EAST - 1	5	118.18			
C	Coris venusta	1	EAST - 1	5	46.94			
C	Coris gaimard	1	EAST - 1	1	449.84			
C	Stethojulis balteata	1	EAST - 1	2	28.82			
C	Stethojulis balteata	1	EAST - 1	1	35.76			
C	Stethojulis balteata	1	EAST - 1	4	16.00			
C	Plagiotremus ewaensis	1	EAST - 1	1	0.95			
C	Rhinecanthus rectangulus	1	EAST - 1	1	144.65			
C	Rhinecanthus rectangulus	1	EAST - 1	3	257.62			
C	Rhinecanthus rectangulus	1	EAST - 1	1	45.36			
C	Sufflamen fraenatus	1	EAST - 1	1	144.65			
C	Sufflamen fraenatus	1	EAST - 1	1	329.34	105	9583.91	30.6
CF	Chaetodon quadrimaculatus	1	EAST - 1	2	50.61	2	50.61	0.2
H	Acanthurus triostegus	1	EAST - 1	3	138.95			
H	Acanthurus triostegus	1	EAST - 1	9	1688.42			
H	Acanthurus triostegus	1	EAST - 1	15	1500.21			
H	Acanthurus leucopareius	1	EAST - 1	3	698.03			
H	Acanthurus nigrofuscus	1	EAST - 1	8	434.02			
H	Acanthurus olivaceus	1	EAST - 1	1	47.48			
H	Acanthurus olivaceus	1	EAST - 1	7	2752.47			
H	Acanthurus olivaceus	1	EAST - 1	5	468.84			
H	Acanthurus olivaceus	1	EAST - 1	1	261.67			
H	Acanthurus dussumieri	1	EAST - 1	1	896.17			
H	Acanthurus dussumieri	1	EAST - 1	2	1128.71			
H	Acanthurus blochii	1	EAST - 1	5	3919.05			
H	Acanthurus blochii	1	EAST - 1	4	391.91			
H	Acanthurus blochii	1	EAST - 1	15	6803.91			
H	Naso unicornis	1	EAST - 1	1	278.71			
H	Naso unicornis	1	EAST - 1	1	73.36	81	21481.89	68.6
O	Melichthys vidua	1	EAST - 1	1	199.03			
O	Canthigaster jactator	1	EAST - 1	2	0.40	3	199.43	0.6
P	Chromis vanderbilti	1	EAST - 1	7	2.21	7	2.21	0.01
		1	EAST - 1	198	31318.05	198	31318.05	100
C	Cephalopholis argus	2	EAST - 2	1	1077.13			
C	Parupeneus multifasciatus	2	EAST - 2	1	54.40			
C	Parupeneus multifasciatus	2	EAST - 2	1	235.75			
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	Paracirrhites forsteri	2	EAST - 2	1	78.83			
C	Thalassoma duperrey	2	EAST - 2	38	1040.84			
C	Thalassoma duperrey	2	EAST - 2	8	776.42			
C	Thalassoma duperrey	2	EAST - 2	20	223.27			
C	Thalassoma duperrey	2	EAST - 2	40	2197.96			
C	Gomphosus varius	2	EAST - 2	1	11.04			
C	Coris venusta	2	EAST - 2	1	23.64			
C	Coris venusta	2	EAST - 2	1	48.38			
C	Stethojulis balteata	2	EAST - 2	8	32.01			

12-Aug-10

GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Stethojulis balteata	2	EAST - 2	8	115.27			
C	Stethojulis balteata	2	EAST - 2	5	178.82			
C	Macropharyngodon geoffroy	2	EAST - 2	3	17.24			
C	Macropharyngodon geoffroy	2	EAST - 2	1	18.63			
C	Halichoeres ornatissimus	2	EAST - 2	1	25.14			
C	Halichoeres ornatissimus	2	EAST - 2	1	16.45			
C	Rhinecanthus rectangulus	2	EAST - 2	3	257.62			
C	Rhinecanthus rectangulus	2	EAST - 2	2	289.30			
C	Sufflamen fraenatus	2	EAST - 2	2	1246.91			
C	Sufflamen fraenatus	2	EAST - 2	1	85.87	152	8164.08	59.2
CF	Chaetodon unimaculatus	2	EAST - 2	2	50.61			
CF	Chaetodon quadrimaculatus	2	EAST - 2	2	50.61			
CF	Chaetodon multicinctus	2	EAST - 2	2	1.65	6	102.87	0.7
H	Acanthurus nigrofuscus	2	EAST - 2	65	923.83			
H	Acanthurus nigrofuscus	2	EAST - 2	17	406.25			
H	Acanthurus olivaceus	2	EAST - 2	3	1689.51			
H	Acanthurus olivaceus	2	EAST - 2	1	393.21			
H	Naso lituratus	2	EAST - 2	2	1244.71	88	4657.51	33.8
O	Stegastes fasciolatus	2	EAST - 2	1	14.76			
O	Melichthys niger	2	EAST - 2	1	163.34			
O	Melichthys vidua	2	EAST - 2	2	592.48			
O	Cantherhines sandwichiensis	2	EAST - 2	1	82.05			
O	Canthigaster jactator	2	EAST - 2	1	3.56	6	856.19	6.2
P	Chromis vanderbilti	2	EAST - 2	61	19.27	61	19.27	0.1
		2	EAST - 2	313	13799.91	313	13799.91	100
C	Parupeneus multifasciatus	3	EAST - 3	1	96.08			
C	Plectroglyphidodon johnstonianus	3	EAST - 3	6	10.33			
C	Paracirrhites arcatus	3	EAST - 3	3	24.35			
C	Pseudocheilinus octotaenia	3	EAST - 3	1	35.76			
C	Thalassoma duperrey	3	EAST - 3	9	246.51			
C	Thalassoma duperrey	3	EAST - 3	12	133.96			
C	Thalassoma duperrey	3	EAST - 3	4	388.21			
C	Thalassoma duperrey	3	EAST - 3	12	659.39			
C	Gomphosus varius	3	EAST - 3	1	22.60			
C	Gomphosus varius	3	EAST - 3	1	39.39			
C	Coris gaimard	3	EAST - 3	2	167.57			
C	Coris gaimard	3	EAST - 3	1	22.07			
C	Stethojulis balteata	3	EAST - 3	3	107.29			
C	Stethojulis balteata	3	EAST - 3	1	72.39			
C	Macropharyngodon geoffroy	3	EAST - 3	1	18.63			
C	Halichoeres ornatissimus	3	EAST - 3	2	32.90			
C	Halichoeres ornatissimus	3	EAST - 3	1	25.14			
C	Halichoeres ornatissimus	3	EAST - 3	1	9.52			
C	Sufflamen bursa	3	EAST - 3	1	45.36			
C	Sufflamen bursa	3	EAST - 3	1	85.87			
C	Sufflamen fraenatus	3	EAST - 3	1	461.25	65	2704.59	48.6
CF	Chaetodon multicinctus	3	EAST - 3	4	52.12	4	52.12	0.9
H	Calotomus carolinus	3	EAST - 3	1	72.28			
H	Scarus psittacus	3	EAST - 3	1	37.87			
H	Scarus rubroviolaceus	3	EAST - 3	1	18.63			
H	Scarus rubroviolaceus	3	EAST - 3	1	85.39			
H	Acanthurus nigrofuscus	3	EAST - 3	22	525.73			
H	Acanthurus nigrofuscus	3	EAST - 3	69	980.68			
H	Acanthurus olivaceus	3	EAST - 3	1	563.17			
H	Ctenochaetus strigosus	3	EAST - 3	1	65.86	97	2349.63	42.2
O	Stegastes fasciolatus	3	EAST - 3	13	191.92			
O	Melichthys niger	3	EAST - 3	1	163.34			
O	Cantherhines sandwichiensis	3	EAST - 3	1	82.05			

12-Aug-10

GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
O	Canthigaster jactator	3	EAST - 3	2	4.41	17	441.72	7.9
P	Chromis vanderbilti	3	EAST - 3	40	12.64			
P	Chromis hanui	3	EAST - 3	2	1.49	42	14.13	0.3
		3	EAST - 3	225	5562.19	225	5562.19	100
C	Parupeneus multifasciatus	4	EAST - 4	2	108.80			
C	Plectroglyphidodon johnstonianus	4	EAST - 4	1	1.72			
C	Plectroglyphidodon imparipennis	4	EAST - 4	1	0.86			
C	Paracirrhites arcatus	4	EAST - 4	4	32.47			
C	Paracirrhites forsteri	4	EAST - 4	1	39.65			
C	Cirrhitops fasciatus	4	EAST - 4	1	8.23			
C	Bodianus bilunulatus	4	EAST - 4	1	648.58			
C	Labroides phthirophagus	4	EAST - 4	2	1.26			
C	Thalassoma duperrey	4	EAST - 4	10	970.52			
C	Thalassoma duperrey	4	EAST - 4	43	1177.79			
C	Thalassoma duperrey	4	EAST - 4	38	2088.06			
C	Thalassoma duperrey	4	EAST - 4	36	401.88			
C	Coris venusta	4	EAST - 4	1	48.38			
C	Coris venusta	4	EAST - 4	2	47.27			
C	Coris gaimard	4	EAST - 4	1	139.13			
C	Halichoeres ornatissimus	4	EAST - 4	1	25.14			
C	Halichoeres ornatissimus	4	EAST - 4	2	32.90			
C	Halichoeres ornatissimus	4	EAST - 4	1	9.52			
C	Rhinecanthus rectangulus	4	EAST - 4	1	144.65			
C	Rhinecanthus rectangulus	4	EAST - 4	1	45.36			
C	Sufflamen fraenatus	4	EAST - 4	1	85.87			
C	Sufflamen fraenatus	4	EAST - 4	1	144.65	152	6202.69	20.6
H	Acanthurus triostegus	4	EAST - 4	4	400.06			
H	Acanthurus nigrofuscus	4	EAST - 4	15	213.19			
H	Acanthurus nigrofuscus	4	EAST - 4	26	621.32			
H	Acanthurus olivaceus	4	EAST - 4	11	2878.34			
H	Acanthurus olivaceus	4	EAST - 4	27	15205.60			
H	Naso lituratus	4	EAST - 4	3	934.84	86	20253.35	67.2
O	Melichthys niger	4	EAST - 4	15	2450.03			
O	Melichthys vidua	4	EAST - 4	2	592.48			
O	Melichthys vidua	4	EAST - 4	3	597.09			
O	Canthigaster jactator	4	EAST - 4	3	10.69			
O	Canthigaster jactator	4	EAST - 4	2	2.45	25	3652.74	12.1
P	Chromis vanderbilti	4	EAST - 4	95	30.01	95	30.01	0.1
		4	EAST - 4	358	30138.79	358	30138.79	100
C	Gymnothorax flavimarginatus	5	Ko Olina 1	1	1360.78			
C	Monotaxis grandoculis	5	Ko Olina 1	2	257.78			
C	Monotaxis grandoculis	5	Ko Olina 1	5	1060.31			
C	Monotaxis grandoculis	5	Ko Olina 1	4	139.16			
C	Plectroglyphidodon johnstonianus	5	Ko Olina 1	2	3.44			
C	Paracirrhites arcatus	5	Ko Olina 1	2	16.24			
