CIP GENERATION PROJECT

2009 COMMUNITY BENEFITS PROGRAM

REEF FISH MONITORING PROJECT

YEAR 2 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 second annual report for this effort covering the period from December 2007 through July 2009 with a focus on the surveys completed in 2009. 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 eight 2007-2009 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 128 species of fishes encountered in the eight 2007-2009 surveys, twenty species are herbivores, thirteen are planktivores, nine are omnivores, seven are coral feeders and 79 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). The sixteen stations geographically fall into four groups along the 7.9 km of coastline; on the southeast are four stations offshore of future 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 as well as the standing crop to be significantly greatest at the three Ko'Olina stations over those in the other three groups. Although not clearly separable thus unequivocally significant, the Ko'Olina stations also had the greatest mean number of fishes counted over the 2007-2009 sample 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 (2007-2009) 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 33 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 2007-2009 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 2009. Data were initially collected in 2008 represent the preconstruction baseline and subsequently in 2009 represent the "construction period" of the generating facility. The 2008 information was presented in Brock (2009) and the "during construction" information is 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 second annual report which covers the continuing baseline conditions since the plant was not fully operational as yet and is issued in support of this program.

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) and Brock *et al*. (1979). 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. However, the splitting of data into “preconstruction” and “during construction” 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 three 2009 surveys is given in Appendix 1 and this information is summarized in Table 2 along with the earlier (2007-2008) 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 eight 2007-2009 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 eight 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 eight 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 eight recent December 2007 - July 2009 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 surveys completed in 2009 found 106 species of fishes at these sixteen sample sites. In total among the eight surveys, 128 species of fishes have been recorded on the sixteen survey sites. Eighty-three percent of the species encountered were in common between the early (five preconstruction 2007-2008) and later (three during construction 2009) surveys. These results are not unexpected because of the greater sampling effort expended in the first five surveys relative to the later three surveys.

Of the 128 species of fishes recorded over the eight surveys at all sixteen sample sites, sixty-two percent (or 79 species) are carnivores, sixteen percent (or 20 species) are herbivores, ten percent (or 13 species) are planktivores, seven percent (or 9 species) are omnivores and five 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) for species encountered on each transect and survey date. 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 74.6% of the planktivore biomass over the six surveys (May 2008 through July 2009) 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 six surveys of this site comprised a mean of 20.3% 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 2007-09 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 the case of the mean number of fish species per transect in each of the four geographic areas, the ANOVA noted a significant difference exists and the SNK Test demonstrated that the three stations offshore of Ko'Olina have a significantly greater number of fish species than found at any of the other three station groups all of which are related. 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 present there. The ANOVA run on the mean number of individual fish censused at transects in each of the four geographic areas did find significant differences among the four groups (range in means from 200 to 328 individuals per transect) but the SNK Test noted considerable overlap among these four means suggesting that the statistical separation is not strong. Thus there are no real statistically significant differences with the mean number of individual fish per transect among the four groups of stations (Table 5 part 2). Finally, the Kruskal-Wallis ANOVA as well as the SNK Test did find statistically significant differences in the mean estimated standing crop of fishes per transect among the four station groups and the SNK Test noted that the mean standing crop of fishes per station for those stations offshore of Ko'Olina were significantly greater than the mean standing crops for at the other three station groups all of which were related (Table 5 part 3).

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). 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 both the mean number of individual fishes censused per transect and the mean estimated biomass of fishes per transect were both greater at the north group of stations (station nos.13-15) relative to the Kahe stations (station nos. 8-12) but with the mean number of fish species per transect, the Kahe group of stations had more (Kahe = 21.6 species/transect versus North = 21.1 species/transect).

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 2007-2009?" 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) provides a list of all fish species seen over the eight 2007-2009 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 2007-2009 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). Ongoing studies (Brock and Norris 1989) suggest that with the manipulation (increasing) of habitat space or food resources (Brock 1987), local 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. Finally in the July 2009 survey the standing crop at station 4 was estimated to be 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.

7. Comparative Analysis of Early HECO Biological Data to the 2007-2009 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 2007-2009 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 2007-2009 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 (2007-2009) 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 2007-2009 dataset. Despite the mean estimated standing crop (here 45 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 ($p>0.48$, 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 33-year period (1976-2009) 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 six of the eight surveys completed to date. All turtles seen were juveniles (i.e., having a carapace length estimated to be less than 75 cm). 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 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 and on the 19 March 2009 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. 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 33 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 33 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 on 30 May, 19 August and 25 November 2008 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 - July 2009 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.

					% Total Biomass (g)				
Sample Date	Transect No.	No. Species	No. Individuals	Biomass g/m2	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-08	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
12-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	

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 eight 2007-2009 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>0.65, n.s.)

Date	(n)	Mean	SNK Grouping
Jul 09	15	25.5	A
Aug 08	15	24.7	A
Nov 08	15	23.9	A
Dec 07	12	22.8	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 eight sample periods.

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

Date	(n)	Mean	SNK Grouping
Jul 09	15	355	A
Aug 08	15	270	A
Nov 08	15	265	A
Apr 08	15	255	A
Dec 07	12	246	A
May 09	15	224	A
May 08	15	222	A
Mar 09	15	195	A

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

TABLE 3. Continued.

3. Mean Total Standing Crop of Fish Per Transect (g) ($p>0.73$, n.s.)

Date	(n)	Mean Total Biomass (g)	SNK Grouping
Dec 07	12	25,969	A
Jul 09	15	19,389	A
Apr 08	15	15,984	A
Nov 08	15	14,174	A
May 09	15	13,782	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 eight 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
Grand Means		37	3	9	3	48

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
Grand Means		16	40	3	0.2	41

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 2007-2009 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	21	30.5	A
Kahe	40	21.6	B
North	24	21.1	B
CIP	32	20.2	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 first eight sample periods.

2. Mean Number of Individual Fish Per Transect by Station Group (p>0.008, Significant)

Station Group	(n)	Mean	SNK Grouping
Ko'Olina	21	328	A
North	24	269	A B
Kahe	40	250	A B
CIP	32	200	B

Interpretation: The Kruskal-Wallis ANOVA noted a significant difference in the mean number of individual fish censused per transect among the four areas however the SNK Test found considerable overlap among these means suggesting that there are no strong statistically significant differences in the mean number of individual fish censused per transect among the four station groups.

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	21	139	A
North	24	93	B
CIP	32	58	B
Kahe	40	49	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 eight periods in 2007-2009?" 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 2007-09 (p < 0.0001, Significant)

Station Group	[n]	Mean	SNK Grouping			
16 (Pipe)	6	41	A			
6 (Ko'Olina 2)	7	33		B		
5 (Ko'Olina 1)	7	31		B	C	
7 (HECO 1D)	7	27		B	C	D
13 (HECO 10C)	8	27		B	C	D
12 (HECO 7E)	8	27		B	C	D
8 (HECO 5B)	8	27		B	C	D
4 (East 4)	8	24	E		C	D
3 (East 3)	8	24	E		C	D
10 (HECO 7C)	8	22	E			D
9 (HECO 7B)	8	21	E			D
15 (Nana-2)	8	19	E	F		D
2 (East 2)	8	19	E	F		D
14 (Nana-1)	8	17	E	F	G	
1 (East 1)	8	13		F	G	
11 (HECO 7D)	8	11			G	

Interpretation:
Despite the Kruskal-Wallis ANOVA finding significant differences in the mean number of fish species per transect across the sixteen satations, 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 2007-09 (p < 0.0001, Significant)

Station Group	[n]	Mean	Grouping			
16 (Pipe)	6	1270	A			
13 (HECO 10C)	8	485		B		
12 (HECO 7E)	8	414		B	C	
8 (HECO 5B)	8	410		B	C	
7 (HECO 1D)	7	346		B	C	D
5 (Ko'Olina 1)	7	334	E	B	C	D
6 (Ko'Olina 2)	7	298	E		C	D
2 (East 2)	8	219	E	F		D
4 (East 4)	8	197	E	F		D
10 (HECO 7C)	8	192	E	F		D
9 (HECO 7B)	8	187	E	F		D
3 (East 3)	8	182	E	F		D
15 (Nana-2)	8	175	E	F		D
14 (Nana-1)	8	147	E	F		
1 (East 1)	8	99		F		
11 (HECO 7D)	8	45		F		

Interpretation:
The Kruskal-Wallis ANOVA noted statistically significant differences in the mean number of individual fish censused among the 16 transects over the eight surveys in 2007-09. 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 2007-09 (p < 0.0001, Significant)

Station Group	[n]	Mean	Grouping			
16 (Pipe)	6	402	A			
6 (Ko'Olina 2)	7	179		B		
13 (HECO 10C)	8	159		B		
5 (Ko'Olina 1)	7	142		B	C	
15 (Nana-2)	8	109		B	C	D
9 (HECO 7B)	8	104		B	C	D
7 (HECO 1D)	7	96		B	C	D
4 (East 4)	8	92		B	C	D
2 (East 2)	8	87		B	C	D
10 (HECO 7C)	8	47			C	D
8 (HECO 5B)	8	41			C	D
3 (East 3)	8	40			C	D
11 (HECO 7D)	8	27			C	D
12 (HECO 7E)	8	27			C	D
1 (East 1)	8	11				D
14 (Nana-1)	8	11				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 twelve years encompassing a 32-year period (i.e., 1976-1984 and 2007-2009 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>0.24, 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
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>0.29, 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
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 twelve 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
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 three 2009 surveys carried out on 19 March, 11 May and 21 July 2009. Data from the five earlier surveys (27 December 2007, 4 April, 30 May, 19 August and 25 November 2008) that comprise the first annual survey are given in Brock (2009). 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).

19 MARCH 2009 FIELD DATA

GRO	SPECIES 19-Mar-09	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	1	EAST - 1	1	96.08			
C	Plectroglyphidodon imparipennis	1	EAST - 1	1	0.86			
C	Paracirrhites arcatus	1	EAST - 1	3	24.35			
C	Labroides phthirophagus	1	EAST - 1	1	0.63			
C	Thalassoma duperrey	1	EAST - 1	17	189.78			
C	Thalassoma duperrey	1	EAST - 1	12	328.69			
C	Thalassoma duperrey	1	EAST - 1	9	494.54			
C	Thalassoma duperrey	1	EAST - 1	4	388.21			
C	Thalassoma duperrey	1	EAST - 1	2	6.30			
C	Coris venusta	1	EAST - 1	1	23.64			
C	Coris venusta	1	EAST - 1	2	18.77			
C	Stethojulis balteata	1	EAST - 1	3	43.23			
C	Stethojulis balteata	1	EAST - 1	2	144.78			
C	Stethojulis balteata	1	EAST - 1	5	178.82			
C	Halichoeres ornatissimus	1	EAST - 1	1	16.45			
C	Rhinecanthus rectangulus	1	EAST - 1	2	171.75	66	2126.86	83.4
CF	Cantherhines dumerili	1	EAST - 1	1	117.96			
CF	Cantherhines dumerili	1	EAST - 1	2	6.57	3	124.53	4.9
H	Acanthurus nigrofuscus	1	EAST - 1	4	95.59			
H	Acanthurus nigrofuscus	1	EAST - 1	7	99.49			
H	Acanthurus olivaceus	1	EAST - 1	2	94.95	13	290.03	11.4
O	Canthigaster jactator	1	EAST - 1	2	7.12	2	7.12	0.3
P	Chromis vanderbilti	1	EAST - 1	9	2.84	9	2.84	0.1
		1	EAST - 1	93	2551.3905	93	2551.39051	100
C	Parupeneus multifasciatus	2	EAST - 2	2	310.84			
C	Parupeneus multifasciatus	2	EAST - 2	2	6.24			
C	Parupeneus multifasciatus	2	EAST - 2	1	54.40			
C	Parupeneus multifasciatus	2	EAST - 2	1	27.12			
C	Plectroglyphidodon imparipennis	2	EAST - 2	2	1.72			
C	Paracirrhites arcatus	2	EAST - 2	2	16.24			
C	Thalassoma duperrey	2	EAST - 2	11	301.30			
C	Thalassoma duperrey	2	EAST - 2	8	25.20			
C	Thalassoma duperrey	2	EAST - 2	5	485.26			
C	Thalassoma duperrey	2	EAST - 2	11	604.44			
C	Thalassoma duperrey	2	EAST - 2	12	133.96			
C	Coris gaimard	2	EAST - 2	1	215.88			
C	Stethojulis balteata	2	EAST - 2	2	28.82			
C	Halichoeres ornatissimus	2	EAST - 2	1	4.41			
C	Halichoeres ornatissimus	2	EAST - 2	2	19.05			
C	Rhinecanthus rectangulus	2	EAST - 2	1	85.87	64	2320.74	79.0
CF	Chaetodon quadrimaculatus	2	EAST - 2	2	82.37	2	82.37	2.8
H	Calotomus carolinus	2	EAST - 2	1	13.46			
H	Acanthurus nigrofuscus	2	EAST - 2	8	191.18			
H	Acanthurus nigrofuscus	2	EAST - 2	15	213.19			
H	Acanthurus olivaceus	2	EAST - 2	3	33.97			
H	Acanthurus olivaceus	2	EAST - 2	1	19.74	28	471.54	16.1
O	Stegastes fasciolatus	2	EAST - 2	3	44.29			
O	Canthigaster jactator	2	EAST - 2	5	17.81	8	62.10	2.1
		2	EAST - 2	102	2936.75517	102	2936.75517	100

GRO	SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
	19-Mar-09							
C	Parupeneus multifasciatus	3	EAST - 3	2	108.80			
C	Parupeneus multifasciatus	3	EAST - 3	1	155.42			
C	Parupeneus multifasciatus	3	EAST - 3	2	471.50			
C	Plectroglyphidodon johnstonianu	3	EAST - 3	6	10.33			
C	Paracirrhites arcatus	3	EAST - 3	4	32.47			
C	Cheilinus bimaculatus	3	EAST - 3	2	38.73			
C	Thalassoma duperrey	3	EAST - 3	4	219.80			
C	Thalassoma duperrey	3	EAST - 3	5	55.82			
C	Thalassoma duperrey	3	EAST - 3	12	328.69			
C	Thalassoma duperrey	3	EAST - 3	1	97.05			
C	Gomphosus varius	3	EAST - 3	1	11.04			
C	Gomphosus varius	3	EAST - 3	1	62.03			
C	Gomphosus varius	3	EAST - 3	1	22.60			
C	Coris venusta	3	EAST - 3	1	23.64			
C	Coris gaimard	3	EAST - 3	2	91.98			
C	Stethojulis balteata	3	EAST - 3	1	72.39			
C	Stethojulis balteata	3	EAST - 3	1	35.76			
C	Macropharyngodon geoffroy	3	EAST - 3	1	18.63			
C	Halichoeres ornatissimus	3	EAST - 3	1	16.45			
C	Halichoeres ornatissimus	3	EAST - 3	1	25.14			
C	Sufflamen bursa	3	EAST - 3	1	144.65			
C	Sufflamen bursa	3	EAST - 3	1	85.87	52	2128.78	50.4
CF	Chaetodon quadrimaculatus	3	EAST - 3	1	25.30			
CF	Chaetodon multicinctus	3	EAST - 3	4	26.63			
CF	Cantherhines dumerili	3	EAST - 3	1	301.33	6	353.26	8.4
H	Scarus rubroviolaceus	3	EAST - 3	1	85.39			
H	Acanthurus nigrofuscus	3	EAST - 3	11	82.77			
H	Acanthurus nigrofuscus	3	EAST - 3	10	238.97			
H	Acanthurus nigrofuscus	3	EAST - 3	25	355.32			
H	Ctenochaetus strigosus	3	EAST - 3	1	7.58	48	770.03	18.2
O	Stegastes fasciolatus	3	EAST - 3	9	132.87			
O	Melichthys niger	3	EAST - 3	5	816.68			
O	Canthigaster jactator	3	EAST - 3	5	17.81			
O	Canthigaster rivulata	3	EAST - 3	1	7.59	20	974.95	23.1
		3	EAST - 3	126	4227.0187	126	4227.01869	100
C	Parupeneus multifasciatus	4	EAST - 4	2	192.16			
C	Parupeneus multifasciatus	4	EAST - 4	1	11.05			
C	Parupeneus bifasciatus	4	EAST - 4	2	58.40			
C	Plectroglyphidodon imparipennis	4	EAST - 4	1	0.86			
C	Paracirrhites arcatus	4	EAST - 4	1	8.12			
C	Bodianus bilunulatus	4	EAST - 4	1	133.12			
C	Cheilinus bimaculatus	4	EAST - 4	2	38.73			
C	Pseudocheilinus octotaenia	4	EAST - 4	1	14.41			
C	Thalassoma duperrey	4	EAST - 4	2	194.10			
C	Thalassoma duperrey	4	EAST - 4	19	212.10			
C	Thalassoma duperrey	4	EAST - 4	13	714.34			
C	Thalassoma duperrey	4	EAST - 4	25	684.76			
C	Coris venusta	4	EAST - 4	1	9.39			
C	Coris venusta	4	EAST - 4	3	70.91			
C	Coris gaimard	4	EAST - 4	1	8.57			
C	Halichoeres ornatissimus	4	EAST - 4	1	16.45			
C	Halichoeres ornatissimus	4	EAST - 4	1	25.14			
C	Rhinecanthus rectangulus	4	EAST - 4	4	343.49			
C	Rhinecanthus rectangulus	4	EAST - 4	2	289.30	83	3025.40	61.2
H	Acanthurus nigrofuscus	4	EAST - 4	9	127.91			
H	Acanthurus nigrofuscus	4	EAST - 4	14	334.56			
H	Acanthurus olivaceus	4	EAST - 4	1	563.17	24	1025.64	20.8

GRO	SPECIES 19-Mar-09	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
O	Stegastes fasciolatus	4	EAST - 4	1	14.76			
O	Melichthys niger	4	EAST - 4	4	653.34			
O	Melichthys vidua	4	EAST - 4	1	199.03			
O	Canthigaster jactator	4	EAST - 4	6	21.37	12	888.51	18.0
P	Chromis vanderbilti	4	EAST - 4	6	1.90	6	1.90	0.04
		4	EAST - 4	125	4941.4483	125	4941.44834	100
C	Gymnothorax meleagris	5	Ko Olina 1	1	73.65			
C	Monotaxis grandoculis	5	Ko Olina 1	1	34.79			
C	Parupeneus multifasciatus	5	Ko Olina 1	2	192.16			
C	Parupeneus multifasciatus	5	Ko Olina 1	1	155.42			
C	Parupeneus cyclostomus	5	Ko Olina 1	1	10.05			
C	Plectroglyphidodon johnstonianu	5	Ko Olina 1	4	6.89			
C	Paracirrhites arcatus	5	Ko Olina 1	1	8.12			
C	Cirrhitus pinnulatus	5	Ko Olina 1	1	90.86			
C	Labroides phthirophagus	5	Ko Olina 1	1	0.63			
C	Thalassoma duperrey	5	Ko Olina 1	18	989.08			
C	Thalassoma duperrey	5	Ko Olina 1	11	122.80			
C	Thalassoma duperrey	5	Ko Olina 1	1	97.05			
C	Thalassoma duperrey	5	Ko Olina 1	18	493.03			
C	Gomphosus varius	5	Ko Olina 1	2	45.20			
C	Gomphosus varius	5	Ko Olina 1	1	11.04			
C	Coris gaimard	5	Ko Olina 1	1	45.99			
C	Stethojulis balteata	5	Ko Olina 1	3	107.29			
C	Sufflamen bursa	5	Ko Olina 1	1	144.65			
C	Sufflamen bursa	5	Ko Olina 1	5	429.37	74	3058.06	13.6
CF	Chaetodon unimaculatus	5	Ko Olina 1	2	82.37			
CF	Chaetodon multicinctus	5	Ko Olina 1	2	26.06			
CF	Chaetodon multicinctus	5	Ko Olina 1	2	45.11			
CF	Cantherhines dumerili	5	Ko Olina 1	1	301.33	7	454.87	2.0
H	Scarus sordidus	5	Ko Olina 1	1	76.01			
H	Scarus rubroviolaceus	5	Ko Olina 1	1	85.39			
H	Acanthurus triostegus	5	Ko Olina 1	1	46.32			
H	Acanthurus triostegus	5	Ko Olina 1	1	100.01			
H	Acanthurus leucopareius	5	Ko Olina 1	3	398.10			
H	Acanthurus nigrofuscus	5	Ko Olina 1	4	217.01			
H	Acanthurus nigrofuscus	5	Ko Olina 1	28	397.96			
H	Acanthurus nigrofuscus	5	Ko Olina 1	39	931.98			
H	Acanthurus olivaceus	5	Ko Olina 1	19	3106.81			
H	Acanthurus olivaceus	5	Ko Olina 1	15	8447.55			
H	Acanthurus olivaceus	5	Ko Olina 1	23	1091.97			
H	Acanthurus blochii	5	Ko Olina 1	2	311.17			
H	Acanthurus blochii	5	Ko Olina 1	1	453.59			
H	Acanthurus blochii	5	Ko Olina 1	1	56.70			
H	Ctenochaetus strigosus	5	Ko Olina 1	36	2371.14			
H	Ctenochaetus strigosus	5	Ko Olina 1	19	510.03	194	18601.76	82.4
O	Stegastes fasciolatus	5	Ko Olina 1	18	265.74			
O	Melichthys niger	5	Ko Olina 1	1	163.34			
O	Canthigaster jactator	5	Ko Olina 1	8	17.64	27	446.72	2.0
		5	Ko Olina 1	302	22561.4069	302	22561.4069	100
C	Parupeneus multifasciatus	6	Ko Olina 2	1	155.42			
C	Parupeneus multifasciatus	6	Ko Olina 2	2	54.23			
C	Parupeneus multifasciatus	6	Ko Olina 2	1	96.08			
C	Parupeneus multifasciatus	6	Ko Olina 2	1	54.40			
C	Parupeneus cyclostomus	6	Ko Olina 2	1	24.80			
C	Chaetodon lunula	6	Ko Olina 2	2	140.60			
C	Plectroglyphidodon johnstonianu	6	Ko Olina 2	2	3.44			

19-Mar-09

GRO	SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Paracirrhites arcatus	6	Ko Olina 2	1	8.12			
C	Cirrhitus pinnulatus	6	Ko Olina 2	1	90.86			
C	Bodianus bilunulatus	6	Ko Olina 2	1	648.58			
C	Labroides phthirophagus	6	Ko Olina 2	2	1.26			
C	Thalassoma duperrey	6	Ko Olina 2	6	329.69			
C	Thalassoma duperrey	6	Ko Olina 2	8	219.12			
C	Thalassoma duperrey	6	Ko Olina 2	3	291.16			
C	Stethojulis balteata	6	Ko Olina 2	1	35.76			
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	3	20.29	40	2553.88	4.9
CF	Chaetodon unimaculatus	6	Ko Olina 2	2	82.37			
CF	Chaetodon ornatissimus	6	Ko Olina 2	4	276.01			
CF	Chaetodon quadrimaculatus	6	Ko Olina 2	2	82.37			
CF	Chaetodon quadrimaculatus	6	Ko Olina 2	2	50.61			
CF	Chaetodon multicinctus	6	Ko Olina 2	8	104.24	18	595.60	1.1
H	Scarus psittacus	6	Ko Olina 2	1	144.94			
H	Scarus psittacus	6	Ko Olina 2	8	634.14			
H	Scarus psittacus	6	Ko Olina 2	11	416.60			
H	Scarus rubroviolaceus	6	Ko Olina 2	4	4640.03			
H	Scarus rubroviolaceus	6	Ko Olina 2	1	1836.38			
H	Scarus rubroviolaceus	6	Ko Olina 2	3	1039.51			
H	Scarus rubroviolaceus	6	Ko Olina 2	1	85.39			
H	Acanthurus triostegus	6	Ko Olina 2	7	700.10			
H	Acanthurus triostegus	6	Ko Olina 2	1	17.17			
H	Acanthurus triostegus	6	Ko Olina 2	7	324.21			
H	Acanthurus leucopareius	6	Ko Olina 2	8	1861.40			
H	Acanthurus leucopareius	6	Ko Olina 2	1	132.70			
H	Acanthurus leucopareius	6	Ko Olina 2	4	1496.26			
H	Acanthurus nigrofuscus	6	Ko Olina 2	37	884.19			
H	Acanthurus nigrofuscus	6	Ko Olina 2	28	397.96			
H	Acanthurus nigroris	6	Ko Olina 2	3	162.76			
H	Acanthurus olivaceus	6	Ko Olina 2	30	16895.11			
H	Acanthurus olivaceus	6	Ko Olina 2	7	332.34			
H	Acanthurus olivaceus	6	Ko Olina 2	13	3401.67			
H	Acanthurus dussumieri	6	Ko Olina 2	2	1128.71			
H	Acanthurus blochii	6	Ko Olina 2	3	10.89			
H	Acanthurus blochii	6	Ko Olina 2	8	783.81			
H	Acanthurus blochii	6	Ko Olina 2	6	2721.56			
H	Acanthurus blochii	6	Ko Olina 2	5	1161.20			
H	Ctenochaetus strigosus	6	Ko Olina 2	11	295.28			
H	Ctenochaetus strigosus	6	Ko Olina 2	1	0.87			
H	Ctenochaetus strigosus	6	Ko Olina 2	12	790.38			
H	Ctenochaetus strigosus	6	Ko Olina 2	25	3303.34			
H	Zebrasoma flavescens	6	Ko Olina 2	8	426.24			
H	Zebrasoma flavescens	6	Ko Olina 2	9	15.19			
H	Zebrasoma flavescens	6	Ko Olina 2	8	75.87			
H	Naso lituratus	6	Ko Olina 2	1	622.36			
H	Naso lituratus	6	Ko Olina 2	1	311.61	275	47050.18	90.8
O	Melichthys niger	6	Ko Olina 2	2	326.67			
O	Melichthys niger	6	Ko Olina 2	1	248.03			
O	Canthigaster jactator	6	Ko Olina 2	8	28.50	11	603.20	1.2
P	Abudefduf abdominalis	6	Ko Olina 2	22	1030.74			
P	Chromis hanui	6	Ko Olina 2	4	2.99	26	1033.73	2.0
		6	Ko Olina 2	370	51836.5907	370	51836.5907	100
C	Myripristis amaenus	7	KAHE 1-D	1	82.08			
C	Aulostomus chinensis	7	KAHE 1-D	1	68.53			

GRO	**19-Mar-09** SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	7	KAHE 1-D	2	192.16			
C	Parupeneus multifasciatus	7	KAHE 1-D	2	108.80			
C	Parupeneus multifasciatus	7	KAHE 1-D	1	155.42			
C	Parupeneus multifasciatus	7	KAHE 1-D	1	27.12			
C	Chaetodon fremblii	7	KAHE 1-D	1	12.46			
C	Plectroglyphidodon johnstonianu	7	KAHE 1-D	4	6.89			
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	2	1.26			
C	Pseudocheilinus tetrataenia	7	KAHE 1-D	1	8.10			
C	Thalassoma duperrey	7	KAHE 1-D	6	582.31			
C	Thalassoma duperrey	7	KAHE 1-D	5	274.74			
C	Thalassoma duperrey	7	KAHE 1-D	10	273.90			
C	Thalassoma ballieui	7	KAHE 1-D	2	56.53			
C	Gomphosus varius	7	KAHE 1-D	1	22.60			
C	Gomphosus varius	7	KAHE 1-D	1	11.04			
C	Rhinecanthus rectangulus	7	KAHE 1-D	2	90.72			
C	Sufflamen bursa	7	KAHE 1-D	2	90.72			
C	Sufflamen bursa	7	KAHE 1-D	2	171.75	50	2329.73	12.8
CF	Chaetodon multicinctus	7	KAHE 1-D	4	26.63			
CF	Exallias brevis	7	KAHE 1-D	1	16.35			
CF	Cantherhines dumerili	7	KAHE 1-D	1	117.96	6	160.94	0.9
H	Centropyge potteri	7	KAHE 1-D	1	4.98			
H	Calotomus carolinus	7	KAHE 1-D	1	131.69			
H	Scarus sordidus	7	KAHE 1-D	4	143.98			
H	Scarus psittacus	7	KAHE 1-D	4	58.46			
H	Scarus psittacus	7	KAHE 1-D	4	151.49			
H	Acanthurus triostegus	7	KAHE 1-D	3	12.71			
H	Acanthurus triostegus	7	KAHE 1-D	17	291.83			
H	Acanthurus leucopareius	7	KAHE 1-D	1	132.70			
H	Acanthurus nigrofuscus	7	KAHE 1-D	41	979.78			
H	Acanthurus nigrofuscus	7	KAHE 1-D	4	56.85			
H	Acanthurus olivaceus	7	KAHE 1-D	115	5459.85			
H	Ctenochaetus strigosus	7	KAHE 1-D	1	65.86			
H	Ctenochaetus strigosus	7	KAHE 1-D	5	134.22	201	7624.41	41.7
O	Stegastes fasciolatus	7	KAHE 1-D	4	59.05			
O	Melichthys niger	7	KAHE 1-D	45	7350.10			
O	Melichthys niger	7	KAHE 1-D	9	489.91			
O	Melichthys vidua	7	KAHE 1-D	1	69.92			
O	Cantherhines sandwichiensis	7	KAHE 1-D	1	46.04	60	8015.01	43.9
P	Chromis vanderbilti	7	KAHE 1-D	9	2.84			
P	Chromis ovalis	7	KAHE 1-D	23	136.43	32	139.27	0.8
		7	KAHE 1-D	349	18269.3604	349	18269.3604	100
C	Decapterus macarellus	8	KAHE 5 -B	3	250.33			
C	Parupeneus multifasciatus	8	KAHE 5 -B	2	192.16			
C	Parupeneus multifasciatus	8	KAHE 5 -B	3	33.15			
C	Parupeneus multifasciatus	8	KAHE 5 -B	3	81.35			
C	Parupeneus multifasciatus	8	KAHE 5 -B	2	108.80			
C	Plectroglyphidodon johnstonianu	8	KAHE 5 -B	2	3.44			
C	Plectroglyphidodon imparipennis	8	KAHE 5 -B	3	2.59			
C	Paracirrhites arcatus	8	KAHE 5 -B	6	48.71			
C	Paracirrhites forsteri	8	KAHE 5 -B	1	39.65			
C	Labroides phthirophagus	8	KAHE 5 -B	1	0.63			
C	Thalassoma duperrey	8	KAHE 5 -B	11	604.44			
C	Thalassoma duperrey	8	KAHE 5 -B	3	291.16			
C	Thalassoma duperrey	8	KAHE 5 -B	23	629.98			
C	Thalassoma duperrey	8	KAHE 5 -B	32	357.22			

GRO	SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
	19-Mar-09							
C	Gomphosus varius	8	KAHE 5 -B	1	11.04			
C	Gomphosus varius	8	KAHE 5 -B	1	22.60			
C	Stethojulis balteata	8	KAHE 5 -B	1	35.76			
C	Macropharyngodon geoffroy	8	KAHE 5 -B	4	22.99			
C	Halichoeres ornatissimus	8	KAHE 5 -B	3	28.57			
C	Halichoeres ornatissimus	8	KAHE 5 -B	2	32.90			
C	Halichoeres ornatissimus	8	KAHE 5 -B	1	25.14			
C	Zanclus cornutus	8	KAHE 5 -B	5	274.49			
C	Zanclus cornutus	8	KAHE 5 -B	4	416.63			
C	Rhinecanthus rectangulus	8	KAHE 5 -B	1	45.36			
C	Sufflamen bursa	8	KAHE 5 -B	2	39.85			
C	Sufflamen bursa	8	KAHE 5 -B	3	257.62	123	3856.57	63.1
CF	Chaetodon multicinctus	8	KAHE 5 -B	4	26.63			
CF	Chaetodon multicinctus	8	KAHE 5 -B	2	26.06	6	52.69	0.9
H	Acanthurus nigrofuscus	8	KAHE 5 -B	21	298.47			
H	Acanthurus nigrofuscus	8	KAHE 5 -B	31	740.81			
H	Acanthurus olivaceus	8	KAHE 5 -B	13	617.20			
H	Acanthurus olivaceus	8	KAHE 5 -B	3	281.31	68	1937.78	31.7
O	Stegastes fasciolatus	8	KAHE 5 -B	6	88.58			
O	Melichthys vidua	8	KAHE 5 -B	1	124.35	7	212.93	3.5
P	Chromis vanderbilti	8	KAHE 5 -B	149	47.07	149	47.07	0.8
		8	KAHE 5 -B	353	6107.0324	353	6107.03239	100
C	Decapterus macarellus	9	KAHE 7 -B	31	11321.48			
C	Mulloides flavolineatus	9	KAHE 7 -B	1	618.55			
C	Parupeneus pleurostigma	9	KAHE 7 -B	1	98.25			
C	Parupeneus multifasciatus	9	KAHE 7 -B	2	108.80			
C	Parupeneus multifasciatus	9	KAHE 7 -B	2	310.84			
C	Parupeneus cyclostomus	9	KAHE 7 -B	1	88.57			
C	Cheilinus bimaculatus	9	KAHE 7 -B	1	19.37			
C	Thalassoma duperrey	9	KAHE 7 -B	1	97.05			
C	Thalassoma duperrey	9	KAHE 7 -B	2	54.78			
C	Thalassoma duperrey	9	KAHE 7 -B	2	22.33			
C	Thalassoma duperrey	9	KAHE 7 -B	1	54.95			
C	Zanclus cornutus	9	KAHE 7 -B	1	104.16			
C	Sufflamen bursa	9	KAHE 7 -B	3	433.95			
C	Sufflamen bursa	9	KAHE 7 -B	3	257.62	52	13590.69	92.1
CF	Chaetodon multicinctus	9	KAHE 7 -B	2	13.31	2	13.31	0.1
H	Calotomus carolinus	9	KAHE 7 -B	1	131.69			
H	Acanthurus nigrofuscus	9	KAHE 7 -B	5	71.06			
H	Acanthurus nigrofuscus	9	KAHE 7 -B	2	47.79			
H	Acanthurus olivaceus	9	KAHE 7 -B	8	379.82			
H	Acanthurus olivaceus	9	KAHE 7 -B	1	163.52			
H	Naso unicornis	9	KAHE 7 -B	2	146.72	19	940.59	6.4
O	Melichthys vidua	9	KAHE 7 -B	1	199.03			
O	Canthigaster jactator	9	KAHE 7 -B	2	7.12	3	206.15	1.4
P	Chromis vanderbilti	9	KAHE 7 -B	35	11.06	35	11.06	0.1
		9	KAHE 7 -B	111	14761.8079	111	14761.8079	100
C	Echidna nebulosa	10	KAHE 7 -C	1	63.06			
C	Parupeneus pleurostigma	10	KAHE 7 -C	2	116.02			
C	Parupeneus multifasciatus	10	KAHE 7 -C	2	108.80			
C	Parupeneus multifasciatus	10	KAHE 7 -C	1	96.08			
C	Parupeneus multifasciatus	10	KAHE 7 -C	3	707.24			
C	Parupeneus multifasciatus	10	KAHE 7 -C	4	108.47			
C	Paracirrhites arcatus	10	KAHE 7 -C	2	16.24			
C	Thalassoma duperrey	10	KAHE 7 -C	1	54.95			
C	Stethojulis balteata	10	KAHE 7 -C	1	72.39			