C	Cirrhitus pinnulatus	5	Ko Olina 1	1	90.86			
C	Bodianus bilunulatus	5	Ko Olina 1	1	1141.37			
C	Labroides phthirophagus	5	Ko Olina 1	6	3.77			
C	Thalassoma duperrey	5	Ko Olina 1	11	301.30			
C	Thalassoma duperrey	5	Ko Olina 1	1	97.05			
C	Thalassoma duperrey	5	Ko Olina 1	14	156.29			
C	Thalassoma duperrey	5	Ko Olina 1	18	989.08			
C	Thalassoma ballieui	5	Ko Olina 1	1	28.26			
C	Gomphosus varius	5	Ko Olina 1	2	45.20			
C	Gomphosus varius	5	Ko Olina 1	2	22.08			
C	Coris gaimard	5	Ko Olina 1	1	8.57			
C	Halichoeres ornatissimus	5	Ko Olina 1	1	16.45			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Zanclus cornutus	5	Ko Olina 1	1	54.90			
C	Sufflamen bursa	5	Ko Olina 1	3	257.62	79	6050.51	18.6
CF	Chaetodon unimaculatus	5	Ko Olina 1	2	50.61			
CF	Chaetodon quadrimaculatus	5	Ko Olina 1	2	50.61			
CF	Chaetodon multicinctus	5	Ko Olina 1	6	78.18	10	179.40	0.6
H	Scarus sordidus	5	Ko Olina 1	1	76.01			
H	Scarus sordidus	5	Ko Olina 1	4	143.98			
H	Scarus psittacus	5	Ko Olina 1	1	79.27			
H	Scarus rubroviolaceus	5	Ko Olina 1	1	232.75			
H	Scarus rubroviolaceus	5	Ko Olina 1	1	85.39			
H	Acanthurus triostegus	5	Ko Olina 1	36	1667.34			
H	Acanthurus triostegus	5	Ko Olina 1	4	400.06			
H	Acanthurus leucopareius	5	Ko Olina 1	15	1990.50			
H	Acanthurus leucopareius	5	Ko Olina 1	4	930.70			
H	Acanthurus leucopareius	5	Ko Olina 1	5	333.70			
H	Acanthurus nigrofuscus	5	Ko Olina 1	32	764.71			
H	Acanthurus nigrofuscus	5	Ko Olina 1	13	184.77			
H	Acanthurus nigroris	5	Ko Olina 1	1	54.25			
H	Acanthurus olivaceus	5	Ko Olina 1	7	2752.47			
H	Acanthurus olivaceus	5	Ko Olina 1	40	3750.75			
H	Acanthurus olivaceus	5	Ko Olina 1	41	6704.17			
H	Acanthurus blochii	5	Ko Olina 1	1	56.70			
H	Ctenochaetus strigosus	5	Ko Olina 1	27	1778.35			
H	Ctenochaetus strigosus	5	Ko Olina 1	25	671.10			
H	Ctenochaetus strigosus	5	Ko Olina 1	2	264.27			
H	Zebrasoma flavescens	5	Ko Olina 1	5	266.40			
H	Naso lituratus	5	Ko Olina 1	5	638.67	271	23826.32	73.3
O	Stegastes fasciolatus	5	Ko Olina 1	12	177.16			
O	Melichthys niger	5	Ko Olina 1	10	1633.35			
O	Melichthys vidua	5	Ko Olina 1	1	296.24			
O	Canthigaster jactator	5	Ko Olina 1	6	13.23	29	2119.98	6.5
P	Abudefduf abdominalis	5	Ko Olina 1	7	327.96			
P	Chromis vanderbilti	5	Ko Olina 1	29	9.16			
P	Chromis agilis	5	Ko Olina 1	1	1.46	37	338.58	1.0
		5	Ko Olina 1	426	32514.79	426	32514.79	100
C	Aulostomus chinensis	6	Ko Olina 2	1	210.62			
C	Scorpaenopsis diabolus	6	Ko Olina 2	1	2684.85			
C	Parupeneus multifasciatus	6	Ko Olina 2	1	54.40			
C	Parupeneus multifasciatus	6	Ko Olina 2	1	27.12			
C	Parupeneus multifasciatus	6	Ko Olina 2	1	235.75			
C	Parupeneus bifasciatus	6	Ko Olina 2	1	176.01			
C	Parupeneus cyclostomus	6	Ko Olina 2	2	177.14			
C	Chaetodon lunula	6	Ko Olina 2	1	35.99			
C	Plectroglyphidodon johnstonianus	6	Ko Olina 2	3	5.17			
C	Paracirrhites arcatus	6	Ko Olina 2	1	8.12			
C	Paracirrhites forsteri	6	Ko Olina 2	1	16.35			
C	Bodianus bilunulatus	6	Ko Olina 2	1	75.64			
C	Labroides phthirophagus	6	Ko Olina 2	5	3.14			
C	Thalassoma duperrey	6	Ko Olina 2	5	485.26			
C	Thalassoma duperrey	6	Ko Olina 2	5	274.74			
C	Thalassoma duperrey	6	Ko Olina 2	8	219.12			
C	Thalassoma duperrey	6	Ko Olina 2	3	33.49			
C	Gomphosus varius	6	Ko Olina 2	4	44.17			
C	Gomphosus varius	6	Ko Olina 2	3	67.80			
C	Stethojulis balteata	6	Ko Olina 2	2	28.82			
C	Stethojulis balteata	6	Ko Olina 2	1	35.76			
C	Halichoeres ornatissimus	6	Ko Olina 2	1	25.14			
C	Halichoeres ornatissimus	6	Ko Olina 2	1	16.45			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Sufflamen bursa	6	Ko Olina 2	3	257.62			
C	Sufflamen bursa	6	Ko Olina 2	2	289.30	58	5487.96	23.2
CF	Chaetodon quadrimaculatus	6	Ko Olina 2	2	125.61			
CF	Chaetodon quadrimaculatus	6	Ko Olina 2	2	50.61			
CF	Chaetodon multicinctus	6	Ko Olina 2	2	26.06	6	202.28	0.9
H	Scarus psittacus	6	Ko Olina 2	4	151.49			
H	Scarus psittacus	6	Ko Olina 2	2	158.54			
H	Acanthurus nigrofuscus	6	Ko Olina 2	12	286.76			
H	Acanthurus nigrofuscus	6	Ko Olina 2	25	355.32			
H	Acanthurus nigroris	6	Ko Olina 2	1	102.47			
H	Acanthurus olivaceus	6	Ko Olina 2	19	7470.99			
H	Acanthurus olivaceus	6	Ko Olina 2	3	281.31			
H	Acanthurus olivaceus	6	Ko Olina 2	9	1471.65			
H	Acanthurus olivaceus	6	Ko Olina 2	2	94.95			
H	Acanthurus blochii	6	Ko Olina 2	1	453.59			
H	Acanthurus blochii	6	Ko Olina 2	1	56.70			
H	Acanthurus blochii	6	Ko Olina 2	1	155.58			
H	Ctenochaetus strigosus	6	Ko Olina 2	9	241.60			
H	Ctenochaetus strigosus	6	Ko Olina 2	14	1849.87			
H	Ctenochaetus strigosus	6	Ko Olina 2	16	1053.84			
H	Zebrasoma flavescens	6	Ko Olina 2	1	1.69			
H	Zebrasoma flavescens	6	Ko Olina 2	12	639.36			
H	Zebrasoma flavescens	6	Ko Olina 2	3	28.45	135	14854.17	62.9
O	Melichthys niger	6	Ko Olina 2	14	2286.70			
O	Melichthys vidua	6	Ko Olina 2	1	199.03			
O	Canthigaster jactator	6	Ko Olina 2	4	14.25	19	2499.98	10.6
P	Abudefduf abdominalis	6	Ko Olina 2	12	562.22			
P	Chromis hanui	6	Ko Olina 2	3	2.24	15	564.46	2.4
		6	Ko Olina 2	233	23608.85	233	23608.85	100
C	Myripristis amaenus	7	KAHE 1-D	7	574.58			
C	Aulostomus chinensis	7	KAHE 1-D	1	172.92			
C	Monotaxis grandoculis	7	KAHE 1-D	2	69.58			
C	Mulloides flavolineatus	7	KAHE 1-D	9	1724.70			
C	Parupeneus multifasciatus	7	KAHE 1-D	1	96.08			
C	Parupeneus multifasciatus	7	KAHE 1-D	1	54.40			
C	Plectroglyphidodon johnstonianus	7	KAHE 1-D	5	8.61			
C	Labroides phthirophagus	7	KAHE 1-D	2	1.26			
C	Thalassoma duperrey	7	KAHE 1-D	19	212.10			
C	Thalassoma duperrey	7	KAHE 1-D	7	384.64			
C	Thalassoma duperrey	7	KAHE 1-D	19	1843.99			
C	Thalassoma duperrey	7	KAHE 1-D	10	273.90			
C	Gomphosus varius	7	KAHE 1-D	8	88.33			
C	Gomphosus varius	7	KAHE 1-D	1	39.39			
C	Coris flavovittata	7	KAHE 1-D	1	83.79			
C	Stethojulis balteata	7	KAHE 1-D	2	71.53			
C	Zanclus cornutus	7	KAHE 1-D	1	54.90			
C	Rhinecanthus rectangulus	7	KAHE 1-D	1	85.87			
C	Sufflamen bursa	7	KAHE 1-D	2	171.75			
C	Sufflamen bursa	7	KAHE 1-D	3	136.09	102	6148.41	30.8
CF	Chaetodon ornatissimus	7	KAHE 1-D	2	138.00			
CF	Chaetodon multicinctus	7	KAHE 1-D	2	26.06	4	164.06	0.8
H	Scarus psittacus	7	KAHE 1-D	29	1098.31			
H	Scarus rubroviolaceus	7	KAHE 1-D	1	147.03			
H	Scarus rubroviolaceus	7	KAHE 1-D	1	2721.55			
H	Acanthurus nigrofuscus	7	KAHE 1-D	12	170.55			
H	Acanthurus nigrofuscus	7	KAHE 1-D	29	693.01			
H	Acanthurus olivaceus	7	KAHE 1-D	1	47.48			
H	Ctenochaetus strigosus	7	KAHE 1-D	9	241.60			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
H	Ctenochaetus strigosus	7	KAHE 1-D	9	592.78	91	5712.31	28.6
O	Stegastes fasciolatus	7	KAHE 1-D	4	59.05			
O	Melichthys niger	7	KAHE 1-D	47	7676.77			
O	Melichthys vidua	7	KAHE 1-D	1	199.03			
O	Canthigaster jactator	7	KAHE 1-D	1	3.56	53	7938.41	39.8
P	Chromis vanderbilti	7	KAHE 1-D	21	6.63	21	6.63	0.03
		7	KAHE 1-D	271	19969.83	271	19969.83	100
C	Adioryx xantherythrus	8	KAHE 5 -B	1	31.67			
C	Parupeneus multifasciatus	8	KAHE 5 -B	2	192.16			
C	Parupeneus multifasciatus	8	KAHE 5 -B	1	155.42			
C	Plectroglyphidodon johnstonianus	8	KAHE 5 -B	4	6.89			
C	Paracirrhites arcatus	8	KAHE 5 -B	5	40.59			
C	Labroides phthirophagus	8	KAHE 5 -B	1	0.63			
C	Thalassoma duperrey	8	KAHE 5 -B	16	178.61			
C	Thalassoma duperrey	8	KAHE 5 -B	11	604.44			
C	Thalassoma duperrey	8	KAHE 5 -B	8	219.12			
C	Gomphosus varius	8	KAHE 5 -B	2	124.06			