GRO	SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
	19-Mar-09							
C	Sufflamen bursa	10	KAHE 7 -C	5	429.37	22	1772.61	63.8
CF	Chaetodon multicinctus	10	KAHE 7 -C	2	26.06	2	26.06	0.9
H	Scarus psittacus	10	KAHE 7 -C	1	37.87			
H	Acanthurus nigrofuscus	10	KAHE 7 -C	4	217.01			
H	Acanthurus nigrofuscus	10	KAHE 7 -C	2	47.79			
H	Acanthurus olivaceus	10	KAHE 7 -C	14	664.68	21	967.35	34.8
O	Canthigaster jactator	10	KAHE 7 -C	3	10.69	3	10.69	0.4
P	Chromis vanderbilti	10	KAHE 7 -C	4	1.26	4	1.26	0.05
		10	KAHE 7 -C	52	2777.97348	52	2777.97348	100
C	Plectroglyphidodon johnstonianu	11	KAHE 7 -D	1	1.72			
C	Cheilinus bimaculatus	11	KAHE 7 -D	1	58.29			
C	Cheilinus bimaculatus	11	KAHE 7 -D	1	19.37			
C	Thalassoma duperrey	11	KAHE 7 -D	1	3.15			
C	Sufflamen bursa	11	KAHE 7 -D	1	85.87	5	168.40	99.6
P	Chromis vanderbilti	11	KAHE 7 -D	2	0.63	2	0.63	0.4
		11	KAHE 7 -D	7	169.0335	7	169.033517	100
C	Fistularia commersoni	12	KAHE 7 - E	1	206.81			
C	Parupeneus pleurostigma	12	KAHE 7 - E	1	30.44			
C	Parupeneus multifasciatus	12	KAHE 7 - E	1	96.08			
C	Parupeneus multifasciatus	12	KAHE 7 - E	5	135.58			
C	Parupeneus multifasciatus	12	KAHE 7 - E	3	9.36			
C	Parupeneus multifasciatus	12	KAHE 7 - E	1	54.40			
C	Parupeneus multifasciatus	12	KAHE 7 - E	5	55.26			
C	Plectroglyphidodon johnstonianu	12	KAHE 7 - E	4	6.89			
C	Paracirrhites arcatus	12	KAHE 7 - E	4	32.47			
C	Cirrhitops fasciatus	12	KAHE 7 - E	1	8.23			
C	Cheilinus bimaculatus	12	KAHE 7 - E	1	19.37			
C	Pseudocheilinus tetrataenia	12	KAHE 7 - E	1	4.00			
C	Novaculichthys taeniourus	12	KAHE 7 - E	1	188.32			
C	Thalassoma duperrey	12	KAHE 7 - E	2	194.10			
C	Thalassoma duperrey	12	KAHE 7 - E	3	164.85			
C	Thalassoma duperrey	12	KAHE 7 - E	3	82.17			
C	Pseudojuloides cerasinus	12	KAHE 7 - E	9	56.88			
C	Stethojulis balteata	12	KAHE 7 - E	2	71.53			
C	Macropharyngodon geoffroy	12	KAHE 7 - E	4	74.51			
C	Macropharyngodon geoffroy	12	KAHE 7 - E	1	5.75			
C	Sufflamen bursa	12	KAHE 7 - E	3	257.62	56	1754.61	57.6
CF	Chaetodon multicinctus	12	KAHE 7 - E	5	33.28			
CF	Cantherhines dumerili	12	KAHE 7 - E	1	117.96	6	151.24	5.0
H	Calotomus carolinus	12	KAHE 7 - E	2	26.93			
H	Scarus psittacus	12	KAHE 7 - E	1	79.27			
H	Acanthurus nigrofuscus	12	KAHE 7 - E	11	82.77			
H	Acanthurus olivaceus	12	KAHE 7 - E	1	93.77			
H	Acanthurus olivaceus	12	KAHE 7 - E	5	98.72			
H	Acanthurus olivaceus	12	KAHE 7 - E	12	569.72			
H	Ctenochaetus strigosus	12	KAHE 7 - E	2	6.18			
H	Naso lituratus	12	KAHE 7 - E	1	36.34			
H	Naso unicornis	12	KAHE 7 - E	1	38.92	36	1032.62	33.9
O	Canthigaster coronata	12	KAHE 7 - E	3	22.77			
O	Canthigaster jactator	12	KAHE 7 - E	8	28.50	11	51.27	1.7
P	Chaetodon kleini	12	KAHE 7 - E	1	6.56			
P	Chromis vanderbilti	12	KAHE 7 - E	133	42.01			
P	Chromis hanui	12	KAHE 7 - E	8	5.97	142	54.54	1.8
		12	KAHE 7 - E	251	3044.2837	251	3044.2837	100

GRO	SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
	19-Mar-09							
C	Myripristis amaenus	13	KAHE 10	2	164.17			
C	Lutjanus kasmira	13	KAHE 10	65	7147.32			
C	Lutjanus kasmira	13	KAHE 10	61	1577.30			
C	Monotaxis grandoculis	13	KAHE 10	1	71.53			
C	Monotaxis grandoculis	13	KAHE 10	1	34.79			
C	Parupeneus pleurostigma	13	KAHE 10	2	116.02			
C	Parupeneus multifasciatus	13	KAHE 10	1	27.12			
C	Parupeneus multifasciatus	13	KAHE 10	2	108.80			
C	Parupeneus multifasciatus	13	KAHE 10	1	96.08			
C	Parupeneus multifasciatus	13	KAHE 10	1	340.44			
C	Parupeneus cyclostomus	13	KAHE 10	1	24.80			
C	Forcipiger flavissimus	13	KAHE 10	2	18.30			
C	Plectroglyphidodon johnstonianu	13	KAHE 10	1	1.72			
C	Plectroglyphidodon imparipennis	13	KAHE 10	2	1.72			
C	Paracirrhites arcatus	13	KAHE 10	3	24.35			
C	Labroides phthirophagus	13	KAHE 10	2	1.26			
C	Thalassoma duperrey	13	KAHE 10	13	356.08			
C	Thalassoma duperrey	13	KAHE 10	8	89.31			
C	Thalassoma duperrey	13	KAHE 10	16	879.18			
C	Thalassoma duperrey	13	KAHE 10	6	582.31			
C	Macropharyngodon geoffroy	13	KAHE 10	1	18.63			
C	Halichoeres ornatissimus	13	KAHE 10	1	25.14			
C	Halichoeres ornatissimus	13	KAHE 10	1	9.52			
C	Halichoeres ornatissimus	13	KAHE 10	1	16.45			
C	Sufflamen bursa	13	KAHE 10	4	343.49	199	12075.81	71.8
CF	Chaetodon multicinctus	13	KAHE 10	2	13.31	2	13.31	0.1
H	Acanthurus triostegus	13	KAHE 10	2	92.63			
H	Acanthurus triostegus	13	KAHE 10	10	171.67			
H	Acanthurus leucopareius	13	KAHE 10	2	55.03			
H	Acanthurus nigrofuscus	13	KAHE 10	8	113.70			
H	Acanthurus nigrofuscus	13	KAHE 10	3	71.69			
H	Acanthurus olivaceus	13	KAHE 10	2	1126.34			
H	Acanthurus olivaceus	13	KAHE 10	14	664.68			
H	Acanthurus olivaceus	13	KAHE 10	6	118.46			
H	Acanthurus olivaceus	13	KAHE 10	4	375.08			
H	Naso lituratus	13	KAHE 10	1	36.34	52	2825.62	16.8
O	Stegastes fasciolatus	13	KAHE 10	7	103.34			
O	Melichthys niger	13	KAHE 10	4	653.34			
O	Melichthys vidua	13	KAHE 10	1	199.03			
O	Canthigaster coronata	13	KAHE 10	1	7.59			
O	Canthigaster jactator	13	KAHE 10	3	10.69	16	973.99	5.8
P	Dascyllus albisella	13	KAHE 10	32	98.83			
P	Abudefduf abdominalis	13	KAHE 10	18	563.99			
P	Chromis vanderbilti	13	KAHE 10	98	30.96			
P	Chromis ovalis	13	KAHE 10	41	243.20	189	936.97	5.6
		13	KAHE 10	458	16825.7049	458	16825.7049	100
C	Gymnothorax meleagris	14	Nanakuli 1	1	44.70			
C	Parupeneus multifasciatus	14	Nanakuli 1	1	155.42			
C	Parupeneus multifasciatus	14	Nanakuli 1	1	3.12			
C	Parupeneus multifasciatus	14	Nanakuli 1	1	27.12			
C	Parupeneus cyclostomus	14	Nanakuli 1	1	10.05			
C	Plectroglyphidodon imparipennis	14	Nanakuli 1	2	1.72			
C	Paracirrhites arcatus	14	Nanakuli 1	1	8.12			
C	Thalassoma duperrey	14	Nanakuli 1	1	97.05			
C	Thalassoma duperrey	14	Nanakuli 1	6	164.34			
C	Thalassoma duperrey	14	Nanakuli 1	5	55.82			
C	Thalassoma duperrey	14	Nanakuli 1	8	25.20			

GRO	19-Mar-09 SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Thalassoma duperrey	14	Nanakuli 1	2	109.90			
C	Thalassoma purpureum	14	Nanakuli 1	1	100.89			
C	Stethojulis balteata	14	Nanakuli 1	1	35.76			
C	Stethojulis balteata	14	Nanakuli 1	3	43.23			
C	Halichoeres ornatissimus	14	Nanakuli 1	1	4.41			
C	Rhinecanthus rectangulus	14	Nanakuli 1	1	45.36			
C	Ostracion meleagris	14	Nanakuli 1	2	5.42	39	937.62	62.7
H	Scarus psittacus	14	Nanakuli 1	5	73.07			
H	Acanthurus triostegus	14	Nanakuli 1	2	92.63			
H	Acanthurus triostegus	14	Nanakuli 1	8	33.90			
H	Acanthurus triostegus	14	Nanakuli 1	5	85.83			
H	Acanthurus triostegus	14	Nanakuli 1	1	100.01			
H	Acanthurus nigrofuscus	14	Nanakuli 1	3	71.69			
H	Acanthurus nigrofuscus	14	Nanakuli 1	5	71.06	29	528.21	35.3
O	Canthigaster jactator	14	Nanakuli 1	1	3.56			
O	Canthigaster rivulata	14	Nanakuli 1	1	22.05	2	25.61	1.7
P	Chromis vanderbilti	14	Nanakuli 1	14	4.42	14	4.42	0.3
		14	Nanakuli 1	84	1495.8654	84	1495.86542	100
C	Parupeneus multifasciatus	15	Nanakuli 2	1	96.08			
C	Parupeneus multifasciatus	15	Nanakuli 2	2	108.80			
C	Parupeneus multifasciatus	15	Nanakuli 2	2	54.23			
C	Parupeneus cyclostomus	15	Nanakuli 2	2	20.10			
C	Parupeneus cyclostomus	15	Nanakuli 2	1	49.96			
C	Forcipiger flavissimus	15	Nanakuli 2	1	9.15			
C	Plectroglyphidodon johnstonianu	15	Nanakuli 2	2	3.44			
C	Paracirrhites arcatus	15	Nanakuli 2	1	8.12			
C	Bodianus bilunulatus	15	Nanakuli 2	1	37.87			
C	Thalassoma duperrey	15	Nanakuli 2	5	55.82			
C	Thalassoma duperrey	15	Nanakuli 2	5	274.74			
C	Thalassoma duperrey	15	Nanakuli 2	8	219.12			
C	Gomphosus varius	15	Nanakuli 2	3	33.12			
C	Stethojulis balteata	15	Nanakuli 2	1	35.76			
C	Halichoeres ornatissimus	15	Nanakuli 2	1	16.45			
C	Sufflamen bursa	15	Nanakuli 2	1	144.65			
C	Sufflamen bursa	15	Nanakuli 2	1	85.87			
C	Ostracion meleagris	15	Nanakuli 2	1	2.71	39	1256.02	5.4
CF	Chaetodon ornatissimus	15	Nanakuli 2	4	276.01			
CF	Chaetodon quadrimaculatus	15	Nanakuli 2	1	25.30			
CF	Chaetodon multicinctus	15	Nanakuli 2	2	13.31	7	314.63	1.4
H	Acanthurus leucopareius	15	Nanakuli 2	3	398.10			
H	Acanthurus leucopareius	15	Nanakuli 2	20	4653.50			
H	Acanthurus leucopareius	15	Nanakuli 2	23	8603.48			
H	Acanthurus nigrofuscus	15	Nanakuli 2	16	227.40			
H	Acanthurus nigrofuscus	15	Nanakuli 2	2	47.79			
H	Acanthurus nigrofuscus	15	Nanakuli 2	5	37.62			
H	Acanthurus olivaceus	15	Nanakuli 2	12	6758.04			
H	Acanthurus dussumieri	15	Nanakuli 2	1	326.59			
H	Ctenochaetus strigosus	15	Nanakuli 2	5	134.22			
H	Ctenochaetus strigosus	15	Nanakuli 2	2	15.15	89	21201.91	91.9
O	Stegastes fasciolatus	15	Nanakuli 2	8	118.11			
O	Melichthys niger	15	Nanakuli 2	1	163.34			
O	Canthigaster jactator	15	Nanakuli 2	4	14.25	13	295.69	1.3
		15	Nanakuli 2	148	23068.2446	148	23068.2446	100
C	Adioryx tiere	16	KAHE PIPE	1	265.90			
C	Myripristis amaenus	16	KAHE PIPE	15	1231.24			
C	Aulostomus chinensis	16	KAHE PIPE	2	177.00			

GRO	SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
	19-Mar-09							
C	Cephalopholis argus	16	KAHE PIPE	1	1077.13			
C	Mulloides flavolineatus	16	KAHE PIPE	57	15352.43			
C	Parupeneus pleurostigma	16	KAHE PIPE	4	232.03			
C	Parupeneus pleurostigma	16	KAHE PIPE	1	153.39			
C	Parupeneus multifasciatus	16	KAHE PIPE	8	435.20			
C	Parupeneus multifasciatus	16	KAHE PIPE	8	768.65			
C	Parupeneus multifasciatus	16	KAHE PIPE	1	235.75			
C	Parupeneus bifasciatus	16	KAHE PIPE	2	540.40			
C	Parupeneus bifasciatus	16	KAHE PIPE	1	553.06			
C	Forcipiger flavissimus	16	KAHE PIPE	1	9.15			
C	Chaetodon lunula	16	KAHE PIPE	2	140.60			
C	Plectroglyphidodon johnstonianu	16	KAHE PIPE	9	15.50			
C	Paracirrhites arcatus	16	KAHE PIPE	12	97.41			
C	Labroides phthirophagus	16	KAHE PIPE	11	6.90			
C	Pseudocheilinus octotaenia	16	KAHE PIPE	1	14.41			
C	Thalassoma duperrey	16	KAHE PIPE	50	4852.60			
C	Thalassoma duperrey	16	KAHE PIPE	15	824.23			
C	Thalassoma duperrey	16	KAHE PIPE	19	520.42			
C	Thalassoma purpureum	16	KAHE PIPE	5	2626.49			
C	Thalassoma purpureum	16	KAHE PIPE	3	2839.76			
C	Thalassoma purpureum	16	KAHE PIPE	1	907.18			
C	Gomphosus varius	16	KAHE PIPE	13	512.13			
C	Gomphosus varius	16	KAHE PIPE	3	186.09			
C	Coris gaimard	16	KAHE PIPE	1	45.99			
C	Stethojulis balteata	16	KAHE PIPE	9	321.87			
C	Stethojulis balteata	16	KAHE PIPE	5	361.95			
C	Halichoeres ornatissimus	16	KAHE PIPE	5	82.25			
C	Halichoeres ornatissimus	16	KAHE PIPE	5	125.68			
C	Zanclus cornutus	16	KAHE PIPE	9	937.42			
C	Sufflamen bursa	16	KAHE PIPE	1	144.65			
C	Sufflamen bursa	16	KAHE PIPE	4	343.49	285	36938.36	32.0
CF	Chaetodon ornatissimus	16	KAHE PIPE	4	547.56			
CF	Chaetodon quadrimaculatus	16	KAHE PIPE	4	101.22			
CF	Chaetodon multicinctus	16	KAHE PIPE	3	39.09			
CF	Pervagor melanocephalus	16	KAHE PIPE	1	36.19	12	724.06	0.6
H	Centropyge potteri	16	KAHE PIPE	1	4.98			
H	Calotomus carolinus	16	KAHE PIPE	1	499.89			
H	Scarus sordidus	16	KAHE PIPE	15	5505.32			
H	Scarus sordidus	16	KAHE PIPE	35	4900.21			
H	Scarus sordidus	16	KAHE PIPE	32	2432.43			
H	Scarus sordidus	16	KAHE PIPE	7	9992.99			
H	Scarus sordidus	16	KAHE PIPE	1	2392.59			
H	Scarus psittacus	16	KAHE PIPE	1	1437.46			
H	Acanthurus nigrofuscus	16	KAHE PIPE	77	4177.44			
H	Acanthurus nigrofuscus	16	KAHE PIPE	25	597.43			
H	Acanthurus nigrofuscus	16	KAHE PIPE	14	105.34			
H	Acanthurus nigroris	16	KAHE PIPE	4	217.01			
H	Acanthurus olivaceus	16	KAHE PIPE	23	1091.97			
H	Acanthurus olivaceus	16	KAHE PIPE	7	1831.67			
H	Acanthurus blochii	16	KAHE PIPE	8	783.81			
H	Ctenochaetus strigosus	16	KAHE PIPE	2	131.73			
H	Ctenochaetus strigosus	16	KAHE PIPE	3	80.53			
H	Zebrasoma flavescens	16	KAHE PIPE	12	113.81			
H	Zebrasoma flavescens	16	KAHE PIPE	8	13.51			
H	Naso lituratus	16	KAHE PIPE	1	36.34	277	36346.47	31.5
O	Stegastes fasciolatus	16	KAHE PIPE	9	132.87			
O	Melichthys niger	16	KAHE PIPE	12	1960.03			
O	Melichthys vidua	16	KAHE PIPE	1	199.03			

19-Mar-09

GRO	SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
O	Canthigaster jactator	16	KAHE PIPE	7	24.93	29	2316.86	2.0
P	Dascyllus albisella	16	KAHE PIPE	10	30.88			
P	Abudefduf abdominalis	16	KAHE PIPE	175	8199.08			
P	Abudefduf abdominalis	16	KAHE PIPE	295	9243.11			
P	Chromis vanderbilti	16	KAHE PIPE	107	33.80			
P	Chromis ovalis	16	KAHE PIPE	142	1641.47			
P	Acanthurus thompsoni	16	KAHE PIPE	6	325.51			
P	Naso hexacanthus	16	KAHE PIPE	26	447.06			
P	Naso hexacanthus	16	KAHE PIPE	19	1393.80			
P	Naso brevirostris	16	KAHE PIPE	45	12541.81			
P	Naso brevirostris	16	KAHE PIPE	10	5252.58	835	39109.12	33.9
		16	KAHE PIPE	1438	115434.8709	1438	115434.871	100

11 MAY 2009 FIELD DATA

GRO	SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
	11-May-09							
C	Plectroglyphidodon imparipennis	1	EAST - 1	1	0.86			
C	Paracirrhites arcatus	1	EAST - 1	2	16.24			
C	Cheilinus bimaculatus	1	EAST - 1	1	34.95			
C	Thalassoma duperrey	1	EAST - 1	8	219.12			
C	Thalassoma duperrey	1	EAST - 1	18	200.94			
C	Thalassoma duperrey	1	EAST - 1	18	56.71			
C	Thalassoma duperrey	1	EAST - 1	5	274.74			
C	Thalassoma duperrey	1	EAST - 1	1	97.05			
C	Stethojulis balteata	1	EAST - 1	1	72.39			
C	Stethojulis balteata	1	EAST - 1	3	43.23			
C	Stethojulis balteata	1	EAST - 1	5	20.01			
C	Halichoeres ornatissimus	1	EAST - 1	2	32.90			
C	Halichoeres ornatissimus	1	EAST - 1	1	25.14			
C	Rhinecanthus rectangulus	1	EAST - 1	1	45.36			
C	Rhinecanthus rectangulus	1	EAST - 1	3	433.95			
C	Rhinecanthus rectangulus	1	EAST - 1	1	85.87			
C	Sufflamen fraenatus	1	EAST - 1	1	144.65	72	1804.11	76.7
H	Acanthurus olivaceus	1	EAST - 1	2	523.33	2	523.33	22.3
O	Canthigaster jactator	1	EAST - 1	4	14.25	4	14.25	0.6
P	Chromis vanderbilti	1	EAST - 1	30	9.48	30	9.48	0.4
		1	EAST - 1	108	2351.1714	108	2351.17143	100
C	Parupeneus multifasciatus	2	EAST - 2	1	96.08			
C	Parupeneus multifasciatus	2	EAST - 2	1	27.12			
C	Plectroglyphidodon johnstonianus	2	EAST - 2	5	8.61			
C	Plectroglyphidodon imparipennis	2	EAST - 2	4	3.45			
C	Paracirrhites arcatus	2	EAST - 2	4	32.47			
C	Cirrhitops fasciatus	2	EAST - 2	1	8.23			
C	Pseudocheilinus octotaenia	2	EAST - 2	1	14.41			
C	Thalassoma duperrey	2	EAST - 2	26	712.15			
C	Thalassoma duperrey	2	EAST - 2	31	1703.42			
C	Thalassoma duperrey	2	EAST - 2	20	1941.04			
C	Coris venusta	2	EAST - 2	1	86.86			
C	Coris venusta	2	EAST - 2	2	96.76			
C	Stethojulis balteata	2	EAST - 2	2	71.53			
C	Halichoeres ornatissimus	2	EAST - 2	1	9.52			
C	Halichoeres ornatissimus	2	EAST - 2	2	32.90			
C	Rhinecanthus rectangulus	2	EAST - 2	4	578.60			
C	Rhinecanthus rectangulus	2	EAST - 2	1	85.87	107	5509.01	67.8
CF	Cantherhines dumerili	2	EAST - 2	1	301.33	1	301.33	3.7
H	Acanthurus nigrofuscus	2	EAST - 2	25	355.32			
H	Acanthurus nigrofuscus	2	EAST - 2	43	1027.57			
H	Acanthurus olivaceus	2	EAST - 2	14	664.68			
H	Acanthurus olivaceus	2	EAST - 2	10	197.43	92	2245.00	27.6
O	Stegastes fasciolatus	2	EAST - 2	3	44.29			
O	Canthigaster jactator	2	EAST - 2	5	17.81	8	62.10	0.8
P	Chromis vanderbilti	2	EAST - 2	23	7.27	23	7.27	0.1
		2	EAST - 2	231	8124.7089	231	8124.70888	100
C	Gymnothorax meleagris	3	EAST - 3	1	44.70			
C	Cephalopholis argus	3	EAST - 3	1	638.29			
C	Monotaxis grandoculis	3	EAST - 3	1	34.79			
C	Parupeneus multifasciatus	3	EAST - 3	1	155.42			
C	Parupeneus multifasciatus	3	EAST - 3	1	54.40			
C	Parupeneus multifasciatus	3	EAST - 3	1	96.08			
C	Forcipiger flavissimus	3	EAST - 3	2	18.30			
C	Plectroglyphidodon johnstonianus	3	EAST - 3	5	8.61			
C	Paracirrhites arcatus	3	EAST - 3	3	24.35			

GRO	SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
	11-May-09							
C	Thalassoma duperrey	3	EAST - 3	20	547.81			
C	Thalassoma duperrey	3	EAST - 3	18	989.08			
C	Thalassoma duperrey	3	EAST - 3	25	279.08			
C	Gomphosus varius	3	EAST - 3	2	45.20			
C	Gomphosus varius	3	EAST - 3	2	78.79			
C	Stethojulis balteata	3	EAST - 3	1	35.76			
C	Stethojulis balteata	3	EAST - 3	1	72.39			
C	Halichoeres ornatissimus	3	EAST - 3	1	16.45			
C	Halichoeres ornatissimus	3	EAST - 3	1	25.14			
C	Sufflamen bursa	3	EAST - 3	3	257.62			
C	Ostracion meleagris	3	EAST - 3	1	13.75	91	3436.01	26.5
CF	Chaetodon ornatissimus	3	EAST - 3	2	138.00			
CF	Chaetodon quadrimaculatus	3	EAST - 3	2	14.05			
CF	Cantherhines dumerili	3	EAST - 3	1	117.96	5	270.02	2.1
H	Calotomus carolinus	3	EAST - 3	1	72.28			
H	Scarus psittacus	3	EAST - 3	4	151.49			
H	Scarus rubroviolaceus	3	EAST - 3	2	2320.02			
H	Scarus rubroviolaceus	3	EAST - 3	1	147.03			
H	Scarus rubroviolaceus	3	EAST - 3	2	3672.76			
H	Scarus rubroviolaceus	3	EAST - 3	3	256.18			
H	Acanthurus nigrofuscus	3	EAST - 3	45	639.57			
H	Acanthurus nigrofuscus	3	EAST - 3	41	979.78			
H	Ctenochaetus strigosus	3	EAST - 3	1	15.20	100	8254.31	63.8
O	Stegastes fasciolatus	3	EAST - 3	7	103.34			
O	Melichthys niger	3	EAST - 3	4	653.34			
O	Melichthys vidua	3	EAST - 3	1	199.03			
O	Canthigaster jactator	3	EAST - 3	7	24.93	19	980.65	7.6
P	Chromis vanderbilti	3	EAST - 3	9	2.84	9	2.84	0.02
		3	EAST - 3	224	12943.8311	224	12943.8311	100
C	Parupeneus pleurostigma	4	EAST - 4	1	30.44			
C	Parupeneus multifasciatus	4	EAST - 4	4	44.21			
C	Parupeneus multifasciatus	4	EAST - 4	2	54.23			
C	Bodianus bilunulatus	4	EAST - 4	1	871.53			
C	Labroides phthirophagus	4	EAST - 4	1	0.63			
C	Pseudocheilinus octotaenia	4	EAST - 4	1	35.76			
C	Pseudocheilinus octotaenia	4	EAST - 4	1	14.41			
C	Thalassoma duperrey	4	EAST - 4	19	1044.03			
C	Thalassoma duperrey	4	EAST - 4	6	582.31			
C	Thalassoma duperrey	4	EAST - 4	30	821.71			
C	Thalassoma duperrey	4	EAST - 4	35	390.71			
C	Coris venusta	4	EAST - 4	3	28.16			
C	Coris gaimard	4	EAST - 4	2	17.13			
C	Coris ballieui	4	EAST - 4	1	8.57			
C	Pseudojuloides cerasinus	4	EAST - 4	8	25.20			
C	Stethojulis balteata	4	EAST - 4	2	28.82			
C	Macropharyngodon geoffroy	4	EAST - 4	6	4.62			
C	Halichoeres ornatissimus	4	EAST - 4	3	49.35			
C	Rhinecanthus rectangulus	4	EAST - 4	2	171.75			
C	Rhinecanthus rectangulus	4	EAST - 4	1	144.65			
C	Ostracion meleagris	4	EAST - 4	1	13.75	130	4381.98	35.8
CF	Cantherhines dumerili	4	EAST - 4	2	389.95	2	389.95	3.2
H	Acanthurus triostegus	4	EAST - 4	1	100.01			
H	Acanthurus nigrofuscus	4	EAST - 4	8	191.18			
H	Acanthurus nigrofuscus	4	EAST - 4	18	255.83			
H	Acanthurus olivaceus	4	EAST - 4	10	3932.10			
H	Acanthurus olivaceus	4	EAST - 4	4	2252.68			
H	Acanthurus dussumieri	4	EAST - 4	1	326.59	42	7058.39	57.7

GROUP	SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
	11-May-09							
O	Stegastes fasciolatus	4	EAST - 4	1	14.76			
O	Melichthys niger	4	EAST - 4	2	326.67			
O	Canthigaster jactator	4	EAST - 4	5	17.81	8	359.24	2.9
P	Chromis vanderbilti	4	EAST - 4	146	46.12	146	46.12	0.4
		4	EAST - 4	328	12235.6946	328	12235.6946	100
C	Saurida gracilis	5	Ko Olina 1	1	83.87			
C	Lutjanus fulvus	5	Ko Olina 1	1	525.17			
C	Parupeneus multifasciatus	5	Ko Olina 1	1	155.42			
C	Parupeneus multifasciatus	5	Ko Olina 1	1	96.08			
C	Parupeneus multifasciatus	5	Ko Olina 1	2	108.80			
C	Parupeneus bifasciatus	5	Ko Olina 1	1	107.31			
C	Plectroglyphidodon johnstonianu	5	Ko Olina 1	1	1.72			
C	Paracirrhites arcatus	5	Ko Olina 1	1	8.12			
C	Labroides phthirophagus	5	Ko Olina 1	2	1.26			
C	Thalassoma duperrey	5	Ko Olina 1	19	212.10			
C	Thalassoma duperrey	5	Ko Olina 1	23	629.98			
C	Thalassoma duperrey	5	Ko Olina 1	15	824.23			
C	Thalassoma duperrey	5	Ko Olina 1	5	485.26			
C	Gomphosus varius	5	Ko Olina 1	1	11.04			
C	Gomphosus varius	5	Ko Olina 1	1	22.60			
C	Stethojulis balteata	5	Ko Olina 1	4	143.05			
C	Halichoeres ornatissimus	5	Ko Olina 1	1	16.45			
C	Halichoeres ornatissimus	5	Ko Olina 1	1	25.14			
C	Zanclus cornutus	5	Ko Olina 1	2	208.32			
C	Sufflamen bursa	5	Ko Olina 1	3	257.62			
C	Sufflamen bursa	5	Ko Olina 1	3	433.95			
C	Ostracion meleagris	5	Ko Olina 1	1	6.76	90	4364.26	9.7
CF	Chaetodon unimaculatus	5	Ko Olina 1	2	50.61			
CF	Chaetodon ornatissimus	5	Ko Olina 1	2	138.00			
CF	Chaetodon multicinctus	5	Ko Olina 1	2	26.06			
CF	Chaetodon multicinctus	5	Ko Olina 1	2	45.11	8	259.79	0.6
H	Scarus psittacus	5	Ko Olina 1	1	37.87			
H	Scarus rubroviolaceus	5	Ko Olina 1	1	1160.01			
H	Scarus rubroviolaceus	5	Ko Olina 1	1	85.39			
H	Scarus rubroviolaceus	5	Ko Olina 1	3	2021.26			
H	Scarus rubroviolaceus	5	Ko Olina 1	1	346.50			
H	Acanthurus triostegus	5	Ko Olina 1	1	46.32			
H	Acanthurus triostegus	5	Ko Olina 1	2	34.33			
H	Acanthurus leucopareius	5	Ko Olina 1	2	1128.73			
H	Acanthurus leucopareius	5	Ko Olina 1	5	1870.32			
H	Acanthurus leucopareius	5	Ko Olina 1	8	1061.60			
H	Acanthurus nigrofuscus	5	Ko Olina 1	31	1681.83			
H	Acanthurus nigrofuscus	5	Ko Olina 1	13	184.77			
H	Acanthurus nigrofuscus	5	Ko Olina 1	9	215.07			
H	Acanthurus nigroris	5	Ko Olina 1	1	172.30			
H	Acanthurus olivaceus	5	Ko Olina 1	26	14642.43			
H	Acanthurus olivaceus	5	Ko Olina 1	2	94.95			
H	Acanthurus olivaceus	5	Ko Olina 1	20	7864.20			
H	Acanthurus blochii	5	Ko Olina 1	3	992.01			
H	Ctenochaetus strigosus	5	Ko Olina 1	7	924.94			
H	Ctenochaetus strigosus	5	Ko Olina 1	44	2898.06			
H	Ctenochaetus strigosus	5	Ko Olina 1	23	617.41			
H	Naso lituratus	5	Ko Olina 1	2	897.88	206	38978.19	86.8
O	Stegastes fasciolatus	5	Ko Olina 1	17	250.97			
O	Melichthys niger	5	Ko Olina 1	6	980.01			
O	Canthigaster jactator	5	Ko Olina 1	9	32.06	32	1263.05	2.8
P	Chromis vanderbilti	5	Ko Olina 1	47	14.85	47	14.85	0.03
		5	Ko Olina 1	383	44880.1288	383	44880.1288	100