C	Gomphosus varius	8	KAHE 5 -B	1	11.04			
C	Coris venusta	8	KAHE 5 -B	2	47.27			
C	Halichoeres ornatissimus	8	KAHE 5 -B	3	49.35			
C	Halichoeres ornatissimus	8	KAHE 5 -B	1	9.52			
C	Plagiotremus ewaensis	8	KAHE 5 -B	1	0.95			
C	Zanclus cornutus	8	KAHE 5 -B	6	624.95			
C	Rhinecanthus rectangulus	8	KAHE 5 -B	1	85.87			
C	Rhinecanthus rectangulus	8	KAHE 5 -B	1	144.65			
C	Sufflamen bursa	8	KAHE 5 -B	1	85.87	68	2613.08	21.2
CF	Pervagor spilosoma	8	KAHE 5 -B	1	16.22	1	16.22	0.1
H	Scarus psittacus	8	KAHE 5 -B	1	79.27			
H	Scarus psittacus	8	KAHE 5 -B	1	37.87			
H	Acanthurus nigrofuscus	8	KAHE 5 -B	39	931.98			
H	Acanthurus nigrofuscus	8	KAHE 5 -B	16	227.40			
H	Acanthurus nigrofuscus	8	KAHE 5 -B	13	705.28			
H	Acanthurus olivaceus	8	KAHE 5 -B	14	2289.23			
H	Acanthurus olivaceus	8	KAHE 5 -B	13	3401.67			
H	Acanthurus olivaceus	8	KAHE 5 -B	12	1125.23			
H	Naso lituratus	8	KAHE 5 -B	1	36.34			
H	Naso unicornis	8	KAHE 5 -B	1	123.12			
H	Naso unicornis	8	KAHE 5 -B	4	21.74	115	8979.15	72.8
O	Stegastes fasciolatus	8	KAHE 5 -B	4	59.05			
O	Melichthys vidua	8	KAHE 5 -B	2	398.06			
O	Cantherhines sandwichiensis	8	KAHE 5 -B	1	21.85			
O	Cantherhines sandwichiensis	8	KAHE 5 -B	2	164.10			
O	Canthigaster jactator	8	KAHE 5 -B	4	14.25	13	657.32	5.3
P	Chromis vanderbilti	8	KAHE 5 -B	228	72.02	228	72.02	0.6
		8	KAHE 5 -B	425	12337.78	425	12337.78	100
C	Gymnothorax steindachneri	9	KAHE 7 -B	1	81.54			
C	Monotaxis grandoculis	9	KAHE 7 -B	1	13.74			
C	Parupeneus pleurostigma	9	KAHE 7 -B	3	294.74			
C	Parupeneus multifasciatus	9	KAHE 7 -B	2	192.16			
C	Parupeneus multifasciatus	9	KAHE 7 -B	1	235.75			
C	Parupeneus multifasciatus	9	KAHE 7 -B	2	108.80			
C	Parupeneus cyclostomus	9	KAHE 7 -B	1	49.96			
C	Chaetodon auriga	9	KAHE 7 -B	1	48.39			
C	Cirrhitops fasciatus	9	KAHE 7 -B	2	16.45			
C	Cheilio inermis	9	KAHE 7 -B	1	618.55			
C	Labroides phthirophagus	9	KAHE 7 -B	1	0.19			
C	Thalassoma duperrey	9	KAHE 7 -B	3	164.85			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Thalassoma duperrey	9	KAHE 7 -B	3	291.16			
C	Thalassoma duperrey	9	KAHE 7 -B	3	82.17			
C	Coris gaimard	9	KAHE 7 -B	1	215.88			
C	Stethojulis balteata	9	KAHE 7 -B	1	35.76			
C	Anampses chrysocephalus	9	KAHE 7 -B	1	0.27			
C	Halichoeres ornatissimus	9	KAHE 7 -B	1	16.45			
C	Halichoeres ornatissimus	9	KAHE 7 -B	1	4.41			
C	Zanclus cornutus	9	KAHE 7 -B	1	104.16			
C	Sufflamen bursa	9	KAHE 7 -B	7	1012.55			
C	Sufflamen bursa	9	KAHE 7 -B	1	85.87	39	3673.79	46.2
CF	Chaetodon multicinctus	9	KAHE 7 -B	2	13.31	2	13.31	0.2
H	Acanthurus nigrofuscus	9	KAHE 7 -B	3	162.76			
H	Acanthurus nigrofuscus	9	KAHE 7 -B	5	119.49			
H	Acanthurus nigrofuscus	9	KAHE 7 -B	2	28.43			
H	Acanthurus olivaceus	9	KAHE 7 -B	15	2452.75			
H	Acanthurus olivaceus	9	KAHE 7 -B	2	786.42			
H	Zebrasoma flavescens	9	KAHE 7 -B	1	1.69			
H	Naso lituratus	9	KAHE 7 -B	1	72.58			
H	Naso unicornis	9	KAHE 7 -B	1	73.36	30	3697.47	46.5
O	Canthigaster coronata	9	KAHE 7 -B	2	27.30			
O	Canthigaster jactator	9	KAHE 7 -B	2	7.12	4	34.43	0.4
P	Dascyllus albisella	9	KAHE 7 -B	3	9.26			
P	Chromis vanderbilti	9	KAHE 7 -B	15	4.74			
P	Chromis hanui	9	KAHE 7 -B	4	2.99			
P	Naso brevirostris	9	KAHE 7 -B	7	513.51	29	530.50	6.7
		9	KAHE 7 -B	104	7949.49	104	7949.49	100
C	Parupeneus multifasciatus	10	KAHE 7 -C	1	96.08			
C	Parupeneus multifasciatus	10	KAHE 7 -C	1	235.75			
C	Plectroglyphidodon johnstonianus	10	KAHE 7 -C	9	7.76			
C	Paracirrhites arcatus	10	KAHE 7 -C	1	8.12			
C	Cheilinus bimaculatus	10	KAHE 7 -C	2	8.20			
C	Xyrichthys pavo	10	KAHE 7 -C	1	2.84			
C	Thalassoma duperrey	10	KAHE 7 -C	18	56.71			
C	Coris venusta	10	KAHE 7 -C	11	28.10			
C	Stethojulis balteata	10	KAHE 7 -C	6	24.01			
C	Macropharyngodon geoffroy	10	KAHE 7 -C	2	11.50			
C	Anampses chrysocephalus	10	KAHE 7 -C	4	1.07			
C	Sufflamen bursa	10	KAHE 7 -C	3	433.95			
C	Sufflamen bursa	10	KAHE 7 -C	2	171.75			
C	Sufflamen fraenatus	10	KAHE 7 -C	1	329.34	62	1415.16	22.8
CF	Chaetodon multicinctus	10	KAHE 7 -C	2	26.06	2	26.06	0.4
H	Acanthurus olivaceus	10	KAHE 7 -C	9	1471.65			
H	Naso unicornis	10	KAHE 7 -C	1	17.19	10	1488.84	24.0
O	Melichthys vidua	10	KAHE 7 -C	1	199.03			
O	Canthigaster coronata	10	KAHE 7 -C	2	27.30			
O	Canthigaster jactator	10	KAHE 7 -C	2	4.41	5	230.74	3.7
P	Chromis vanderbilti	10	KAHE 7 -C	11	3.47			
P	Naso brevirostris	10	KAHE 7 -C	16	3051.90	27	3055.38	49.2
		10	KAHE 7 -C	106	6216.18	106	6216.18	100
C	Parupeneus multifasciatus	11	KAHE 7 -D	1	235.75			
C	Parupeneus multifasciatus	11	KAHE 7 -D	1	3.12			
C	Plectroglyphidodon johnstonianus	11	KAHE 7 -D	6	5.17			
C	Thalassoma duperrey	11	KAHE 7 -D	5	15.75			
C	Thalassoma duperrey	11	KAHE 7 -D	1	27.39			
C	Thalassoma duperrey	11	KAHE 7 -D	3	33.49			
C	Coris venusta	11	KAHE 7 -D	3	7.66			
C	Macropharyngodon geoffroy	11	KAHE 7 -D	3	2.31			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Anampses chrysocephalus	11	KAHE 7 -D	3	0.80			
C	Sufflamen bursa	11	KAHE 7 -D	1	85.87	27	417.32	52.7
H	Naso lituratus	11	KAHE 7 -D	1	72.58	1	72.58	9.2
O	Melichthys vidua	11	KAHE 7 -D	1	199.03			
O	Cantherhines sandwichiensis	11	KAHE 7 -D	1	82.05			
O	Canthigaster jactator	11	KAHE 7 -D	2	7.12	4	288.21	36.4
P	Dascyllus albisella	11	KAHE 7 -D	4	6.74			
P	Chromis vanderbilti	11	KAHE 7 -D	22	6.95	26	13.69	1.7
		11	KAHE 7 -D	58	791.80	58	791.80	100
C	Parupeneus multifasciatus	12	KAHE 7 - E	14	43.67			
C	Parupeneus multifasciatus	12	KAHE 7 - E	1	54.40			
C	Parupeneus multifasciatus	12	KAHE 7 - E	1	96.08			
C	Forcipiger flavissimus	12	KAHE 7 - E	1	9.15			
C	Plectroglyphidodon johnstonianus	12	KAHE 7 - E	3	2.59			
C	Paracirrhites arcatus	12	KAHE 7 - E	3	24.35			
C	Cirrhitops fasciatus	12	KAHE 7 - E	2	16.45			
C	Pseudocheilinus octotaenia	12	KAHE 7 - E	2	8.00			
C	Thalassoma duperrey	12	KAHE 7 - E	3	164.85			
C	Thalassoma duperrey	12	KAHE 7 - E	1	97.05			
C	Pseudojuloides cerasinus	12	KAHE 7 - E	7	78.14			
C	Stethojulis balteata	12	KAHE 7 - E	3	107.29			
C	Macropharyngodon geoffroy	12	KAHE 7 - E	4	22.99			
C	Anampses chrysocephalus	12	KAHE 7 - E	3	0.80			
C	Halichoeres ornatissimus	12	KAHE 7 - E	2	8.82			
C	Zanclus cornutus	12	KAHE 7 - E	2	109.80			
C	Sufflamen bursa	12	KAHE 7 - E	4	343.49	56	1187.92	24.6
CF	Chaetodon unimaculatus	12	KAHE 7 - E	2	1.57			
CF	Chaetodon multicinctus	12	KAHE 7 - E	4	3.31	6	4.88	0.1
H	Centropyge potteri	12	KAHE 7 - E	1	4.98			
H	Calotomus carolinus	12	KAHE 7 - E	1	13.46			
H	Acanthurus nigrofuscus	12	KAHE 7 - E	5	37.62			
H	Acanthurus nigrofuscus	12	KAHE 7 - E	20	20.87			
H	Acanthurus nigrofuscus	12	KAHE 7 - E	10	142.13			
H	Acanthurus olivaceus	12	KAHE 7 - E	1	261.67			
H	Ctenochaetus strigosus	12	KAHE 7 - E	14	12.20			
H	Zebrasoma flavescens	12	KAHE 7 - E	1	1.69			
H	Naso lituratus	12	KAHE 7 - E	1	36.34			
H	Naso unicornis	12	KAHE 7 - E	1	5.44			
H	Naso unicornis	12	KAHE 7 - E	1	881.55	56	1417.96	29.4
O	Melichthys niger	12	KAHE 7 - E	2	326.67			
O	Melichthys vidua	12	KAHE 7 - E	2	398.06			
O	Canthigaster jactator	12	KAHE 7 - E	1	3.56	5	728.29	15.1
P	Chaetodon miliaris	12	KAHE 7 - E	1	0.88			
P	Chromis vanderbilti	12	KAHE 7 - E	152	48.02			
P	Chromis hanui	12	KAHE 7 - E	4	2.99			
P	Naso brevirostris	12	KAHE 7 - E	37	1440.21	194	1492.09	30.9
		12	KAHE 7 - E	317	4831.14	317	4831.14	100
C	Cephalopholis argus	13	KAHE 10	1	2043.61			