GRO	SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	6	Ko Olina 2	1	340.44			
C	Parupeneus multifasciatus	6	Ko Olina 2	2	54.23			
C	Forcipiger flavissimus	6	Ko Olina 2	3	27.45			
C	Chaetodon lunula	6	Ko Olina 2	1	35.99			
C	Plectroglyphidodon johnstonianu	6	Ko Olina 2	3	5.17			
C	Paracirrhites arcatus	6	Ko Olina 2	2	16.24			
C	Labroides phthirophagus	6	Ko Olina 2	3	1.88			
C	Thalassoma duperrey	6	Ko Olina 2	6	329.69			
C	Thalassoma duperrey	6	Ko Olina 2	10	273.90			
C	Thalassoma duperrey	6	Ko Olina 2	4	44.65			
C	Thalassoma duperrey	6	Ko Olina 2	1	97.05			
C	Halichoeres ornatissimus	6	Ko Olina 2	1	16.45			
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	1	144.65			
C	Sufflamen bursa	6	Ko Olina 2	1	85.87			
C	Ostracion meleagris	6	Ko Olina 2	1	6.76	44	1707.81	5.6
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			
CF	Cantherhines dumerili	6	Ko Olina 2	1	623.68	7	838.36	2.7
H	Acanthurus triostegus	6	Ko Olina 2	1	46.32			
H	Acanthurus triostegus	6	Ko Olina 2	2	200.03			
H	Acanthurus triostegus	6	Ko Olina 2	3	51.50			
H	Acanthurus leucopareius	6	Ko Olina 2	2	748.13			
H	Acanthurus leucopareius	6	Ko Olina 2	9	1194.30			
H	Acanthurus leucopareius	6	Ko Olina 2	4	266.96			
H	Acanthurus nigrofuscus	6	Ko Olina 2	5	71.06			
H	Acanthurus nigrofuscus	6	Ko Olina 2	4	217.01			
H	Acanthurus nigrofuscus	6	Ko Olina 2	26	621.32			
H	Acanthurus olivaceus	6	Ko Olina 2	12	3140.00			
H	Acanthurus olivaceus	6	Ko Olina 2	18	10137.06			
H	Acanthurus dussumieri	6	Ko Olina 2	1	40.82			
H	Acanthurus dussumieri	6	Ko Olina 2	1	564.35			
H	Acanthurus blochii	6	Ko Olina 2	5	3919.05			
H	Acanthurus blochii	6	Ko Olina 2	4	1814.38			
H	Acanthurus blochii	6	Ko Olina 2	4	226.80			
H	Ctenochaetus strigosus	6	Ko Olina 2	6	395.19			
H	Ctenochaetus strigosus	6	Ko Olina 2	13	348.97			
H	Ctenochaetus strigosus	6	Ko Olina 2	5	75.99			
H	Ctenochaetus strigosus	6	Ko Olina 2	9	1189.20			
H	Zebrasoma flavescens	6	Ko Olina 2	3	28.45			
H	Zebrasoma flavescens	6	Ko Olina 2	2	106.56			
H	Naso lituratus	6	Ko Olina 2	1	622.36			
H	Naso lituratus	6	Ko Olina 2	1	311.61	141	26337.44	86.0
O	Stegastes fasciolatus	6	Ko Olina 2	3	44.29			
O	Melichthys niger	6	Ko Olina 2	4	653.34			
O	Melichthys vidua	6	Ko Olina 2	2	398.06			
O	Canthigaster jactator	6	Ko Olina 2	11	39.18	20	1134.87	3.7
P	Abudefduf abdominalis	6	Ko Olina 2	19	595.32			
P	Chromis vanderbilti	6	Ko Olina 2	9	2.84	28	598.16	2.0
		6	Ko Olina 2	240	30616.6452	240	30616.6452	100
C	Parupeneus multifasciatus	7	KAHE 1-D	1	54.40			
C	Parupeneus bifasciatus	7	KAHE 1-D	1	59.77			
C	Parupeneus cyclostomus	7	KAHE 1-D	1	24.80			
C	Plectroglyphidodon johnstonianu	7	KAHE 1-D	5	8.61			
C	Plectroglyphidodon imparipennis	7	KAHE 1-D	4	3.45			
C	Cirrhitus pinnulatus	7	KAHE 1-D	1	44.59			

11-May-09

GRO	SPECIES **11-May-09**	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Labroides phthirophagus	7	KAHE 1-D	2	1.26			
C	Thalassoma duperrey	7	KAHE 1-D	5	485.26			
C	Thalassoma duperrey	7	KAHE 1-D	14	383.47			
C	Thalassoma duperrey	7	KAHE 1-D	4	219.80			
C	Gomphosus varius	7	KAHE 1-D	1	22.60			
C	Coris gaimard	7	KAHE 1-D	1	139.13			
C	Stethojulis balteata	7	KAHE 1-D	2	71.53			
C	Stethojulis balteata	7	KAHE 1-D	1	72.39			
C	Halichoeres ornatissimus	7	KAHE 1-D	1	16.45			
C	Zanclus cornutus	7	KAHE 1-D	3	164.70			
C	Rhinecanthus rectangulus	7	KAHE 1-D	1	85.87			
C	Rhinecanthus rectangulus	7	KAHE 1-D	1	45.36			
C	Sufflamen bursa	7	KAHE 1-D	4	343.49			
C	Sufflamen bursa	7	KAHE 1-D	1	19.92	54	2266.83	22.1
CF	Chaetodon quadrimaculatus	7	KAHE 1-D	4	101.22	4	101.22	1.0
H	Scarus psittacus	7	KAHE 1-D	32	1211.92			
H	Scarus psittacus	7	KAHE 1-D	1	144.94			
H	Acanthurus triostegus	7	KAHE 1-D	1	17.17			
H	Acanthurus triostegus	7	KAHE 1-D	1	46.32			
H	Acanthurus nigrofuscus	7	KAHE 1-D	52	1242.65			
H	Ctenochaetus strigosus	7	KAHE 1-D	1	65.86			
H	Ctenochaetus strigosus	7	KAHE 1-D	9	241.60			
H	Ctenochaetus strigosus	7	KAHE 1-D	12	182.38			
H	Zebrasoma flavescens	7	KAHE 1-D	1	9.48	110	3162.32	30.9
O	Stegastes fasciolatus	7	KAHE 1-D	4	59.05			
O	Melichthys niger	7	KAHE 1-D	27	4410.06			
O	Melichthys vidua	7	KAHE 1-D	1	124.35	32	4593.46	44.8
P	Chromis vanderbilti	7	KAHE 1-D	45	14.22			
P	Chromis ovalis	7	KAHE 1-D	18	106.77	63	120.99	1.2
		7	KAHE 1-D	263	10244.8125	263	10244.8125	100
C	Parupeneus multifasciatus	8	KAHE 5 -B	1	27.12			
C	Parupeneus multifasciatus	8	KAHE 5 -B	1	155.42			
C	Parupeneus multifasciatus	8	KAHE 5 -B	3	288.24			
C	Plectroglyphidodon johnstonianu	8	KAHE 5 -B	4	6.89			
C	Plectroglyphidodon imparipennis	8	KAHE 5 -B	4	3.45			
C	Paracirrhites arcatus	8	KAHE 5 -B	1	8.12			
C	Labroides phthirophagus	8	KAHE 5 -B	1	0.63			
C	Thalassoma duperrey	8	KAHE 5 -B	2	194.10			
C	Thalassoma duperrey	8	KAHE 5 -B	5	274.74			
C	Thalassoma duperrey	8	KAHE 5 -B	11	301.30			
C	Thalassoma duperrey	8	KAHE 5 -B	19	212.10			
C	Gomphosus varius	8	KAHE 5 -B	1	62.03			
C	Gomphosus varius	8	KAHE 5 -B	2	45.20			
C	Stethojulis balteata	8	KAHE 5 -B	3	107.29			
C	Halichoeres ornatissimus	8	KAHE 5 -B	1	16.45			
C	Halichoeres ornatissimus	8	KAHE 5 -B	1	25.14			
C	Zanclus cornutus	8	KAHE 5 -B	1	104.16			
C	Rhinecanthus rectangulus	8	KAHE 5 -B	1	85.87			
C	Sufflamen bursa	8	KAHE 5 -B	1	19.92			
C	Sufflamen bursa	8	KAHE 5 -B	2	171.75	65	2109.92	29.9
CF	Chaetodon multicinctus	8	KAHE 5 -B	4	52.12			
CF	Pervagor melanocephalus	8	KAHE 5 -B	1	9.75	5	61.87	0.9
H	Scarus psittacus	8	KAHE 5 -B	17	643.83			
H	Acanthurus triostegus	8	KAHE 5 -B	1	17.17			
H	Acanthurus nigrofuscus	8	KAHE 5 -B	9	488.27			
H	Acanthurus nigrofuscus	8	KAHE 5 -B	21	298.47			
H	Acanthurus nigrofuscus	8	KAHE 5 -B	24	573.53			
H	Acanthurus olivaceus	8	KAHE 5 -B	2	187.54			

GRO	11-May-09 SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
H	Acanthurus olivaceus	8	KAHE 5 -B	2	94.95			
H	Acanthurus olivaceus	8	KAHE 5 -B	2	523.33			
H	Acanthurus olivaceus	8	KAHE 5 -B	1	563.17			
H	Naso unicornis	8	KAHE 5 -B	1	525.26	80	3915.52	55.5
O	Stegastes fasciolatus	8	KAHE 5 -B	10	147.63			
O	Melichthys vidua	8	KAHE 5 -B	2	398.06			
O	Cantherhines sandwichiensis	8	KAHE 5 -B	1	82.05			
O	Canthigaster jactator	8	KAHE 5 -B	3	10.69			
O	Canthigaster rivulata	8	KAHE 5 -B	1	7.59	17	646.02	9.2
P	Chromis vanderbilti	8	KAHE 5 -B	192	60.65			
P	Naso hexacanthus	8	KAHE 5 -B	2	146.72			
P	Naso brevirostris	8	KAHE 5 -B	1	38.92			
P	Naso brevirostris	8	KAHE 5 -B	1	73.36	196	319.65	4.5
		8	KAHE 5 -B	363	7052.9861	363	7052.98605	100
C	Parupeneus pleurostigma	9	KAHE 7 -B	1	225.63			
C	Parupeneus pleurostigma	9	KAHE 7 -B	1	98.25			
C	Parupeneus pleurostigma	9	KAHE 7 -B	1	153.39			
C	Parupeneus multifasciatus	9	KAHE 7 -B	1	96.08			
C	Parupeneus multifasciatus	9	KAHE 7 -B	1	27.12			
C	Parupeneus multifasciatus	9	KAHE 7 -B	1	54.40			
C	Parupeneus multifasciatus	9	KAHE 7 -B	1	155.42			
C	Bodianus bilunulatus	9	KAHE 7 -B	1	0.52			
C	Thalassoma duperrey	9	KAHE 7 -B	1	97.05			
C	Thalassoma duperrey	9	KAHE 7 -B	2	109.90			
C	Thalassoma duperrey	9	KAHE 7 -B	4	109.56			
C	Thalassoma duperrey	9	KAHE 7 -B	2	6.30			
C	Coris venusta	9	KAHE 7 -B	1	23.64			
C	Stethojulis balteata	9	KAHE 7 -B	3	107.29			
C	Stethojulis balteata	9	KAHE 7 -B	1	72.39			
C	Zanclus cornutus	9	KAHE 7 -B	1	54.90			
C	Sufflamen bursa	9	KAHE 7 -B	6	515.24	29	1907.07	48.2
H	Acanthurus triostegus	9	KAHE 7 -B	1	46.32			
H	Acanthurus triostegus	9	KAHE 7 -B	1	17.17			
H	Acanthurus nigrofuscus	9	KAHE 7 -B	1	54.25			
H	Acanthurus nigrofuscus	9	KAHE 7 -B	1	23.90			
H	Acanthurus olivaceus	9	KAHE 7 -B	1	93.77			
H	Acanthurus olivaceus	9	KAHE 7 -B	37	1756.65			
H	Naso unicornis	9	KAHE 7 -B	1	38.92	43	2030.97	51.3
O	Canthigaster coronata	9	KAHE 7 -B	2	15.18	2	15.18	0.4
P	Dascyllus albisella	9	KAHE 7 -B	2	3.37			
P	Chromis vanderbilti	9	KAHE 7 -B	12	3.79	14	7.16	0.2
		9	KAHE 7 -B	88	3960.3888	88	3960.3888	100
C	Parupeneus pleurostigma	10	KAHE 7 -C	2	116.02			
C	Parupeneus pleurostigma	10	KAHE 7 -C	1	98.25			
C	Parupeneus multifasciatus	10	KAHE 7 -C	8	216.93			
C	Parupeneus multifasciatus	10	KAHE 7 -C	4	217.60			
C	Parupeneus multifasciatus	10	KAHE 7 -C	2	192.16			
C	Labroides phthirophagus	10	KAHE 7 -C	1	0.63			
C	Thalassoma duperrey	10	KAHE 7 -C	1	97.05			
C	Thalassoma duperrey	10	KAHE 7 -C	4	219.80			
C	Thalassoma duperrey	10	KAHE 7 -C	6	66.98			
C	Thalassoma duperrey	10	KAHE 7 -C	12	328.69			
C	Coris venusta	10	KAHE 7 -C	1	23.64			
C	Coris venusta	10	KAHE 7 -C	1	2.55			
C	Stethojulis balteata	10	KAHE 7 -C	1	72.39			
C	Halichoeres ornatissimus	10	KAHE 7 -C	1	9.52			
C	Sufflamen bursa	10	KAHE 7 -C	2	289.30			

	11-May-09					GROUP	GROUP	GROUP
GRO	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	BIOMASS	PERCENT
C	Sufflamen bursa	10	KAHE 7 -C	4	343.49	51	2294.99	52.1
CF	Chaetodon multicinctus	10	KAHE 7 -C	2	13.31	2	13.31	0.3
H	Calotomus carolinus	10	KAHE 7 -C	1	34.69			
H	Acanthurus triostegus	10	KAHE 7 -C	12	555.78			
H	Acanthurus nigrofuscus	10	KAHE 7 -C	3	71.69			
H	Acanthurus nigrofuscus	10	KAHE 7 -C	2	108.50			
H	Acanthurus nigrofuscus	10	KAHE 7 -C	6	85.28			
H	Acanthurus olivaceus	10	KAHE 7 -C	12	569.72	36	1425.67	32.3
O	Stegastes fasciolatus	10	KAHE 7 -C	1	14.76			
O	Melichthys vidua	10	KAHE 7 -C	2	398.06			
O	Cantherhines sandwichiensis	10	KAHE 7 -C	2	164.10			
O	Canthigaster coronata	10	KAHE 7 -C	5	37.95	10	614.88	14.0
P	Chromis vanderbilti	10	KAHE 7 -C	56	17.69			
P	Chromis hanui	10	KAHE 7 -C	3	2.24			
P	Naso brevirostris	10	KAHE 7 -C	1	38.92	60	58.85	1.3
		10	KAHE 7 -C	159	4407.7093	159	4407.7093	100
C	Bodianus bilunulatus	11	KAHE 7 -D	1	0.52			
C	Sufflamen bursa	11	KAHE 7 -D	2	289.30			
C	Sufflamen bursa	11	KAHE 7 -D	2	171.75	5	461.56	92.6
O	Canthigaster coronata	11	KAHE 7 -D	1	7.59			
O	Canthigaster coronata	11	KAHE 7 -D	1	22.05			
O	Canthigaster jactator	11	KAHE 7 -D	2	7.12	4	36.77	7.4
		11	KAHE 7 -D	9	498.3265	9	498.326531	100
C	Gymnothorax eurostus	12	KAHE 7 - E	1	335.03			
C	Monotaxis grandoculis	12	KAHE 7 - E	1	13.74			
C	Parupeneus multifasciatus	12	KAHE 7 - E	14	379.63			
C	Parupeneus multifasciatus	12	KAHE 7 - E	1	155.42			
C	Parupeneus multifasciatus	12	KAHE 7 - E	1	235.75			
C	Parupeneus multifasciatus	12	KAHE 7 - E	1	54.40			
C	Forcipiger flavissimus	12	KAHE 7 - E	2	18.30			
C	Plectroglyphidodon johnstonianu	12	KAHE 7 - E	5	8.61			
C	Paracirrhites arcatus	12	KAHE 7 - E	4	32.47			
C	Pseudocheilinus octotaenia	12	KAHE 7 - E	1	14.41			
C	Thalassoma duperrey	12	KAHE 7 - E	5	136.95			
C	Thalassoma duperrey	12	KAHE 7 - E	6	329.69			
C	Thalassoma duperrey	12	KAHE 7 - E	14	156.29			
C	Thalassoma duperrey	12	KAHE 7 - E	1	97.05			
C	Coris venusta	12	KAHE 7 - E	1	9.39			
C	Pseudojuloides cerasinus	12	KAHE 7 - E	5	15.75			
C	Pseudojuloides cerasinus	12	KAHE 7 - E	7	191.73			
C	Stethojulis balteata	12	KAHE 7 - E	1	35.76			
C	Macropharyngodon geoffroy	12	KAHE 7 - E	1	5.75			
C	Zanclus cornutus	12	KAHE 7 - E	1	54.90			
C	Sufflamen bursa	12	KAHE 7 - E	2	289.30			
C	Sufflamen bursa	12	KAHE 7 - E	4	343.49	79	2913.81	74.5
CF	Chaetodon multicinctus	12	KAHE 7 - E	4	26.63	4	26.63	0.7
H	Centropyge potteri	12	KAHE 7 - E	1	4.98			
H	Scarus psittacus	12	KAHE 7 - E	2	75.75			
H	Acanthurus nigrofuscus	12	KAHE 7 - E	27	203.16			
H	Acanthurus nigrofuscus	12	KAHE 7 - E	14	198.98			
H	Ctenochaetus strigosus	12	KAHE 7 - E	3	22.73	51	505.60	12.9
O	Melichthys vidua	12	KAHE 7 - E	1	124.35			
O	Melichthys vidua	12	KAHE 7 - E	1	199.03			
O	Cantherhines sandwichiensis	12	KAHE 7 - E	1	82.05			
O	Canthigaster jactator	12	KAHE 7 - E	5	17.81	8	423.24	10.8
P	Chromis vanderbilti	12	KAHE 7 - E	122	38.54			
P	Chromis hanui	12	KAHE 7 - E	3	2.24	125	40.78	1.0
		12	KAHE 7 - E	263	3910.0564	267	3910.05641	100

GRO	SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
	11-May-09							
C	Aulostomus chinensis	13	KAHE 10	1	52.00			
C	Cephalopholis argus	13	KAHE 10	1	1077.13			
C	Cephalopholis argus	13	KAHE 10	1	638.29			
C	Lutjanus kasmira	13	KAHE 10	19	3622.29			
C	Lutjanus kasmira	13	KAHE 10	91	10006.24			
C	Parupeneus multifasciatus	13	KAHE 10	9	99.46			
C	Parupeneus multifasciatus	13	KAHE 10	1	96.08			
C	Parupeneus multifasciatus	13	KAHE 10	4	108.47			
C	Parupeneus multifasciatus	13	KAHE 10	1	235.75			
C	Parupeneus multifasciatus	13	KAHE 10	4	217.60			
C	Parupeneus cyclostomus	13	KAHE 10	1	88.57			
C	Parupeneus cyclostomus	13	KAHE 10	1	24.80			
C	Forcipiger flavissimus	13	KAHE 10	2	18.30			
C	Cirrhitops fasciatus	13	KAHE 10	2	16.45			
C	Labroides phthirophagus	13	KAHE 10	1	0.63			
C	Thalassoma duperrey	13	KAHE 10	17	1649.88			
C	Thalassoma duperrey	13	KAHE 10	4	44.65			
C	Thalassoma duperrey	13	KAHE 10	19	520.42			
C	Thalassoma duperrey	13	KAHE 10	25	1373.72			
C	Stethojulis balteata	13	KAHE 10	4	143.05			
C	Stethojulis balteata	13	KAHE 10	3	217.17			
C	Zanclus cornutus	13	KAHE 10	2	109.80			
C	Sufflamen bursa	13	KAHE 10	2	171.75			
C	Sufflamen bursa	13	KAHE 10	2	289.30	217	20821.79	70.8
CF	Chaetodon multicinctus	13	KAHE 10	2	26.06	2	26.06	0.1
H	Calotomus carolinus	13	KAHE 10	1	499.89			
H	Calotomus carolinus	13	KAHE 10	1	707.00			
H	Scarus sordidus	13	KAHE 10	1	234.65			
H	Acanthurus triostegus	13	KAHE 10	31	1435.77			
H	Acanthurus triostegus	13	KAHE 10	8	137.33			
H	Acanthurus nigrofuscus	13	KAHE 10	2	108.50			
H	Acanthurus nigrofuscus	13	KAHE 10	4	95.59			
H	Acanthurus nigrofuscus	13	KAHE 10	5	71.06			
H	Acanthurus nigroris	13	KAHE 10	1	54.25			
H	Acanthurus olivaceus	13	KAHE 10	5	468.84			
H	Acanthurus olivaceus	13	KAHE 10	4	654.07			
H	Acanthurus olivaceus	13	KAHE 10	3	142.43			
H	Acanthurus blochii	13	KAHE 10	1	330.67			
H	Acanthurus blochii	13	KAHE 10	2	195.95			
H	Naso lituratus	13	KAHE 10	1	622.36			
H	Naso lituratus	13	KAHE 10	1	205.99	71	5964.36	20.3
O	Stegastes fasciolatus	13	KAHE 10	13	191.92			
O	Melichthys vidua	13	KAHE 10	1	199.03			
O	Canthigaster jactator	13	KAHE 10	3	10.69	17	401.64	1.4
P	Dascyllus albisella	13	KAHE 10	32	98.83			
P	Abudefduf abdominalis	13	KAHE 10	9	421.67			
P	Abudefduf abdominalis	13	KAHE 10	35	1096.64			
P	Chromis vanderbilti	13	KAHE 10	27	8.53			
P	Chromis ovalis	13	KAHE 10	49	566.42	152	2192.09	7.5
		13	KAHE 10	459	29405.9362	459	29405.9362	100
C	Parupeneus multifasciatus	14	Nanakuli 1	1	96.08			
C	Parupeneus multifasciatus	14	Nanakuli 1	2	54.23			
C	Parupeneus multifasciatus	14	Nanakuli 1	3	163.20			
C	Plectroglyphidodon imparipennis	14	Nanakuli 1	3	2.59			
C	Thalassoma duperrey	14	Nanakuli 1	3	82.17			
C	Thalassoma duperrey	14	Nanakuli 1	6	66.98			
C	Thalassoma duperrey	14	Nanakuli 1	2	109.90			
C	Thalassoma duperrey	14	Nanakuli 1	1	97.05			
C	Stethojulis balteata	14	Nanakuli 1	2	71.53			
C	Rhinecanthus rectangulus	14	Nanakuli 1	2	12.50			

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GRO	SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Rhinecanthus rectangulus	14	Nanakuli 1	1	45.36			
C	Ostracion meleagris	14	Nanakuli 1	1	6.76	27	808.35	67.0
H	Acanthurus triostegus	14	Nanakuli 1	3	138.95			
H	Acanthurus triostegus	14	Nanakuli 1	2	34.33			
H	Acanthurus nigrofuscus	14	Nanakuli 1	2	28.43			
H	Acanthurus nigrofuscus	14	Nanakuli 1	4	95.59	11	297.29	24.7
O	Cantherhines sandwichiensis	14	Nanakuli 1	1	82.05			
O	Canthigaster coronata	14	Nanakuli 1	1	7.59			
O	Canthigaster jactator	14	Nanakuli 1	3	10.69	5	100.33	8.3
		14	Nanakuli 1	43	1205.9692	43	1205.96922	100
C	Gymnothorax undulatus	15	Nanakuli 2	1	547.31			
C	Monotaxis grandoculis	15	Nanakuli 2	1	34.79			
C	Parupeneus multifasciatus	15	Nanakuli 2	2	471.50			
C	Parupeneus multifasciatus	15	Nanakuli 2	7	672.57			
C	Parupeneus multifasciatus	15	Nanakuli 2	4	621.69			
C	Parupeneus multifasciatus	15	Nanakuli 2	1	27.12			
C	Labroides phthirophagus	15	Nanakuli 2	1	0.63			
C	Thalassoma duperrey	15	Nanakuli 2	7	191.73			
C	Thalassoma duperrey	15	Nanakuli 2	13	714.34			
C	Thalassoma duperrey	15	Nanakuli 2	8	776.42			
C	Gomphosus varius	15	Nanakuli 2	1	22.60			
C	Halichoeres ornatissimus	15	Nanakuli 2	1	16.45			
C	Zanclus cornutus	15	Nanakuli 2	2	208.32	49	4305.45	12.3
H	Acanthurus leucopareius	15	Nanakuli 2	10	8111.69			
H	Acanthurus leucopareius	15	Nanakuli 2	24	8977.54			
H	Acanthurus nigrofuscus	15	Nanakuli 2	18	976.54			
H	Acanthurus nigrofuscus	15	Nanakuli 2	10	142.13			
H	Acanthurus nigrofuscus	15	Nanakuli 2	33	788.60			
H	Acanthurus olivaceus	15	Nanakuli 2	7	5436.23			
H	Acanthurus dussumieri	15	Nanakuli 2	2	1128.71			
H	Acanthurus dussumieri	15	Nanakuli 2	5	1632.97			
H	Acanthurus blochii	15	Nanakuli 2	3	2351.43			
H	Acanthurus blochii	15	Nanakuli 2	3	696.72			
H	Ctenochaetus strigosus	15	Nanakuli 2	4	107.38	119	30349.95	87.0
O	Stegastes fasciolatus	15	Nanakuli 2	15	221.45			
O	Canthigaster jactator	15	Nanakuli 2	4	14.25	19	235.70	0.7
P	Chromis vanderbilti	15	Nanakuli 2	7	2.21	7	2.21	0.01
		15	Nanakuli 2	194	34893.3088	194	34893.3088	100
C	Myripristis amaenus	16	KAHE PIPE	37	3037.07			
C	Myripristis amaenus	16	KAHE PIPE	19	2675.36			
C	Decapterus macarellus	16	KAHE PIPE	26	3387.26			
C	Decapterus macarellus	16	KAHE PIPE	7	1885.39			
C	Aphareus furcatus	16	KAHE PIPE	1	202.48			
C	Mulloides vanicolensis	16	KAHE PIPE	12	3976.50			
C	Parupeneus pleurostigma	16	KAHE PIPE	1	153.39			
C	Parupeneus multifasciatus	16	KAHE PIPE	2	108.80			
C	Parupeneus multifasciatus	16	KAHE PIPE	1	340.44			
C	Parupeneus bifasciatus	16	KAHE PIPE	1	176.01			
C	Forcipiger flavissimus	16	KAHE PIPE	1	9.15			
C	Chaetodon fremblii	16	KAHE PIPE	3	62.73			
C	Chaetodon auriga	16	KAHE PIPE	2	96.78			
C	Chaetodon lunula	16	KAHE PIPE	1	35.99			
C	Paracirrhites arcatus	16	KAHE PIPE	4	32.47			
C	Labroides phthirophagus	16	KAHE PIPE	4	2.51			
C	Thalassoma duperrey	16	KAHE PIPE	32	876.50			
C	Thalassoma duperrey	16	KAHE PIPE	52	5046.70			
C	Thalassoma duperrey	16	KAHE PIPE	10	1569.92			
C	Thalassoma duperrey	16	KAHE PIPE	30	1648.47			
C	Thalassoma purpureum	16	KAHE PIPE	1	946.59			

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GRO	SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Gomphosus varius	16	KAHE PIPE	2	45.20			
C	Gomphosus varius	16	KAHE PIPE	4	248.12			
C	Coris gaimard	16	KAHE PIPE	2	278.26			
C	Stethojulis balteata	16	KAHE PIPE	2	144.78			
C	Stethojulis balteata	16	KAHE PIPE	8	286.11			
C	Macropharyngodon geoffroy	16	KAHE PIPE	4	74.51			
C	Halichoeres ornatissimus	16	KAHE PIPE	2	32.90			
C	Halichoeres ornatissimus	16	KAHE PIPE	4	100.55			
C	Zanclus cornutus	16	KAHE PIPE	4	416.63			
C	Sufflamen bursa	16	KAHE PIPE	4	343.49			
C	Sufflamen bursa	16	KAHE PIPE	5	723.25			
C	Alutera scripta	16	KAHE PIPE	3	2909.62	291	31873.93	37.5
CF	Chaetodon multicinctus	16	KAHE PIPE	2	26.06			
CF	Pervagor melanocephalus	16	KAHE PIPE	2	19.50	4	45.56	0.1
H	Scarus sordidus	16	KAHE PIPE	1	367.02			
H	Scarus sordidus	16	KAHE PIPE	1	1427.57			
H	Scarus sordidus	16	KAHE PIPE	14	1960.08			
H	Scarus sordidus	16	KAHE PIPE	14	7623.96			
H	Scarus sordidus	16	KAHE PIPE	19	14726.30			
H	Scarus psittacus	16	KAHE PIPE	25	946.82			
H	Scarus psittacus	16	KAHE PIPE	3	237.80			
H	Acanthurus nigrofuscus	16	KAHE PIPE	13	184.77			
H	Acanthurus nigrofuscus	16	KAHE PIPE	41	979.78			
H	Acanthurus nigrofuscus	16	KAHE PIPE	18	976.54			
H	Ctenochaetus strigosus	16	KAHE PIPE	3	80.53			
H	Ctenochaetus strigosus	16	KAHE PIPE	4	263.46	156	29774.63	35.0
O	Stegastes fasciolatus	16	KAHE PIPE	13	191.92			
O	Melichthys niger	16	KAHE PIPE	24	3920.05			
O	Melichthys vidua	16	KAHE PIPE	3	597.09			
O	Cantherhines sandwichiensis	16	KAHE PIPE	1	196.14			
O	Canthigaster jactator	16	KAHE PIPE	9	32.06	50	4937.26	5.8
P	Chaetodon miliaris	16	KAHE PIPE	15	317.52			
P	Abudefduf abdominalis	16	KAHE PIPE	540	16919.59			
P	Chromis vanderbilti	16	KAHE PIPE	117	36.96			
P	Chromis ovalis	16	KAHE PIPE	159	943.15			
P	Naso brevirostris	16	KAHE PIPE	1	190.74	832	18407.97	21.6
		16	KAHE PIPE	1333	85039.3540	1333	85039.3540	100