C	Cephalopholis argus	13	KAHE 10	1	638.29			
C	Monotaxis grandoculis	13	KAHE 10	1	34.79			
C	Mulloides vanicolensis	13	KAHE 10	1	24.74			
C	Parupeneus pleurostigma	13	KAHE 10	1	98.25			
C	Parupeneus multifasciatus	13	KAHE 10	1	235.75			
C	Parupeneus multifasciatus	13	KAHE 10	2	108.80			
C	Parupeneus multifasciatus	13	KAHE 10	4	384.33			
C	Parupeneus multifasciatus	13	KAHE 10	2	6.24			
C	Parupeneus bifasciatus	13	KAHE 10	1	107.31			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Plectroglyphidodon imparipennis	13	KAHE 10	4	3.45			
C	Paracirrhites arcatus	13	KAHE 10	3	24.35			
C	Cirrhitops fasciatus	13	KAHE 10	1	8.23			
C	Labroides phthirophagus	13	KAHE 10	2	1.26			
C	Thalassoma duperrey	13	KAHE 10	17	1649.88			
C	Thalassoma duperrey	13	KAHE 10	27	301.41			
C	Thalassoma duperrey	13	KAHE 10	10	273.90			
C	Thalassoma duperrey	13	KAHE 10	16	879.18			
C	Coris gaimard	13	KAHE 10	1	45.99			
C	Stethojulis balteata	13	KAHE 10	1	14.41			
C	Stethojulis balteata	13	KAHE 10	1	72.39			
C	Stethojulis balteata	13	KAHE 10	3	107.29			
C	Anampses chrysocephalus	13	KAHE 10	2	0.53			
C	Halichoeres ornatissimus	13	KAHE 10	1	9.52			
C	Halichoeres ornatissimus	13	KAHE 10	4	65.80			
C	Halichoeres ornatissimus	13	KAHE 10	1	25.14			
C	Sufflamen bursa	13	KAHE 10	7	601.11			
C	Sufflamen fraenatus	13	KAHE 10	2	289.30	118	8055.24	67.6
H	Acanthurus triostegus	13	KAHE 10	2	92.63			
H	Acanthurus nigrofuscus	13	KAHE 10	11	156.34			
H	Acanthurus nigrofuscus	13	KAHE 10	8	191.18			
H	Acanthurus olivaceus	13	KAHE 10	2	327.03			
H	Acanthurus olivaceus	13	KAHE 10	4	375.08			
H	Ctenochaetus strigosus	13	KAHE 10	1	65.86			
H	Naso lituratus	13	KAHE 10	1	72.58	29	1280.70	10.7
O	Stegastes fasciolatus	13	KAHE 10	11	162.40			
O	Melichthys niger	13	KAHE 10	5	816.68			
O	Melichthys vidua	13	KAHE 10	1	199.03			
O	Canthigaster jactator	13	KAHE 10	1	3.56	18	1181.67	9.9
P	Dascyllus albisella	13	KAHE 10	27	83.38			
P	Abudefduf abdominalis	13	KAHE 10	24	751.98			
P	Abudefduf vaigiensis	13	KAHE 10	3	140.56			
P	Chromis vanderbilti	13	KAHE 10	73	23.06			
P	Chromis ovalis	13	KAHE 10	61	361.84			
P	Chromis ovalis	13	KAHE 10	5	0.47			
P	Naso hexacanthus	13	KAHE 10	1	38.92	194	1400.21	11.7
		13	KAHE 10	359	11917.83	359	11917.83	100
C	Gymnothorax meleagris	14	Nanakuli 1	1	24.76			
C	Plectroglyphidodon johnstonianus	14	Nanakuli 1	1	0.86			
C	Plectroglyphidodon imparipennis	14	Nanakuli 1	1	0.86			
C	Thalassoma duperrey	14	Nanakuli 1	3	82.17			
C	Thalassoma duperrey	14	Nanakuli 1	8	89.31			
C	Thalassoma duperrey	14	Nanakuli 1	3	164.85			
C	Stethojulis balteata	14	Nanakuli 1	4	16.00			
C	Stethojulis balteata	14	Nanakuli 1	2	28.82			
C	Halichoeres ornatissimus	14	Nanakuli 1	2	8.82			
C	Rhinecanthus rectangulus	14	Nanakuli 1	1	45.36			
C	Rhinecanthus rectangulus	14	Nanakuli 1	1	144.65			
C	Ostracion meleagris	14	Nanakuli 1	1	13.75	28	620.21	13.5
CF	Chaetodon quadrimaculatus	14	Nanakuli 1	2	82.37	2	82.37	1.8
H	Acanthurus triostegus	14	Nanakuli 1	3	138.95			
H	Acanthurus olivaceus	14	Nanakuli 1	10	2616.67			
H	Acanthurus olivaceus	14	Nanakuli 1	2	1126.34	15	3881.96	84.6
O	Canthigaster jactator	14	Nanakuli 1	1	3.56	1	3.56	0.1
P	Chromis vanderbilti	14	Nanakuli 1	5	1.58	5	1.58	0.03
		14	Nanakuli 1	51	4589.68	51	4589.68	100
C	Parupeneus multifasciatus	15	Nanakuli 2	3	163.20			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	15	Nanakuli 2	1	235.75			
C	Parupeneus multifasciatus	15	Nanakuli 2	7	672.57			
C	Parupeneus multifasciatus	15	Nanakuli 2	2	310.84			
C	Chaetodon lunula	15	Nanakuli 2	1	35.99			
C	Plectroglyphidodon johnstonianus	15	Nanakuli 2	1	1.72			
C	Paracirrhites arcatus	15	Nanakuli 2	2	16.24			
C	Bodianus bilunulatus	15	Nanakuli 2	1	75.64			
C	Thalassoma duperrey	15	Nanakuli 2	7	679.36			
C	Thalassoma duperrey	15	Nanakuli 2	18	493.03			
C	Thalassoma duperrey	15	Nanakuli 2	21	1153.93			
C	Stethojulis balteata	15	Nanakuli 2	4	143.05			
C	Macropharyngodon geoffroy	15	Nanakuli 2	2	37.26			
C	Halichoeres ornatissimus	15	Nanakuli 2	1	16.45			
C	Sufflamen bursa	15	Nanakuli 2	1	144.65	72	4179.69	10.1
CF	Chaetodon quadrimaculatus	15	Nanakuli 2	2	82.37			
CF	Chaetodon multicinctus	15	Nanakuli 2	2	26.06	4	108.43	0.3
H	Acanthurus triostegus	15	Nanakuli 2	5	500.07			
H	Acanthurus triostegus	15	Nanakuli 2	13	602.10			
H	Acanthurus leucopareius	15	Nanakuli 2	9	3366.58			
H	Acanthurus leucopareius	15	Nanakuli 2	29	6747.58			
H	Acanthurus leucopareius	15	Nanakuli 2	7	928.90			
H	Acanthurus nigrofuscus	15	Nanakuli 2	4	217.01			
H	Acanthurus nigrofuscus	15	Nanakuli 2	20	477.94			
H	Acanthurus nigrofuscus	15	Nanakuli 2	10	142.13			
H	Acanthurus olivaceus	15	Nanakuli 2	34	19147.79			
H	Acanthurus olivaceus	15	Nanakuli 2	9	2355.00			
H	Acanthurus blochii	15	Nanakuli 2	5	1653.35			
H	Ctenochaetus strigosus	15	Nanakuli 2	1	0.87			
H	Ctenochaetus strigosus	15	Nanakuli 2	5	75.99			
H	Ctenochaetus strigosus	15	Nanakuli 2	1	26.84			
H	Zebrasoma flavescens	15	Nanakuli 2	4	213.12			
H	Zebrasoma flavescens	15	Nanakuli 2	1	1.69			
H	Naso lituratus	15	Nanakuli 2	1	205.99	158	36662.95	88.5
O	Stegastes fasciolatus	15	Nanakuli 2	6	88.58			
O	Melichthys niger	15	Nanakuli 2	1	163.34			
O	Cantherhines sandwichiensis	15	Nanakuli 2	1	82.05			
O	Canthigaster jactator	15	Nanakuli 2	4	14.25	12	348.21	0.8
P	Chaetodon miliaris	15	Nanakuli 2	1	33.05			
P	Naso hexacanthus	15	Nanakuli 2	1	73.36	2	106.41	0.3
		15	Nanakuli 2	248	41405.69	248	41405.69	100
C	Myripristis amaenus	16	KAHE PIPE	32	2626.65			
C	Myripristis amaenus	16	KAHE PIPE	30	1272.10			
C	Myripristis amaenus	16	KAHE PIPE	33	4646.68			
C	Fistularia commersoni	16	KAHE PIPE	1	253.56			
C	Decapterus macarellus	16	KAHE PIPE	90	7510.02			
C	Decapterus macarellus	16	KAHE PIPE	120	22996.02			
C	Parupeneus pleurostigma	16	KAHE PIPE	3	174.02			
C	Parupeneus multifasciatus	16	KAHE PIPE	4	942.99			
C	Forcipiger flavissimus	16	KAHE PIPE	2	18.30			
C	Chaetodon lunula	16	KAHE PIPE	3	107.98			
C	Labroides phthirophagus	16	KAHE PIPE	4	2.51			
C	Thalassoma duperrey	16	KAHE PIPE	75	4121.17			
C	Thalassoma duperrey	16	KAHE PIPE	29	4552.78			
C	Thalassoma duperrey	16	KAHE PIPE	135	13102.02			
C	Thalassoma fuscum	16	KAHE PIPE	3	327.67			
C	Gomphosus varius	16	KAHE PIPE	5	113.00			
C	Anampses cuvier	16	KAHE PIPE	1	288.32			
C	Anampses cuvier	16	KAHE PIPE	1	115.17			

12-Aug-10

GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Halichoeres ornatissimus	16	KAHE PIPE	9	226.23			
C	Zanclus cornutus	16	KAHE PIPE	3	312.47			
C	Alutera scripta	16	KAHE PIPE	3	7213.49	586	70923.16	58.8
CF	Chaetodon multicinctus	16	KAHE PIPE	2	26.06	2	26.06	0.0
H	Calotomus carolinus	16	KAHE PIPE	1	1288.03			
H	Calotomus carolinus	16	KAHE PIPE	4	526.74			
H	Scarus sordidus	16	KAHE PIPE	5	3875.34			
H	Scarus sordidus	16	KAHE PIPE	3	4282.71			
H	Scarus sordidus	16	KAHE PIPE	1	367.02			
H	Scarus psittacus	16	KAHE PIPE	1	786.15			
H	Scarus psittacus	16	KAHE PIPE	18	1426.82			
H	Acanthurus nigrofuscus	16	KAHE PIPE	21	501.84			
H	Acanthurus nigrofuscus	16	KAHE PIPE	8	113.70			
H	Acanthurus nigrofuscus	16	KAHE PIPE	35	1898.84			
H	Acanthurus olivaceus	16	KAHE PIPE	3	785.00			
H	Ctenochaetus strigosus	16	KAHE PIPE	7	461.05			
H	Ctenochaetus strigosus	16	KAHE PIPE	9	241.60	116	16554.85	13.7
O	Stegastes fasciolatus	16	KAHE PIPE	21	545.59			
O	Melichthys vidua	16	KAHE PIPE	2	398.06			