21 JULY 2009 FIELD DATA

GRO	SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
	21-Jul-09							
C	Parupeneus multifasciatus	1	EAST - 1	1	11.05			
C	Plectroglyphidodon imparipennis	1	EAST - 1	7	6.03			
C	Paracirrhites arcatus	1	EAST - 1	4	32.47			
C	Cirrhitops fasciatus	1	EAST - 1	1	8.23			
C	Cheilinus bimaculatus	1	EAST - 1	2	8.20			
C	Cheilinus bimaculatus	1	EAST - 1	1	58.29			
C	Thalassoma duperrey	1	EAST - 1	13	356.08			
C	Thalassoma duperrey	1	EAST - 1	19	59.86			
C	Thalassoma duperrey	1	EAST - 1	8	439.59			
C	Thalassoma duperrey	1	EAST - 1	3	291.16			
C	Thalassoma duperrey	1	EAST - 1	18	200.94			
C	Coris venusta	1	EAST - 1	2	5.11			
C	Coris gaimard	1	EAST - 1	1	139.13			
C	Stethojulis balteata	1	EAST - 1	10	40.01			
C	Stethojulis balteata	1	EAST - 1	3	43.23			
C	Stethojulis balteata	1	EAST - 1	3	107.29			
C	Rhinecanthus rectangulus	1	EAST - 1	1	45.36			
C	Rhinecanthus rectangulus	1	EAST - 1	4	343.49			
C	Rhinecanthus rectangulus	1	EAST - 1	3	433.95			
C	Sufflamen fraenatus	1	EAST - 1	1	329.34	105	2958.80	80.9
CF	Cantherhines dumerili	1	EAST - 1	1	301.33	1	301.33	8.2
H	Acanthurus nigrofuscus	1	EAST - 1	1	54.25			
H	Acanthurus olivaceus	1	EAST - 1	1	11.32	2	65.57	1.8
O	Melichthys vidua	1	EAST - 1	1	296.24			
O	Canthigaster jactator	1	EAST - 1	8	28.50	9	324.74	8.9
P	Chromis vanderbilti	1	EAST - 1	24	7.58	24	7.58	0.2
		1	EAST - 1	141	3658.0191	141	3658.01906	100
C	Cephalopholis argus	2	EAST - 2	1	638.29			
C	Cephalopholis argus	2	EAST - 2	1	1077.13			
C	Parupeneus multifasciatus	2	EAST - 2	1	235.75			
C	Parupeneus multifasciatus	2	EAST - 2	1	11.05			
C	Parupeneus multifasciatus	2	EAST - 2	1	27.12			
C	Parupeneus cyclostomus	2	EAST - 2	1	24.80			
C	Plectroglyphidodon johnstonianu	2	EAST - 2	5	8.61			
C	Plectroglyphidodon imparipennis	2	EAST - 2	6	5.17			
C	Paracirrhites arcatus	2	EAST - 2	6	48.71			
C	Cirrhitops fasciatus	2	EAST - 2	1	15.63			
C	Thalassoma duperrey	2	EAST - 2	21	234.43			
C	Thalassoma duperrey	2	EAST - 2	8	25.20			
C	Thalassoma duperrey	2	EAST - 2	14	1358.73			
C	Thalassoma duperrey	2	EAST - 2	23	1263.82			
C	Thalassoma duperrey	2	EAST - 2	24	657.37			
C	Gomphosus varius	2	EAST - 2	1	39.39			
C	Gomphosus varius	2	EAST - 2	1	11.04			
C	Coris venusta	2	EAST - 2	2	18.77			
C	Coris gaimard	2	EAST - 2	1	8.57			
C	Stethojulis balteata	2	EAST - 2	1	35.76			
C	Macropharyngodon geoffroy	2	EAST - 2	2	21.96			
C	Macropharyngodon geoffroy	2	EAST - 2	4	74.51			
C	Halichoeres ornatissimus	2	EAST - 2	2	32.90			
C	Zanclus cornutus	2	EAST - 2	1	54.90			
C	Rhinecanthus rectangulus	2	EAST - 2	1	45.36			
C	Rhinecanthus rectangulus	2	EAST - 2	2	171.75			
C	Rhinecanthus rectangulus	2	EAST - 2	1	144.65	133	6291.37	43.3
CF	Chaetodon unimaculatus	2	EAST - 2	2	50.61			
CF	Chaetodon ornatissimus	2	EAST - 2	2	138.00			
CF	Chaetodon quadrimaculatus	2	EAST - 2	1	25.30			
CF	Cantherhines dumerili	2	EAST - 2	1	301.33	6	515.24	3.5
H	Acanthurus nigrofuscus	2	EAST - 2	7	52.67			
H	Acanthurus nigrofuscus	2	EAST - 2	58	824.34			

GRO	SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
	21-Jul-09							
H	Acanthurus nigrofuscus	2	EAST - 2	15	358.46			
H	Acanthurus olivaceus	2	EAST - 2	9	177.69			
H	Acanthurus olivaceus	2	EAST - 2	11	6194.87	100	7608.03	52.4
O	Stegastes fasciolatus	2	EAST - 2	3	44.29			
O	Canthigaster jactator	2	EAST - 2	6	21.37	9	65.66	0.5
P	Chromis vanderbilti	2	EAST - 2	141	44.54	141	44.54	0.3
		2	EAST - 2	389	14524.8430	389	14524.843	100
C	Saurida gracilis	3	EAST - 3	1	51.93			
C	Cephalopholis argus	3	EAST - 3	1	471.73			
C	Cephalopholis argus	3	EAST - 3	1	1077.13			
C	Parupeneus multifasciatus	3	EAST - 3	1	54.40			
C	Parupeneus multifasciatus	3	EAST - 3	1	27.12			
C	Parupeneus multifasciatus	3	EAST - 3	1	235.75			
C	Parupeneus multifasciatus	3	EAST - 3	1	11.05			
C	Forcipiger flavissimus	3	EAST - 3	1	9.15			
C	Plectroglyphidodon johnstonianu	3	EAST - 3	7	12.05			
C	Paracirrhites arcatus	3	EAST - 3	10	81.18			
C	Labroides phthirophagus	3	EAST - 3	2	1.26			
C	Pseudocheilinus octotaenia	3	EAST - 3	1	14.41			
C	Thalassoma duperrey	3	EAST - 3	18	989.08			
C	Thalassoma duperrey	3	EAST - 3	18	493.03			
C	Thalassoma duperrey	3	EAST - 3	4	388.21			
C	Thalassoma duperrey	3	EAST - 3	9	100.47			
C	Gomphosus varius	3	EAST - 3	1	11.04			
C	Coris gaimard	3	EAST - 3	1	215.88			
C	Coris gaimard	3	EAST - 3	1	83.79			
C	Stethojulis balteata	3	EAST - 3	5	178.82			
C	Stethojulis balteata	3	EAST - 3	1	14.41			
C	Halichoeres ornatissimus	3	EAST - 3	3	49.35			
C	Sufflamen bursa	3	EAST - 3	3	257.62			
C	Sufflamen fraenatus	3	EAST - 3	1	329.34			
C	Sufflamen fraenatus	3	EAST - 3	1	224.79			
C	Sufflamen fraenatus	3	EAST - 3	1	144.65	95	5527.62	34.4
CF	Chaetodon ornatissimus	3	EAST - 3	2	138.00			
CF	Chaetodon quadrimaculatus	3	EAST - 3	2	50.61			
CF	Chaetodon multicinctus	3	EAST - 3	4	26.63			
CF	Cantherhines dumerili	3	EAST - 3	1	442.38	9	657.62	4.1
H	Scarus psittacus	3	EAST - 3	2	29.23			
H	Scarus psittacus	3	EAST - 3	1	79.27			
H	Scarus psittacus	3	EAST - 3	4	151.49			
H	Scarus rubroviolaceus	3	EAST - 3	1	232.75			
H	Scarus rubroviolaceus	3	EAST - 3	1	85.39			
H	Acanthurus nigrofuscus	3	EAST - 3	20	477.94			
H	Acanthurus nigrofuscus	3	EAST - 3	19	142.97			
H	Acanthurus nigrofuscus	3	EAST - 3	49	696.42			
H	Acanthurus olivaceus	3	EAST - 3	1	563.17			
H	Acanthurus olivaceus	3	EAST - 3	4	1572.84			
H	Ctenochaetus strigosus	3	EAST - 3	2	53.69			
H	Ctenochaetus strigosus	3	EAST - 3	2	6.18	106	4091.34	25.5
O	Stegastes fasciolatus	3	EAST - 3	19	280.50			
O	Melichthys niger	3	EAST - 3	19	3103.37			
O	Melichthys niger	3	EAST - 3	1	248.03			
O	Melichthys vidua	3	EAST - 3	1	199.03			
O	Melichthys vidua	3	EAST - 3	1	296.24			
O	Cantherhines sandwichiensis	3	EAST - 3	1	82.05			
O	Canthigaster jactator	3	EAST - 3	9	760.54	51	4969.76	31.0
P	Chromis vanderbilti	3	EAST - 3	23	7.27			
P	Naso brevirostris	3	EAST - 3	13	506.02			
P	Naso brevirostris	3	EAST - 3	4	293.43	40	806.72	5.0
		3	EAST - 3	301	16053.0587	301	16053.0587	100

GRO	21-Jul-09 SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Fistularia commersoni	4	EAST - 4	1	206.81			
C	Parupeneus multifasciatus	4	EAST - 4	1	96.08			
C	Parupeneus multifasciatus	4	EAST - 4	4	44.21			
C	Parupeneus multifasciatus	4	EAST - 4	1	155.42			
C	Parupeneus multifasciatus	4	EAST - 4	1	235.75			
C	Plectroglyphidodon johnstonianu	4	EAST - 4	1	1.72			
C	Paracirrhites arcatus	4	EAST - 4	3	24.35			
C	Cirrhitops fasciatus	4	EAST - 4	1	15.63			
C	Bodianus bilunulatus	4	EAST - 4	1	467.86			
C	Labroides phthirophagus	4	EAST - 4	4	2.51			
C	Thalassoma duperrey	4	EAST - 4	10	970.52			
C	Thalassoma duperrey	4	EAST - 4	21	66.16			
C	Thalassoma duperrey	4	EAST - 4	22	602.59			
C	Thalassoma duperrey	4	EAST - 4	16	178.61			
C	Thalassoma duperrey	4	EAST - 4	21	1153.93			
C	Coris venusta	4	EAST - 4	2	5.11			
C	Coris gaimard	4	EAST - 4	1	318.06			
C	Coris gaimard	4	EAST - 4	1	139.13			
C	Stethojulis balteata	4	EAST - 4	4	16.00			
C	Macropharyngodon geoffroy	4	EAST - 4	3	32.94			
C	Macropharyngodon geoffroy	4	EAST - 4	8	6.16			
C	Halichoeres ornatissimus	4	EAST - 4	1	16.45			
C	Plagiotremus ewaensis	4	EAST - 4	1	0.95			
C	Rhinecanthus rectangulus	4	EAST - 4	2	171.75			
C	Rhinecanthus rectangulus	4	EAST - 4	3	433.95			
C	Sufflamen fraenatus	4	EAST - 4	2	449.59			
C	Sufflamen fraenatus	4	EAST - 4	1	329.34	137	6141.58	14.7
CF	Cantherhines dumerili	4	EAST - 4	1	442.38	1	442.38	1.1
H	Calotomus carolinus	4	EAST - 4	1	707.00			
H	Acanthurus triostegus	4	EAST - 4	11	1100.16			
H	Acanthurus triostegus	4	EAST - 4	8	1500.82			
H	Acanthurus nigrofuscus	4	EAST - 4	1	23.90			
H	Acanthurus nigrofuscus	4	EAST - 4	36	511.66			
H	Acanthurus olivaceus	4	EAST - 4	8	6212.84			
H	Acanthurus olivaceus	4	EAST - 4	38	21400.47			
H	Acanthurus olivaceus	4	EAST - 4	4	1572.84			
H	Acanthurus dussumieri	4	EAST - 4	1	326.59	108	33356.27	79.9
O	Melichthys niger	4	EAST - 4	6	980.01			
O	Melichthys vidua	4	EAST - 4	1	296.24			
O	Melichthys vidua	4	EAST - 4	2	398.06			
O	Canthigaster coronata	4	EAST - 4	2	15.18			
O	Canthigaster coronata	4	EAST - 4	1	22.05			
O	Canthigaster jactator	4	EAST - 4	7	24.93	19	1736.48	4.2
P	Chromis vanderbilti	4	EAST - 4	241	76.13	241	76.13	0.2
		4	EAST - 4	506	41752.8403	506	41752.8403	100
C	Adioryx spinifer	5	Ko Olina 1	3	1480.24			
C	Cephalopholis argus	5	Ko Olina 1	2	2154.26			
C	Cephalopholis argus	5	Ko Olina 1	1	638.29			
C	Decapterus macarellus	5	Ko Olina 1	23	4407.57			
C	Monotaxis grandoculis	5	Ko Olina 1	6	208.74			
C	Monotaxis grandoculis	5	Ko Olina 1	5	357.64			
C	Parupeneus multifasciatus	5	Ko Olina 1	1	54.40			
C	Parupeneus bifasciatus	5	Ko Olina 1	1	107.31			
C	Parupeneus bifasciatus	5	Ko Olina 1	1	29.20			
C	Plectroglyphidodon johnstonianu	5	Ko Olina 1	4	6.89			
C	Paracirrhites arcatus	5	Ko Olina 1	1	8.12			
C	Labroides phthirophagus	5	Ko Olina 1	4	2.51			
C	Thalassoma duperrey	5	Ko Olina 1	9	100.47			
C	Thalassoma duperrey	5	Ko Olina 1	23	629.98			
C	Thalassoma duperrey	5	Ko Olina 1	5	485.26			

GRO	SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
	21-Jul-09							
C	Thalassoma duperrey	5	Ko Olina 1	2	6.30			
C	Thalassoma duperrey	5	Ko Olina 1	10	549.49			
C	Gomphosus varius	5	Ko Olina 1	1	11.04			
C	Coris gaimard	5	Ko Olina 1	2	44.14			
C	Stethojulis balteata	5	Ko Olina 1	6	214.58			
C	Sufflamen bursa	5	Ko Olina 1	5	429.37			
C	Sufflamen fraenatus	5	Ko Olina 1	1	329.34			
C	Ostracion meleagris	5	Ko Olina 1	1	6.76	117	12261.89	22.9
CF	Chaetodon unimaculatus	5	Ko Olina 1	4	101.22			
CF	Chaetodon quadrimaculatus	5	Ko Olina 1	2	50.61			
CF	Chaetodon multicinctus	5	Ko Olina 1	10	130.30	16	282.13	0.5
H	Scarus sordidus	5	Ko Olina 1	2	152.03			
H	Scarus sordidus	5	Ko Olina 1	3	107.98			
H	Scarus sordidus	5	Ko Olina 1	1	140.01			
H	Scarus psittacus	5	Ko Olina 1	1	79.27			
H	Scarus psittacus	5	Ko Olina 1	21	795.33			
H	Scarus psittacus	5	Ko Olina 1	1	786.15			
H	Scarus rubroviolaceus	5	Ko Olina 1	1	1360.78			
H	Scarus rubroviolaceus	5	Ko Olina 1	1	43.92			
H	Scarus rubroviolaceus	5	Ko Olina 1	2	294.05			
H	Scarus rubroviolaceus	5	Ko Olina 1	1	673.75			
H	Cirripectes variolosus	5	Ko Olina 1	1	38.28			
H	Acanthurus triostegus	5	Ko Olina 1	4	400.06			
H	Acanthurus triostegus	5	Ko Olina 1	26	1204.19			
H	Acanthurus triostegus	5	Ko Olina 1	27	463.50			
H	Acanthurus leucopareius	5	Ko Olina 1	3	200.22			
H	Acanthurus leucopareius	5	Ko Olina 1	1	232.68			
H	Acanthurus nigrofuscus	5	Ko Olina 1	30	716.91			
H	Acanthurus nigrofuscus	5	Ko Olina 1	23	1247.81			
H	Acanthurus nigrofuscus	5	Ko Olina 1	20	284.25			
H	Acanthurus nigroris	5	Ko Olina 1	1	102.47			
H	Acanthurus olivaceus	5	Ko Olina 1	14	1312.76			
H	Acanthurus olivaceus	5	Ko Olina 1	9	6989.44			
H	Acanthurus olivaceus	5	Ko Olina 1	10	5631.70			
H	Acanthurus olivaceus	5	Ko Olina 1	5	1966.05			
H	Acanthurus blochii	5	Ko Olina 1	3	992.01			
H	Acanthurus blochii	5	Ko Olina 1	1	29.03			
H	Ctenochaetus strigosus	5	Ko Olina 1	30	3964.01			
H	Ctenochaetus strigosus	5	Ko Olina 1	45	2963.92			
H	Ctenochaetus strigosus	5	Ko Olina 1	25	671.10			
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	1	205.99	315	35120.95	65.7
O	Stegastes fasciolatus	5	Ko Olina 1	19	280.50			
O	Melichthys vidua	5	Ko Olina 1	9	2666.15			
O	Cantherhines sandwichiensis	5	Ko Olina 1	1	277.18			
O	Canthigaster jactator	5	Ko Olina 1	15	53.43			
O	Canthigaster rivulata	5	Ko Olina 1	1	13.65	45	3290.91	6.2
P	Abudefduf abdominalis	5	Ko Olina 1	26	814.65			
P	Chromis vanderbilti	5	Ko Olina 1	48	15.16			
P	Naso hexacanthus	5	Ko Olina 1	7	1335.21			
P	Naso hexacanthus	5	Ko Olina 1	8	311.40	89	2476.41	4.6
		5	Ko Olina 1	582	53432.2818	582	53432.2818	100
C	Aulostomus chinensis	6	Ko Olina 2	1	88.50			
C	Scorpaenopsis diabolus	6	Ko Olina 2	1	2056.66			
C	Cephalopholis argus	6	Ko Olina 2	1	229.32			
C	Cephalopholis argus	6	Ko Olina 2	1	638.29			
C	Parupeneus multifasciatus	6	Ko Olina 2	1	96.08			
C	Parupeneus multifasciatus	6	Ko Olina 2	3	81.35			
C	Chaetodon lunula	6	Ko Olina 2	1	35.99			