O	Cantherhines sandwichiensis	16	KAHE PIPE	1	131.57			
O	Canthigaster jactator	16	KAHE PIPE	6	21.37	30	1096.59	0.9
P	Chaetodon miliaris	16	KAHE PIPE	1	33.05			
P	Dascyllus albisella	16	KAHE PIPE	17	52.50			
P	Abudefduf abdominalis	16	KAHE PIPE	95	4450.93			
P	Abudefduf viagiensis	16	KAHE PIPE	230	10775.94			
P	Chromis vanderbilti	16	KAHE PIPE	72	22.74			
P	Chromis ovalis	16	KAHE PIPE	350	4045.88			
P	Naso brevirostris	16	KAHE PIPE	55	10490.92			
P	Naso brevirostris	16	KAHE PIPE	30	2200.74	850	32072.70	26.6
		16	KAHE PIPE	1584	120673.36	1584	120673.36	100

29 OCTOBER 2010 FIELD DATA

29-Oct-10

GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	1	EAST - 1	3	707.24			
C	Parupeneus multifasciatus	1	EAST - 1	5	777.11			
C	Parupeneus multifasciatus	1	EAST - 1	1	340.44			
C	Parupeneus bifasciatus	1	EAST - 1	1	553.06			
C	Paracirrhites arcatus	1	EAST - 1	3	24.35			
C	Thalassoma duperrey	1	EAST - 1	9	873.47			
C	Thalassoma duperrey	1	EAST - 1	5	274.74			
C	Thalassoma purpureum	1	EAST - 1	4	43.01			
C	Coris gaimard	1	EAST - 1	1	8.57			
C	Stethojulis balteata	1	EAST - 1	2	28.82			
C	Stethojulis balteata	1	EAST - 1	3	107.29			
C	Rhinecanthus rectangulus	1	EAST - 1	1	144.65			
C	Rhinecanthus rectangulus	1	EAST - 1	1	85.87	39	3968.63	20.7
H	Acanthurus triostegus	1	EAST - 1	14	2626.43			
H	Acanthurus triostegus	1	EAST - 1	11	509.47			
H	Acanthurus nigrofuscus	1	EAST - 1	6	325.51			
H	Acanthurus olivaceus	1	EAST - 1	12	1962.20			
H	Acanthurus olivaceus	1	EAST - 1	13	5111.73			
H	Acanthurus olivaceus	1	EAST - 1	4	3106.42			
H	Acanthurus dussumieri	1	EAST - 1	1	564.35			
H	Acanthurus blochii	1	EAST - 1	1	996.55	62	15202.65	79.3
O	Canthigaster jactator	1	EAST - 1	3	10.69	3	10.69	0.1
		1	EAST - 1	104	19181.97	104	19181.97	100
C	Parupeneus multifasciatus	2	EAST - 2	2	192.16			
C	Plectroglyphidodon imparipennis	2	EAST - 2	1	0.86			
C	Paracirrhites arcatus	2	EAST - 2	4	32.47			
C	Thalassoma duperrey	2	EAST - 2	2	194.10			
C	Thalassoma duperrey	2	EAST - 2	19	212.10			
C	Thalassoma duperrey	2	EAST - 2	20	1098.98			
C	Thalassoma duperrey	2	EAST - 2	29	794.32			
C	Coris gaimard	2	EAST - 2	1	139.13			
C	Stethojulis balteata	2	EAST - 2	5	178.82			
C	Halichoeres ornatissimus	2	EAST - 2	1	16.45			
C	Halichoeres ornatissimus	2	EAST - 2	1	25.14			
C	Rhinecanthus rectangulus	2	EAST - 2	1	85.87	86	2970.41	26.3
CF	Chaetodon quadrimaculatus	2	EAST - 2	1	25.30			
CF	Pervagor spilosoma	2	EAST - 2	1	9.75	2	35.06	0.3
H	Acanthurus nigrofuscus	2	EAST - 2	44	625.36			
H	Acanthurus nigrofuscus	2	EAST - 2	58	1386.03			
H	Acanthurus olivaceus	2	EAST - 2	10	3932.10			
H	Acanthurus olivaceus	2	EAST - 2	1	0.69			
H	Acanthurus olivaceus	2	EAST - 2	3	2329.81	116	8273.99	73.3
O	Canthigaster jactator	2	EAST - 2	4	14.25	4	14.25	0.1
		2	EAST - 2	208	11293.71	208	11293.71	100
C	Parupeneus multifasciatus	3	EAST - 3	3	163.20			
C	Forcipiger flavissimus	3	EAST - 3	2	18.30			
C	Plectroglyphidodon johnstonianus	3	EAST - 3	3	5.17			
C	Paracirrhites arcatus	3	EAST - 3	5	40.59			
C	Labroides phthirophagus	3	EAST - 3	1	0.63			
C	Thalassoma duperrey	3	EAST - 3	13	356.08			
C	Thalassoma duperrey	3	EAST - 3	13	714.34			
C	Thalassoma duperrey	3	EAST - 3	6	66.98			
C	Thalassoma duperrey	3	EAST - 3	2	194.10			
C	Gomphosus varius	3	EAST - 3	1	22.60			
C	Gomphosus varius	3	EAST - 3	1	11.04			
C	Coris gaimard	3	EAST - 3	1	139.13			
C	Coris gaimard	3	EAST - 3	2	91.98			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Stethojulis balteata	3	EAST - 3	1	35.76			
C	Macropharyngodon geoffroy	3	EAST - 3	2	37.26			
C	Macropharyngodon geoffroy	3	EAST - 3	1	42.90			
C	Halichoeres ornatissimus	3	EAST - 3	2	32.90			
C	Halichoeres ornatissimus	3	EAST - 3	3	75.41			
C	Balistes polylepis	3	EAST - 3	1	623.45			
C	Sufflamen bursa	3	EAST - 3	3	257.62			
C	Sufflamen fraenatus	3	EAST - 3	1	224.79	67	3154.24	32.0
CF	Chaetodon ornatissimus	3	EAST - 3	2	138.00			
CF	Chaetodon multicinctus	3	EAST - 3	2	26.06	4	164.06	1.7
H	Calotomus carolinus	3	EAST - 3	1	13.46			
H	Acanthurus nigrofuscus	3	EAST - 3	39	554.30			
H	Acanthurus nigrofuscus	3	EAST - 3	35	836.40			
H	Acanthurus olivaceus	3	EAST - 3	10	3932.10			
H	Acanthurus blochii	3	EAST - 3	2	195.95			
H	Acanthurus blochii	3	EAST - 3	1	330.67			
H	Ctenochaetus strigosus	3	EAST - 3	2	15.15			
H	Zebrasoma flavescens	3	EAST - 3	2	106.56	92	5984.59	60.7
O	Stegastes fasciolatus	3	EAST - 3	11	162.40			
O	Melichthys vidua	3	EAST - 3	1	296.24			
O	Cantherhines sandwichiensis	3	EAST - 3	1	82.05			
O	Canthigaster jactator	3	EAST - 3	2	7.12	15	547.81	5.6
P	Chromis vanderbilti	3	EAST - 3	5	1.58	5	1.58	0.02
		3	EAST - 3	183	9852.28	183	9852.28	100
C	Gymnothorax meleagris	4	EAST - 4	1	1814.37			
C	Apogon kallopterus	4	EAST - 4	6	205.00			
C	Parupeneus multifasciatus	4	EAST - 4	1	11.05			
C	Plectroglyphidodon johnstonianus	4	EAST - 4	1	1.72			
C	Paracirrhites arcatus	4	EAST - 4	5	40.59			
C	Paracirrhites forsteri	4	EAST - 4	1	39.65			
C	Bodianus bilunulatus	4	EAST - 4	1	15.53			
C	Labroides phthirophagus	4	EAST - 4	1	0.63			
C	Thalassoma duperrey	4	EAST - 4	3	291.16			
C	Thalassoma duperrey	4	EAST - 4	5	274.74			
C	Thalassoma duperrey	4	EAST - 4	17	465.64			
C	Thalassoma duperrey	4	EAST - 4	25	279.08			
C	Coris venusta	4	EAST - 4	3	28.16			
C	Coris gaimard	4	EAST - 4	1	215.88			
C	Pseudojuloides cerasinus	4	EAST - 4	1	3.15			
C	Stethojulis balteata	4	EAST - 4	3	107.29			
C	Stethojulis balteata	4	EAST - 4	1	72.39			
C	Halichoeres ornatissimus	4	EAST - 4	3	49.35			
C	Rhinecanthus rectangulus	4	EAST - 4	2	171.75			
C	Ostracion meleagris	4	EAST - 4	1	13.75	82	4100.87	31.1
H	Acanthurus triostegus	4	EAST - 4	17	3189.23			
H	Acanthurus triostegus	4	EAST - 4	8	800.11			
H	Acanthurus nigrofuscus	4	EAST - 4	31	740.81			
H	Acanthurus nigrofuscus	4	EAST - 4	31	440.59			
H	Acanthurus olivaceus	4	EAST - 4	5	2815.85	92	7986.60	60.6
O	Melichthys niger	4	EAST - 4	3	490.01			
O	Melichthys vidua	4	EAST - 4	3	597.09	6	1087.10	8.2
P	Chromis vanderbilti	4	EAST - 4	15	4.74	15	4.74	0.04
		4	EAST - 4	195	13179.31	195	13179.31	100
C	Adioryx spinifer	5	Ko Olina 1	1	1219.20			
C	Cephalopholis argus	5	Ko Olina 1	1	229.32			
C	Monotaxis grandoculis	5	Ko Olina 1	1	0.00			
C	Monotaxis grandoculis	5	Ko Olina 1	4	139.16			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	5	Ko Olina 1	2	108.80			
C	Parupeneus multifasciatus	5	Ko Olina 1	1	11.05			
C	Parupeneus bifasciatus	5	Ko Olina 1	1	29.20			
C	Parupeneus bifasciatus	5	Ko Olina 1	1	59.77			
C	Parupeneus bifasciatus	5	Ko Olina 1	1	176.01			
C	Forcipiger flavissimus	5	Ko Olina 1	1	9.15			
C	Chaetodon lunula	5	Ko Olina 1	2	71.99			
C	Plectroglyphidodon johnstonianus	5	Ko Olina 1	4	6.89			
C	Paracirrhites arcatus	5	Ko Olina 1	1	8.12			
C	Cirrhitops fasciatus	5	Ko Olina 1	1	8.23			
C	Bodianus bilunulatus	5	Ko Olina 1	1	133.12			
C	Thalassoma duperrey	5	Ko Olina 1	22	1208.88			
C	Thalassoma duperrey	5	Ko Olina 1	13	356.08			
C	Thalassoma duperrey	5	Ko Olina 1	7	78.14			
C	Thalassoma ballieui	5	Ko Olina 1	1	167.53			
C	Gomphosus varius	5	Ko Olina 1	5	55.21			
C	Gomphosus varius	5	Ko Olina 1	1	22.60			
C	Stethojulis balteata	5	Ko Olina 1	4	143.05			
C	Stethojulis balteata	5	Ko Olina 1	1	72.39			
C	Zanclus cornutus	5	Ko Olina 1	1	104.16			
C	Sufflamen bursa	5	Ko Olina 1	3	257.62	81	4675.65	23.9
CF	Chaetodon unimaculatus	5	Ko Olina 1	2	50.61			
CF	Chaetodon ornatissimus	5	Ko Olina 1	4	276.01			
CF	Chaetodon multicinctus	5	Ko Olina 1	6	78.18	12	404.80	2.1
H	Calotomus carolinus	5	Ko Olina 1	1	34.69			
H	Calotomus carolinus	5	Ko Olina 1	1	339.30			
H	Scarus sordidus	5	Ko Olina 1	4	560.02			
H	Scarus psittacus	5	Ko Olina 1	6	869.64			
H	Scarus psittacus	5	Ko Olina 1	9	713.41			
H	Scarus psittacus	5	Ko Olina 1	9	340.85			
H	Scarus rubroviolaceus	5	Ko Olina 1	1	232.75			
H	Acanthurus triostegus	5	Ko Olina 1	11	509.47			
H	Acanthurus leucopareius	5	Ko Olina 1	7	928.90			
H	Acanthurus nigrofuscus	5	Ko Olina 1	45	1075.37			
H	Acanthurus nigrofuscus	5	Ko Olina 1	7	379.77			
H	Acanthurus nigroris	5	Ko Olina 1	1	14.21			
H	Acanthurus olivaceus	5	Ko Olina 1	6	1570.00			
H	Acanthurus olivaceus	5	Ko Olina 1	5	817.58			
H	Acanthurus blochii	5	Ko Olina 1	3	87.09			
H	Ctenochaetus strigosus	5	Ko Olina 1	40	2634.60			
H	Ctenochaetus strigosus	5	Ko Olina 1	23	617.41			
H	Zebrasoma flavescens	5	Ko Olina 1	1	26.03			
H	Zebrasoma flavescens	5	Ko Olina 1	2	3.38			
H	Naso lituratus	5	Ko Olina 1	1	448.94			
H	Naso lituratus	5	Ko Olina 1	1	622.36			
H	Naso lituratus	5	Ko Olina 1	5	638.67	189	13464.44	68.7
O	Stegastes fasciolatus	5	Ko Olina 1	12	177.16			
O	Melichthys niger	5	Ko Olina 1	4	653.34			
O	Melichthys vidua	5	Ko Olina 1	1	199.03			
O	Canthigaster jactator	5	Ko Olina 1	7	24.93	24	1054.47	5.4
P	Chromis vanderbilti	5	Ko Olina 1	9	2.84	9	2.84	0.01
		5	Ko Olina 1	315	19602.19	315	19602.19	100
C	Adioryx spinifer	6	Ko Olina 2	1	493.41			
C	Parupeneus multifasciatus	6	Ko Olina 2	2	471.50			
C	Parupeneus multifasciatus	6	Ko Olina 2	1	340.44			
C	Parupeneus multifasciatus	6	Ko Olina 2	1	96.08			
C	Parupeneus multifasciatus	6	Ko Olina 2	1	155.42			
C	Forcipiger flavissimus	6	Ko Olina 2	1	9.15			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Chaetodon lunula	6	Ko Olina 2	2	71.99			
C	Plectroglyphidodon johnstonianus	6	Ko Olina 2	3	5.17			
C	Plectroglyphidodon imparipennis	6	Ko Olina 2	2	1.72			
C	Paracirrhites arcatus	6	Ko Olina 2	3	24.35			
C	Cirrhitus pinnulatus	6	Ko Olina 2	1	90.86			
C	Labroides phthirophagus	6	Ko Olina 2	3	1.88			
C	Thalassoma duperrey	6	Ko Olina 2	16	438.25			
C	Thalassoma duperrey	6	Ko Olina 2	3	291.16			
C	Thalassoma duperrey	6	Ko Olina 2	10	549.49			
C	Gomphosus varius	6	Ko Olina 2	1	11.04			
C	Stethojulis balteata	6	Ko Olina 2	1	35.76			
C	Halichoeres ornatissimus	6	Ko Olina 2	2	32.90			
C	Zanclus cornutus	6	Ko Olina 2	2	208.32			
C	Sufflamen bursa	6	Ko Olina 2	3	257.62	59	3586.52	14.6
CF	Chaetodon unimaculatus	6	Ko Olina 2	4	101.22			
CF	Chaetodon ornatissimus	6	Ko Olina 2	2	273.78			
CF	Chaetodon ornatissimus	6	Ko Olina 2	2	138.00			
CF	Chaetodon quadrimaculatus	6	Ko Olina 2	2	50.61	10	563.61	2.3
H	Calotomus carolinus	6	Ko Olina 2	1	72.28			
H	Scarus rubroviolaceus	6	Ko Olina 2	2	984.40			
H	Scarus rubroviolaceus	6	Ko Olina 2	1	673.75			
H	Scarus rubroviolaceus	6	Ko Olina 2	1	1472.49			
H	Acanthurus triostegus	6	Ko Olina 2	18	309.00			
H	Acanthurus triostegus	6	Ko Olina 2	26	2600.37			
H	Acanthurus triostegus	6	Ko Olina 2	36	1667.34			
H	Acanthurus leucopareius	6	Ko Olina 2	1	132.70			
H	Acanthurus leucopareius	6	Ko Olina 2	1	232.68			
H	Acanthurus nigrofuscus	6	Ko Olina 2	19	454.04			
H	Acanthurus nigrofuscus	6	Ko Olina 2	12	170.55			
H	Acanthurus nigroris	6	Ko Olina 2	3	516.89			
H	Acanthurus olivaceus	6	Ko Olina 2	7	3942.19			
H	Acanthurus olivaceus	6	Ko Olina 2	16	2616.26			
H	Acanthurus blochii	6	Ko Olina 2	1	56.70			
H	Acanthurus blochii	6	Ko Olina 2	2	195.95			
H	Ctenochaetus strigosus	6	Ko Olina 2	1	7.58			
H	Ctenochaetus strigosus	6	Ko Olina 2	1	0.87			
H	Ctenochaetus strigosus	6	Ko Olina 2	10	658.65			
H	Ctenochaetus strigosus	6	Ko Olina 2	9	1189.20			
H	Ctenochaetus strigosus	6	Ko Olina 2	4	107.38			
H	Zebrasoma flavescens	6	Ko Olina 2	1	9.48			
H	Zebrasoma flavescens	6	Ko Olina 2	7	182.21			
H	Naso lituratus	6	Ko Olina 2	2	411.98			
H	Naso lituratus	6	Ko Olina 2	1	622.36	183	19287.31	78.6
O	Stegastes fasciolatus	6	Ko Olina 2	9	132.87			
O	Melichthys niger	6	Ko Olina 2	3	490.01			
O	Cantherhines sandwichiensis	6	Ko Olina 2	1	82.05			
O	Canthigaster jactator	6	Ko Olina 2	4	14.25	17	719.18	2.9
P	Abudefduf abdominalis	6	Ko Olina 2	12	375.99			
P	Chromis vanderbilti	6	Ko Olina 2	12	3.79			
P	Chromis hanui	6	Ko Olina 2	1	0.75	25	380.53	1.6
		6	Ko Olina 2	294	24537.14	294	24537.14	100
C	Myripristis amaenus	7	KAHE 1-D	3	246.25			
C	Myripristis amaenus	7	KAHE 1-D	6	254.42			
C	Monotaxis grandoculis	7	KAHE 1-D	1	34.79			
C	Mulloides vanicolensis	7	KAHE 1-D	250	12629.55			
C	Parupeneus multifasciatus	7	KAHE 1-D	1	27.12			
C	Parupeneus multifasciatus	7	KAHE 1-D	1	54.40			
C	Forcipiger flavissimus	7	KAHE 1-D	1	9.15			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Plectroglyphidodon johnstonianus	7	KAHE 1-D	5	8.61			
C	Plectroglyphidodon imparipennis	7	KAHE 1-D	3	2.59			
C	Paracirrhites arcatus	7	KAHE 1-D	1	8.12			
C	Paracirrhites forsteri	7	KAHE 1-D	1	39.65			
C	Cirrhitus pinnulatus	7	KAHE 1-D	1	90.86			
C	Labroides phthirophagus	7	KAHE 1-D	2	1.26			
C	Thalassoma duperrey	7	KAHE 1-D	63	3461.78			
C	Thalassoma duperrey	7	KAHE 1-D	17	1649.88			
C	Thalassoma duperrey	7	KAHE 1-D	57	1561.26			
C	Thalassoma ballieui	7	KAHE 1-D	1	102.61			
C	Gomphosus varius	7	KAHE 1-D	1	22.60			
C	Gomphosus varius	7	KAHE 1-D	5	55.21			
C	Stethojulis balteata	7	KAHE 1-D	3	43.23			
C	Stethojulis balteata	7	KAHE 1-D	2	71.53			
C	Zanclus cornutus	7	KAHE 1-D	1	54.90			
C	Rhinecanthus rectangulus	7	KAHE 1-D	1	85.87			
C	Sufflamen bursa	7	KAHE 1-D	2	171.75			
C	Sufflamen bursa	7	KAHE 1-D	1	45.36			
C	Ostracion meleagris	7	KAHE 1-D	1	6.76	431	20739.48	42.3
CF	Cantherhines dumerili	7	KAHE 1-D	1	117.96	1	117.96	0.2
H	Scarus sordidus	7	KAHE 1-D	1	76.01			
H	Scarus psittacus	7	KAHE 1-D	47	1780.01			
H	Acanthurus triostegus	7	KAHE 1-D	7	324.21			
H	Acanthurus nigrofuscus	7	KAHE 1-D	40	955.88			
H	Ctenochaetus strigosus	7	KAHE 1-D	10	268.44			
H	Ctenochaetus strigosus	7	KAHE 1-D	4	263.46	109	3668.01	7.5
O	Stegastes fasciolatus	7	KAHE 1-D	5	73.82			
O	Melichthys niger	7	KAHE 1-D	148	24173.65			
O	Melichthys vidua	7	KAHE 1-D	1	199.03			
O	Canthigaster jactator	7	KAHE 1-D	5	17.81			
O	Canthigaster rivulata	7	KAHE 1-D	1	13.65	160	24477.96	49.9
P	Chromis vanderbilti	7	KAHE 1-D	42	13.27	42	13.27	0.03
		7	KAHE 1-D	743	49016.68	743	49016.68	100
C	Aulostomus chinensis	8	KAHE 5 -B	1	52.00			
C	Aulostomus chinensis	8	KAHE 5 -B	1	112.28			
C	Parupeneus multifasciatus	8	KAHE 5 -B	1	96.08			
C	Parupeneus multifasciatus	8	KAHE 5 -B	2	108.80			
C	Parupeneus multifasciatus	8	KAHE 5 -B	1	155.42			
C	Parupeneus multifasciatus	8	KAHE 5 -B	2	54.23			
C	Plectroglyphidodon johnstonianus	8	KAHE 5 -B	6	10.33			
C	Plectroglyphidodon imparipennis	8	KAHE 5 -B	2	1.72			
C	Paracirrhites arcatus	8	KAHE 5 -B	4	32.47			
C	Thalassoma duperrey	8	KAHE 5 -B	13	145.12			
C	Thalassoma duperrey	8	KAHE 5 -B	18	493.03			
C	Thalassoma duperrey	8	KAHE 5 -B	3	291.16			
C	Thalassoma duperrey	8	KAHE 5 -B	4	219.80			
C	Gomphosus varius	8	KAHE 5 -B	1	39.39			
C	Coris venusta	8	KAHE 5 -B	1	23.64			
C	Coris venusta	8	KAHE 5 -B	1	48.38			
C	Stethojulis balteata	8	KAHE 5 -B	2	144.78			
C	Stethojulis balteata	8	KAHE 5 -B	1	35.76			
C	Macropharyngodon geoffroy	8	KAHE 5 -B	1	18.63			
C	Macropharyngodon geoffroy	8	KAHE 5 -B	2	11.50			
C	Anampses chrysocephalus	8	KAHE 5 -B	1	98.66			
C	Halichoeres ornatissimus	8	KAHE 5 -B	3	49.35			
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	2	39.85			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Sufflamen bursa	8	KAHE 5 -B	4	343.49	80	2920.06	60.4
CF	Chaetodon multicinctus	8	KAHE 5 -B	1	13.03			
CF	Pervagor melanocephalus	8	KAHE 5 -B	1	5.23	2	18.26	0.4
H	Scarus sordidus	8	KAHE 5 -B	2	27.46			
H	Scarus psittacus	8	KAHE 5 -B	12	175.37			
H	Scarus psittacus	8	KAHE 5 -B	2	75.75			
H	Acanthurus nigrofuscus	8	KAHE 5 -B	29	693.01			
H	Acanthurus nigrofuscus	8	KAHE 5 -B	20	284.25			
H	Acanthurus olivaceus	8	KAHE 5 -B	2	187.54			
H	Acanthurus olivaceus	8	KAHE 5 -B	4	78.97			
H	Ctenochaetus strigosus	8	KAHE 5 -B	1	7.58			
H	Naso lituratus	8	KAHE 5 -B	1	4.24			
H	Naso lituratus	8	KAHE 5 -B	2	16.93			
H	Naso unicornis	8	KAHE 5 -B	4	21.74	79	1572.85	32.6
O	Stegastes fasciolatus	8	KAHE 5 -B	5	73.82			
O	Melichthys vidua	8	KAHE 5 -B	1	199.03			
O	Canthigaster jactator	8	KAHE 5 -B	5	17.81			
O	Canthigaster jactator	8	KAHE 5 -B	1	1.23	12	291.88	6.0
P	Chromis vanderbilti	8	KAHE 5 -B	89	28.11	89	28.11	0.6
		8	KAHE 5 -B	262	4831.17	262	4831.17	100
C	Gymnothorax meleagris	9	KAHE 7 -B	1	73.65			
C	Mulloides flavolineatus	9	KAHE 7 -B	394	143892.32			
C	Parupeneus multifasciatus	9	KAHE 7 -B	1	27.12			
C	Parupeneus multifasciatus	9	KAHE 7 -B	3	288.24			
C	Parupeneus cyclostomus	9	KAHE 7 -B	1	49.96			
C	Paracirrhites arcatus	9	KAHE 7 -B	3	24.35			
C	Labroides phthirophagus	9	KAHE 7 -B	1	0.63			
C	Thalassoma duperrey	9	KAHE 7 -B	3	82.17			
C	Thalassoma duperrey	9	KAHE 7 -B	3	164.85			
C	Thalassoma duperrey	9	KAHE 7 -B	1	97.05			
C	Stethojulis balteata	9	KAHE 7 -B	1	72.39			
C	Macropharyngodon geoffroy	9	KAHE 7 -B	3	17.24			
C	Zanclus cornutus	9	KAHE 7 -B	1	24.04			
C	Sufflamen bursa	9	KAHE 7 -B	5	429.37	421	145243.39	99.5
CF	Chaetodon multicinctus	9	KAHE 7 -B	2	1.65	2	1.65	0.001
H	Calotomus carolinus	9	KAHE 7 -B	1	339.30			
H	Acanthurus nigrofuscus	9	KAHE 7 -B	4	30.10			
H	Acanthurus nigrofuscus	9	KAHE 7 -B	4	95.59			
H	Acanthurus blochii	9	KAHE 7 -B	1	29.03			
H	Ctenochaetus strigosus	9	KAHE 7 -B	1	0.87			
H	Naso unicornis	9	KAHE 7 -B	1	5.44			
H	Naso unicornis	9	KAHE 7 -B	1	38.92	13	539.25	0.4
O	Melichthys vidua	9	KAHE 7 -B	1	199.03			
O	Canthigaster jactator	9	KAHE 7 -B	2	7.12	3	206.15	0.1
P	Dascyllus albisella	9	KAHE 7 -B	4	12.35			
P	Dascyllus albisella	9	KAHE 7 -B	8	6.43			
P	Chromis vanderbilti	9	KAHE 7 -B	15	4.74			
P	Chromis hanui	9	KAHE 7 -B	1	0.75	28	24.27	0.02
		9	KAHE 7 -B	467	146014.72	467	146014.72	100
C	Parupeneus pleurostigma	10	KAHE 7 -C	1	98.25			
C	Parupeneus multifasciatus	10	KAHE 7 -C	1	155.42			
C	Parupeneus multifasciatus	10	KAHE 7 -C	2	192.16			
C	Parupeneus multifasciatus	10	KAHE 7 -C	1	340.44			
C	Paracirrhites arcatus	10	KAHE 7 -C	1	8.12			
C	Bodianus bilunulatus	10	KAHE 7 -C	1	648.58			
C	Cheilinus bimaculatus	10	KAHE 7 -C	1	4.10			
C	Thalassoma duperrey	10	KAHE 7 -C	2	194.10			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Thalassoma duperrey	10	KAHE 7 -C	2	109.90			
C	Thalassoma duperrey	10	KAHE 7 -C	2	54.78			
C	Pseudojuloides cerasinus	10	KAHE 7 -C	1	3.15			
C	Halichoeres ornatissimus	10	KAHE 7 -C	1	16.45			
C	Zanclus cornutus	10	KAHE 7 -C	1	104.16			
C	Sufflamen bursa	10	KAHE 7 -C	6	515.24	23	2444.86	58.7
CF	Chaetodon multicinctus	10	KAHE 7 -C	2	26.06			
CF	Chaetodon multicinctus	10	KAHE 7 -C	1	0.83	3	26.89	0.6
H	Acanthurus triostegus	10	KAHE 7 -C	4	400.06			
H	Acanthurus nigrofuscus	10	KAHE 7 -C	1	7.52			
H	Acanthurus olivaceus	10	KAHE 7 -C	1	163.52			
H	Acanthurus olivaceus	10	KAHE 7 -C	7	656.38			
H	Acanthurus blochii	10	KAHE 7 -C	2	58.06			
H	Naso unicornis	10	KAHE 7 -C	1	5.44	16	1290.98	31.0
O	Melichthys vidua	10	KAHE 7 -C	2	398.06	2	398.06	9.6
P	Chromis vanderbilti	10	KAHE 7 -C	13	4.11	13	4.11	0.1
		10	KAHE 7 -C	57	4164.89	57	4164.89	100
C	Plectroglyphidodon johnstonianus	11	KAHE 7 -D	2	1.72			
C	Paracirrhites arcatus	11	KAHE 7 -D	1	8.12			
C	Paracirrhites arcatus	11	KAHE 7 -D	1	16.35			
C	Cheilinus bimaculatus	11	KAHE 7 -D	1	9.63			
C	Thalassoma duperrey	11	KAHE 7 -D	3	9.45			
C	Coris venusta	11	KAHE 7 -D	1	48.38			
C	Pseudojuloides cerasinus	11	KAHE 7 -D	1	3.15			
C	Sufflamen bursa	11	KAHE 7 -D	1	85.87			
C	Sufflamen fraenatus	11	KAHE 7 -D	1	224.79	12	407.47	63.9
H	Acanthurus nigrofuscus	11	KAHE 7 -D	1	7.52	1	7.52	1.2
O	Melichthys vidua	11	KAHE 7 -D	1	199.03			
O	Canthigaster coronata	11	KAHE 7 -D	2	15.18			
O	Canthigaster jactator	11	KAHE 7 -D	1	2.21	4	216.42	33.9
P	Chromis vanderbilti	11	KAHE 7 -D	21	6.63	21	6.63	1.0
		11	KAHE 7 -D	38	638.05	38	638.05	100
C	Aulostomus chinensis	12	KAHE 7 - E	1	4.76			
C	Fistularia commersoni	12	KAHE 7 - E	1	24.67			
C	Parupeneus pleurostigma	12	KAHE 7 - E	1	30.44			
C	Parupeneus multifasciatus	12	KAHE 7 - E	2	54.23			
C	Parupeneus multifasciatus	12	KAHE 7 - E	17	187.88			
C	Parupeneus multifasciatus	12	KAHE 7 - E	1	54.40			
C	Parupeneus multifasciatus	12	KAHE 7 - E	1	96.08			
C	Forcipiger flavissimus	12	KAHE 7 - E	2	18.30			
C	Plectroglyphidodon johnstonianus	12	KAHE 7 - E	2	1.72			
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	2	8.20			
C	Pseudocheilinus octotaenia	12	KAHE 7 - E	1	14.41			
C	Thalassoma duperrey	12	KAHE 7 - E	2	109.90			
C	Thalassoma duperrey	12	KAHE 7 - E	2	54.78			
C	Thalassoma duperrey	12	KAHE 7 - E	2	194.10			
C	Coris venusta	12	KAHE 7 - E	2	47.27			
C	Coris gaimard	12	KAHE 7 - E	1	8.57			
C	Pseudojuloides cerasinus	12	KAHE 7 - E	2	22.33			
C	Pseudojuloides cerasinus	12	KAHE 7 - E	9	28.35			
C	Stethojulis balteata	12	KAHE 7 - E	2	71.53			
C	Macropharyngodon geoffroy	12	KAHE 7 - E	4	22.99			
C	Macropharyngodon geoffroy	12	KAHE 7 - E	1	18.63			
C	Anampses chrysocephalus	12	KAHE 7 - E	12	31.54			
C	Sufflamen bursa	12	KAHE 7 - E	4	343.49			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Sufflamen fraenatus	12	KAHE 7 - E	1	623.45			
C	Sufflamen fraenatus	12	KAHE 7 - E	1	144.65	83	2269.13	50.1
CF	Chaetodon multicinctus	12	KAHE 7 - E	3	19.97			
CF	Chaetodon multicinctus	12	KAHE 7 - E	6	4.96	9	24.93	0.6
H	Scarus sordidus	12	KAHE 7 - E	1	3.53			
H	Scarus psittacus	12	KAHE 7 - E	4	58.46			
H	Acanthurus nigrofuscus	12	KAHE 7 - E	14	14.61			
H	Acanthurus nigrofuscus	12	KAHE 7 - E	15	112.87			
H	Acanthurus olivaceus	12	KAHE 7 - E	2	786.42			
H	Ctenochaetus strigosus	12	KAHE 7 - E	4	3.49			
H	Naso lituratus	12	KAHE 7 - E	6	2.97			
H	Naso lituratus	12	KAHE 7 - E	3	12.72			
H	Naso unicornis	12	KAHE 7 - E	1	525.26			
H	Naso unicornis	12	KAHE 7 - E	7	38.05	57	1558.37	34.4
O	Melichthys niger	12	KAHE 7 - E	2	326.67			
O	Melichthys vidua	12	KAHE 7 - E	1	199.03			
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	14.25	10	601.17	13.3
P	Chaetodon kleini	12	KAHE 7 - E	2	1.77			
P	Chromis vanderbilti	12	KAHE 7 - E	147	46.44			
P	Naso hexacanthus	12	KAHE 7 - E	23	17.46			
P	Naso brevirostris	12	KAHE 7 - E	3	7.20	175	72.87	1.6
		12	KAHE 7 - E	334	4526.46	334	4526.46	100
C	Aulostomus chinensis	13	KAHE 10	1	88.50			
C	Lutjanus kasmira	13	KAHE 10	13	745.58			
C	Lutjanus kasmira	13	KAHE 10	24	7370.08			
C	Lutjanus kasmira	13	KAHE 10	34	3738.60			
C	Monotaxis grandoculis	13	KAHE 10	1	34.79			
C	Mulloides flavolineatus	13	KAHE 10	26	7002.86			
C	Parupeneus pleurostigma	13	KAHE 10	3	294.74			
C	Parupeneus multifasciatus	13	KAHE 10	1	27.12			
C	Parupeneus multifasciatus	13	KAHE 10	1	340.44			
C	Parupeneus multifasciatus	13	KAHE 10	2	108.80			
C	Parupeneus multifasciatus	13	KAHE 10	2	310.84			
C	Parupeneus bifasciatus	13	KAHE 10	1	107.31			
C	Parupeneus cyclostomus	13	KAHE 10	1	24.80			
C	Chaetodon lunula	13	KAHE 10	2	71.99			
C	Plectroglyphidodon imparipennis	13	KAHE 10	4	3.45			
C	Paracirrhites arcatus	13	KAHE 10	3	24.35			
C	Cirrhitops fasciatus	13	KAHE 10	1	8.23			
C	Labroides phthirophagus	13	KAHE 10	1	0.63			
C	Thalassoma duperrey	13	KAHE 10	27	1483.62			
C	Thalassoma duperrey	13	KAHE 10	31	3008.61			
C	Thalassoma duperrey	13	KAHE 10	29	794.32			
C	Thalassoma duperrey	13	KAHE 10	12	133.96			
C	Stethojulis balteata	13	KAHE 10	2	71.53			
C	Stethojulis balteata	13	KAHE 10	4	57.64			
C	Macropharyngodon geoffroy	13	KAHE 10	2	37.26			
C	Halichoeres ornatissimus	13	KAHE 10	1	25.14			
C	Zanclus cornutus	13	KAHE 10	3	72.13			
C	Sufflamen bursa	13	KAHE 10	4	343.49			
C	Sufflamen fraenatus	13	KAHE 10	1	144.65	237	26475.44	69.1
CF	Chaetodon ornatissimus	13	KAHE 10	2	138.00			
CF	Cantherhines dumerili	13	KAHE 10	1	301.33	3	439.33	1.1
H	Calotomus carolinus	13	KAHE 10	2	2576.07			
H	Acanthurus nigrofuscus	13	KAHE 10	13	310.66			
H	Acanthurus olivaceus	13	KAHE 10	12	3140.00			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
H	Acanthurus olivaceus	13	KAHE 10	3	1689.51			
H	Acanthurus blochii	13	KAHE 10	1	783.81			
H	Ctenochaetus strigosus	13	KAHE 10	1	26.84			
H	Naso lituratus	13	KAHE 10	1	311.61	33	8838.51	23.1
O	Stegastes fasciolatus	13	KAHE 10	9	132.87			
O	Melichthys vidua	13	KAHE 10	2	398.06			
O	Canthigaster jactator	13	KAHE 10	3	10.69	14	541.62	1.4
P	Dascyllus albisella	13	KAHE 10	29	89.56			
P	Abudefduf abdominalis	13	KAHE 10	50	1566.63			
P	Chromis vanderbilti	13	KAHE 10	70	22.11			
P	Chromis ovalis	13	KAHE 10	18	208.07			
P	Chromis ovalis	13	KAHE 10	24	142.36	191	2028.74	5.3
		13	KAHE 10	478	38323.64	478	38323.64	100
C	Parupeneus multifasciatus	14	Nanakuli 1	1	54.40			
C	Parupeneus multifasciatus	14	Nanakuli 1	2	22.10			
C	Plectroglyphidodon imparipennis	14	Nanakuli 1	4	3.45			
C	Thalassoma lutescens	14	Nanakuli 1	1	97.05			
C	Thalassoma duperrey	14	Nanakuli 1	4	12.60			
C	Thalassoma duperrey	14	Nanakuli 1	11	301.30			
C	Thalassoma duperrey	14	Nanakuli 1	9	100.47			
C	Thalassoma duperrey	14	Nanakuli 1	4	219.80			
C	Stethojulis balteata	14	Nanakuli 1	3	107.29			
C	Halichoeres ornatissimus	14	Nanakuli 1	1	16.45			
C	Rhinecanthus rectangulus	14	Nanakuli 1	6	515.24	46	1450.15	98.9
O	Canthigaster jactator	14	Nanakuli 1	4	14.25	4	14.25	1.0
P	Chromis vanderbilti	14	Nanakuli 1	7	2.21	7	2.21	0.2
		14	Nanakuli 1	57	1466.61	57	1466.61	100
C	Aulostomus chinensis	15	Nanakuli 2	1	210.62			
C	Parupeneus multifasciatus	15	Nanakuli 2	3	288.24			
C	Parupeneus multifasciatus	15	Nanakuli 2	1	155.42			
C	Parupeneus multifasciatus	15	Nanakuli 2	4	108.47			
C	Parupeneus multifasciatus	15	Nanakuli 2	2	108.80			
C	Plectroglyphidodon johnstonianus	15	Nanakuli 2	4	6.89			
C	Labroides phthirophagus	15	Nanakuli 2	2	2.98			
C	Thalassoma duperrey	15	Nanakuli 2	2	194.10			
C	Thalassoma duperrey	15	Nanakuli 2	9	100.47			
C	Thalassoma duperrey	15	Nanakuli 2	4	219.80			
C	Thalassoma duperrey	15	Nanakuli 2	10	273.90			
C	Thalassoma ballieui	15	Nanakuli 2	1	167.53			
C	Gomphosus varius	15	Nanakuli 2	3	33.12			
C	Coris gaimard	15	Nanakuli 2	1	83.79			
C	Stethojulis balteata	15	Nanakuli 2	1	72.39			
C	Stethojulis balteata	15	Nanakuli 2	3	43.23			
C	Stethojulis balteata	15	Nanakuli 2	5	178.82			
C	Macropharyngodon geoffroy	15	Nanakuli 2	1	42.90			
C	Macropharyngodon geoffroy	15	Nanakuli 2	1	18.63			
C	Halichoeres ornatissimus	15	Nanakuli 2	3	49.35			
C	Zanclus cornutus	15	Nanakuli 2	2	208.32			
C	Rhinecanthus rectangulus	15	Nanakuli 2	2	171.75			
C	Sufflamen bursa	15	Nanakuli 2	1	85.87	66	2825.38	46.2
CF	Chaetodon ornatissimus	15	Nanakuli 2	4	547.56			
CF	Chaetodon multicinctus	15	Nanakuli 2	6	16.80			
CF	Cantherhines dumerili	15	Nanakuli 2	3	584.93	13	1149.30	18.8
H	Acanthurus leucopareius	15	Nanakuli 2	1	66.74			
H	Acanthurus nigrofuscus	15	Nanakuli 2	23	549.63			
H	Acanthurus nigrofuscus	15	Nanakuli 2	34	483.23			
H	Acanthurus blochii	15	Nanakuli 2	2	7.26			

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	GROUP BIOMASS	GROUP PERCENT
H	Ctenochaetus strigosus	15	Nanakuli 2	1	65.86			
H	Ctenochaetus strigosus	15	Nanakuli 2	3	9.26			
H	Naso lituratus	15	Nanakuli 2	1	311.61	65	1493.61	24.4
O	Stegastes fasciolatus	15	Nanakuli 2	12	177.16			
O	Melichthys niger	15	Nanakuli 2	2	326.67			
O	Cantherhines sandwichiensis	15	Nanakuli 2	1	131.57			
O	Canthigaster jactator	15	Nanakuli 2	4	14.25	19	649.65	10.6
P	Chromis vanderbilti	15	Nanakuli 2	5	1.58			
P	Chromis hanui	15	Nanakuli 2	1	0.75	6	2.33	0.04
		15	Nanakuli 2	169	6120.26	169	6120.26	100
C	Myripristis amaenus	16	KAHE PIPE	7	296.82			
C	Aulostomus chinensis	16	KAHE PIPE	1	88.50			
C	Aulostomus chinensis	16	KAHE PIPE	1	52.00			
C	Decapterus macarellus	16	KAHE PIPE	50	6513.95			
C	Decapterus macarellus	16	KAHE PIPE	145	39054.43			
C	Lutjanus kasmira	16	KAHE PIPE	17	157.40			
C	Lutjanus kasmira	16	KAHE PIPE	135	25737.32			
C	Monotaxis grandoculis	16	KAHE PIPE	2	27.47			
C	Mulloides flavolineatus	16	KAHE PIPE	4	1460.84			
C	Mulloides vanicolensis	16	KAHE PIPE	15	4970.63			
C	Forcipiger flavissimus	16	KAHE PIPE	1	9.15			
C	Chaetodon auriga	16	KAHE PIPE	2	96.78			
C	Paracirrhites arcatus	16	KAHE PIPE	2	16.24			
C	Labroides phthirophagus	16	KAHE PIPE	3	1.09			
C	Thalassoma duperrey	16	KAHE PIPE	16	1552.83			
C	Thalassoma duperrey	16	KAHE PIPE	19	212.10			
C	Thalassoma duperrey	16	KAHE PIPE	38	2088.06			
C	Thalassoma duperrey	16	KAHE PIPE	29	794.32			
C	Coris gaimard	16	KAHE PIPE	1	45.99			
C	Stethojulis balteata	16	KAHE PIPE	5	178.82			
C	Stethojulis balteata	16	KAHE PIPE	1	72.39			
C	Zanclus cornutus	16	KAHE PIPE	1	54.90			
C	Sufflamen bursa	16	KAHE PIPE	2	171.75			
C	Sufflamen fraenatus	16	KAHE PIPE	1	224.79	498	83878.56	75.7
H	Calotomus carolinus	16	KAHE PIPE	1	218.67			
H	Scarus dubius	16	KAHE PIPE	2	289.88			
H	Scarus sordidus	16	KAHE PIPE	1	1427.57			
H	Scarus sordidus	16	KAHE PIPE	1	775.07			
H	Scarus sordidus	16	KAHE PIPE	6	456.08			
H	Scarus sordidus	16	KAHE PIPE	3	107.98			
H	Scarus psittacus	16	KAHE PIPE	1	554.69			
H	Scarus psittacus	16	KAHE PIPE	9	1304.46			
H	Acanthurus nigrofuscus	16	KAHE PIPE	30	716.91			
H	Acanthurus blochii	16	KAHE PIPE	3	293.93			
H	Ctenochaetus strigosus	16	KAHE PIPE	25	1646.62	82	7791.87	7.0
O	Stegastes fasciolatus	16	KAHE PIPE	30	442.90			
O	Melichthys vidua	16	KAHE PIPE	1	124.35			
O	Canthigaster jactator	16	KAHE PIPE	8	28.50	39	595.74	0.5
P	Chaetodon miliaris	16	KAHE PIPE	8	169.34			
P	Dascyllus albisella	16	KAHE PIPE	13	40.15			
P	Abudefduf vaigensis	16	KAHE PIPE	40	1253.30			
P	Abudefduf abdominalis	16	KAHE PIPE	175	5483.20			
P	Chromis vanderbilti	16	KAHE PIPE	12	3.79			
P	Chromis ovalis	16	KAHE PIPE	45	520.19			
P	Chromis agilis	16	KAHE PIPE	7	10.19			
P	Naso brevirostris	16	KAHE PIPE	45	1751.60			
P	Naso brevirostris	16	KAHE PIPE	75	9233.86	420	18465.61	16.7
		16	KAHE PIPE	1039	110731.78	1039	110731.78	100