GRO	SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
	21-Jul-09							
C	Plectroglyphidodon johnstonianu	6	Ko Olina 2	3	5.17			
C	Paracirrhites arcatus	6	Ko Olina 2	2	16.24			
C	Cirrhitus pinnulatus	6	Ko Olina 2	1	90.86			
C	Labroides phthirophagus	6	Ko Olina 2	4	2.51			
C	Thalassoma duperrey	6	Ko Olina 2	15	410.86			
C	Thalassoma duperrey	6	Ko Olina 2	3	291.16			
C	Thalassoma duperrey	6	Ko Olina 2	18	200.94			
C	Thalassoma duperrey	6	Ko Olina 2	10	31.51			
C	Thalassoma duperrey	6	Ko Olina 2	15	824.23			
C	Gomphosus varius	6	Ko Olina 2	2	22.08			
C	Gomphosus varius	6	Ko Olina 2	1	22.60			
C	Stethojulis balteata	6	Ko Olina 2	1	35.76			
C	Macropharyngodon geoffroy	6	Ko Olina 2	2	37.26			
C	Halichoeres ornatissimus	6	Ko Olina 2	1	16.45			
C	Zanclus cornutus	6	Ko Olina 2	4	416.63			
C	Sufflamen bursa	6	Ko Olina 2	3	257.62	94	5908.07	15.7
CF	Chaetodon ornatissimus	6	Ko Olina 2	2	138.00			
CF	Chaetodon ornatissimus	6	Ko Olina 2	2	273.78			
CF	Chaetodon quadrimaculatus	6	Ko Olina 2	2	50.61			
CF	Chaetodon multicinctus	6	Ko Olina 2	6	78.18	12	540.58	1.4
H	Scarus psittacus	6	Ko Olina 2	2	482.85			
H	Scarus psittacus	6	Ko Olina 2	2	75.75			
H	Scarus rubroviolaceus	6	Ko Olina 2	2	1347.51			
H	Scarus rubroviolaceus	6	Ko Olina 2	1	85.39			
H	Scarus rubroviolaceus	6	Ko Olina 2	1	1160.01			
H	Acanthurus triostegus	6	Ko Olina 2	3	300.04			
H	Acanthurus triostegus	6	Ko Olina 2	14	648.41			
H	Acanthurus achilles	6	Ko Olina 2	1	26.95			
H	Acanthurus leucopareius	6	Ko Olina 2	2	265.40			
H	Acanthurus leucopareius	6	Ko Olina 2	1	66.74			
H	Acanthurus nigrofuscus	6	Ko Olina 2	20	477.94			
H	Acanthurus nigrofuscus	6	Ko Olina 2	10	542.52			
H	Acanthurus nigrofuscus	6	Ko Olina 2	40	568.51			
H	Acanthurus olivaceus	6	Ko Olina 2	25	14079.26			
H	Acanthurus olivaceus	6	Ko Olina 2	1	163.52			
H	Acanthurus blochii	6	Ko Olina 2	10	566.99			
H	Acanthurus blochii	6	Ko Olina 2	3	1360.78			
H	Acanthurus blochii	6	Ko Olina 2	2	24.49			
H	Acanthurus blochii	6	Ko Olina 2	3	696.72			
H	Acanthurus blochii	6	Ko Olina 2	4	116.12			
H	Ctenochaetus strigosus	6	Ko Olina 2	4	107.38			
H	Ctenochaetus strigosus	6	Ko Olina 2	7	924.94			
H	Ctenochaetus strigosus	6	Ko Olina 2	10	658.65			
H	Ctenochaetus strigosus	6	Ko Olina 2	2	6.18			
H	Zebrasoma flavescens	6	Ko Olina 2	5	266.40			
H	Zebrasoma flavescens	6	Ko Olina 2	6	156.18			
H	Naso lituratus	6	Ko Olina 2	2	1244.71			
H	Naso lituratus	6	Ko Olina 2	3	1346.83	186	27767.15	73.8
O	Stegastes fasciolatus	6	Ko Olina 2	6	88.58			
O	Melichthys niger	6	Ko Olina 2	11	1796.69			
O	Melichthys niger	6	Ko Olina 2	2	496.06			
O	Melichthys vidua	6	Ko Olina 2	2	398.06			
O	Canthigaster jactator	6	Ko Olina 2	13	46.31	34	2825.70	7.5
P	Abudefduf abdominalis	6	Ko Olina 2	18	563.99			
P	Chromis vanderbilti	6	Ko Olina 2	9	2.84			
P	Chromis hanui	6	Ko Olina 2	1	0.75	28	567.58	1.5
		6	Ko Olina 2	354	37609.0702	354	37609.0702	100
C	Myripristis amaenus	7	KAHE 1-D	1	82.08			
C	Fistularia commersoni	7	KAHE 1-D	1	130.63			
C	Mulloides flavolineatus	7	KAHE 1-D	12	2299.60			

GRO	SPECIES 21-Jul-09	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	7	KAHE 1-D	2	192.16			
C	Parupeneus multifasciatus	7	KAHE 1-D	1	27.12			
C	Parupeneus multifasciatus	7	KAHE 1-D	1	54.40			
C	Parupeneus bifasciatus	7	KAHE 1-D	1	11.60			
C	Parupeneus bifasciatus	7	KAHE 1-D	1	107.31			
C	Plectroglyphidodon johnstonianu	7	KAHE 1-D	5	8.61			
C	Plectroglyphidodon imparipennis	7	KAHE 1-D	2	1.72			
C	Paracirrhites arcatus	7	KAHE 1-D	1	8.12			
C	Labroides phthirophagus	7	KAHE 1-D	1	0.63			
C	Thalassoma duperrey	7	KAHE 1-D	11	301.30			
C	Thalassoma duperrey	7	KAHE 1-D	12	659.39			
C	Thalassoma duperrey	7	KAHE 1-D	15	1455.78			
C	Thalassoma duperrey	7	KAHE 1-D	20	223.27			
C	Gomphosus varius	7	KAHE 1-D	5	55.21			
C	Gomphosus varius	7	KAHE 1-D	4	90.40			
C	Gomphosus varius	7	KAHE 1-D	1	39.39			
C	Coris gaimard	7	KAHE 1-D	1	83.79			
C	Stethojulis balteata	7	KAHE 1-D	5	178.82			
C	Stethojulis balteata	7	KAHE 1-D	3	43.23			
C	Anampses cuvier	7	KAHE 1-D	1	64.38			
C	Zanclus cornutus	7	KAHE 1-D	1	54.90			
C	Sufflamen bursa	7	KAHE 1-D	2	171.75			
C	Ostracion meleagris	7	KAHE 1-D	1	6.76	111	6352.33	20.5
CF	Chaetodon quadrimaculatus	7	KAHE 1-D	2	50.61			
CF	Chaetodon multicinctus	7	KAHE 1-D	4	26.63	6	77.23	0.2
H	Scarus psittacus	7	KAHE 1-D	19	277.67			
H	Scarus psittacus	7	KAHE 1-D	13	492.34			
H	Scarus rubroviolaceus	7	KAHE 1-D	2	2721.55			
H	Cirripectes vanderbilti	7	KAHE 1-D	1	7.25			
H	Acanthurus triostegus	7	KAHE 1-D	19	879.99			
H	Acanthurus triostegus	7	KAHE 1-D	57	978.49			
H	Acanthurus leucopareius	7	KAHE 1-D	2	465.35			
H	Acanthurus leucopareius	7	KAHE 1-D	1	132.70			
H	Acanthurus nigrofuscus	7	KAHE 1-D	18	430.15			
H	Acanthurus nigrofuscus	7	KAHE 1-D	10	142.13			
H	Acanthurus olivaceus	7	KAHE 1-D	9	177.69			
H	Acanthurus olivaceus	7	KAHE 1-D	6	284.86			
H	Ctenochaetus strigosus	7	KAHE 1-D	8	526.92			
H	Ctenochaetus strigosus	7	KAHE 1-D	23	617.41			
H	Ctenochaetus strigosus	7	KAHE 1-D	3	396.40			
H	Zebrasoma flavescens	7	KAHE 1-D	1	53.28	192	8584.19	27.7
O	Stegastes fasciolatus	7	KAHE 1-D	8	118.11			
O	Melichthys niger	7	KAHE 1-D	64	10453.47			
O	Melichthys niger	7	KAHE 1-D	19	4712.59			
O	Canthigaster jactator	7	KAHE 1-D	4	14.25	95	15298.42	49.3
P	Chromis vanderbilti	7	KAHE 1-D	65	20.53			
P	Chromis ovalis	7	KAHE 1-D	120	711.81	185	732.35	2.4
		7	KAHE 1-D	589	31044.5192	589	31044.5192	100
C	Aulostomus chinensis	8	KAHE 5 -B	1	52.00			
C	Aulostomus chinensis	8	KAHE 5 -B	1	88.50			
C	Fistularia commersoni	8	KAHE 5 -B	1	100.51			
C	Parupeneus multifasciatus	8	KAHE 5 -B	10	110.52			
C	Parupeneus multifasciatus	8	KAHE 5 -B	1	235.75			
C	Parupeneus multifasciatus	8	KAHE 5 -B	1	54.40			
C	Parupeneus multifasciatus	8	KAHE 5 -B	4	108.47			
C	Plectroglyphidodon johnstonianu	8	KAHE 5 -B	5	8.61			
C	Plectroglyphidodon imparipennis	8	KAHE 5 -B	3	2.59			
C	Paracirrhites arcatus	8	KAHE 5 -B	9	73.06			
C	Paracirrhites forsteri	8	KAHE 5 -B	2	79.29			
C	Paracirrhites forsteri	8	KAHE 5 -B	1	4.69			

	21-Jul-09					GROUP	GROUP	GROUP
GRO	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	BIOMASS	PERCENT
C	Paracirrhites forsteri	8	KAHE 5 -B	1	16.35			
C	Cirrhitops fasciatus	8	KAHE 5 -B	2	16.45			
C	Labroides phthirophagus	8	KAHE 5 -B	2	1.26			
C	Thalassoma duperrey	8	KAHE 5 -B	28	312.57			
C	Thalassoma duperrey	8	KAHE 5 -B	22	69.31			
C	Thalassoma duperrey	8	KAHE 5 -B	5	485.26			
C	Thalassoma duperrey	8	KAHE 5 -B	13	714.34			
C	Thalassoma duperrey	8	KAHE 5 -B	22	602.59			
C	Coris gaimard	8	KAHE 5 -B	1	22.07			
C	Coris gaimard	8	KAHE 5 -B	1	45.99			
C	Stethojulis balteata	8	KAHE 5 -B	1	72.39			
C	Halichoeres ornatissimus	8	KAHE 5 -B	3	75.41			
C	Halichoeres ornatissimus	8	KAHE 5 -B	2	19.05			
C	Halichoeres ornatissimus	8	KAHE 5 -B	3	49.35			
C	Rhinecanthus rectangulus	8	KAHE 5 -B	2	289.30			
C	Rhinecanthus rectangulus	8	KAHE 5 -B	2	171.75			
C	Sufflamen bursa	8	KAHE 5 -B	3	257.62	152	4139.42	44.0
CF	Chaetodon multicinctus	8	KAHE 5 -B	4	26.63	4	26.63	0.3
H	Scarus psittacus	8	KAHE 5 -B	1	79.27			
H	Acanthurus triostegus	8	KAHE 5 -B	4	185.26			
H	Acanthurus leucopareius	8	KAHE 5 -B	1	232.68			
H	Acanthurus nigrofuscus	8	KAHE 5 -B	20	477.94			
H	Acanthurus nigrofuscus	8	KAHE 5 -B	5	512.37			
H	Acanthurus nigrofuscus	8	KAHE 5 -B	11	156.34			
H	Acanthurus olivaceus	8	KAHE 5 -B	3	142.43			
H	Acanthurus olivaceus	8	KAHE 5 -B	8	750.15			
H	Acanthurus olivaceus	8	KAHE 5 -B	5	817.58			
H	Acanthurus olivaceus	8	KAHE 5 -B	4	1046.67	62	4400.69	46.8
O	Stegastes fasciolatus	8	KAHE 5 -B	13	191.92			
O	Melichthys vidua	8	KAHE 5 -B	2	398.06			
O	Canthigaster jactator	8	KAHE 5 -B	7	24.93	22	614.92	6.5
P	Chromis vanderbilti	8	KAHE 5 -B	559	176.58			
P	Naso brevirostris	8	KAHE 5 -B	1	38.92	560	215.51	2.3
		8	KAHE 5 -B	800	9397.1602	800	9397.1602	100
C	Fistularia commersoni	9	KAHE 7 -B	1	306.53			
C	Aprion virescens	9	KAHE 7 -B	1	440.21			
C	Monotaxis grandoculis	9	KAHE 7 -B	1	34.79			
C	Mulloides flavolineatus	9	KAHE 7 -B	24	8765.01			
C	Parupeneus pleurostigma	9	KAHE 7 -B	2	116.02			
C	Parupeneus multifasciatus	9	KAHE 7 -B	2	471.50			
C	Parupeneus multifasciatus	9	KAHE 7 -B	2	192.16			
C	Parupeneus cyclostomus	9	KAHE 7 -B	1	88.57			
C	Thalassoma duperrey	9	KAHE 7 -B	5	274.74			
C	Thalassoma duperrey	9	KAHE 7 -B	3	33.49			
C	Thalassoma duperrey	9	KAHE 7 -B	2	194.10			
C	Thalassoma duperrey	9	KAHE 7 -B	6	164.34			
C	Thalassoma duperrey	9	KAHE 7 -B	5	15.75			
C	Coris venusta	9	KAHE 7 -B	2	96.76			
C	Coris venusta	9	KAHE 7 -B	4	94.55			
C	Macropharyngodon geoffroy	9	KAHE 7 -B	1	5.75			
C	Halichoeres ornatissimus	9	KAHE 7 -B	1	9.52			
C	Zanclus cornutus	9	KAHE 7 -B	1	104.16			
C	Sufflamen bursa	9	KAHE 7 -B	3	257.62			
C	Sufflamen bursa	9	KAHE 7 -B	4	578.60			
C	Ostracion meleagris	9	KAHE 7 -B	1	6.76	72	12250.95	87.1
CF	Chaetodon multicinctus	9	KAHE 7 -B	2	13.31	2	13.31	0.1
H	Acanthurus triostegus	9	KAHE 7 -B	1	17.17			
H	Acanthurus nigrofuscus	9	KAHE 7 -B	2	108.50			
H	Acanthurus nigrofuscus	9	KAHE 7 -B	4	56.85			
H	Acanthurus olivaceus	9	KAHE 7 -B	3	281.31			

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GRO	SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
H	Acanthurus olivaceus	9	KAHE 7 -B	8	379.82	18	843.64	6.0
O	Melichthys vidua	9	KAHE 7 -B	2	398.06			
O	Canthigaster coronata	9	KAHE 7 -B	1	7.59			
O	Canthigaster jactator	9	KAHE 7 -B	3	10.69	6	416.34	3.0
P	Dascyllus albisella	9	KAHE 7 -B	2	6.18			
P	Chromis vanderbilti	9	KAHE 7 -B	84	26.53			
P	Chromis ovalis	9	KAHE 7 -B	3	0.28			
P	Chromis hanui	9	KAHE 7 -B	4	2.99			
P	Naso hexacanthus	9	KAHE 7 -B	3	116.77			
P	Naso brevirostris	9	KAHE 7 -B	10	389.24	106	542.00	3.9
		9	KAHE 7 -B	204	14066.2448	204	14066.2448	100
C	Gymnothorax steindachneri	10	KAHE 7 -C	1	63.06			
C	Parupeneus pleurostigma	10	KAHE 7 -C	1	98.25			
C	Parupeneus pleurostigma	10	KAHE 7 -C	1	58.01			
C	Parupeneus multifasciatus	10	KAHE 7 -C	3	33.15			
C	Parupeneus multifasciatus	10	KAHE 7 -C	1	3.12			
C	Parupeneus multifasciatus	10	KAHE 7 -C	1	235.75			
C	Parupeneus multifasciatus	10	KAHE 7 -C	1	27.12			
C	Parupeneus multifasciatus	10	KAHE 7 -C	4	621.69			
C	Parupeneus cyclostomus	10	KAHE 7 -C	2	177.14			
C	Plectroglyphidodon johnstonianu	10	KAHE 7 -C	1	1.72			
C	Paracirrhites arcatus	10	KAHE 7 -C	5	40.59			
C	Labroides phthirophagus	10	KAHE 7 -C	1	0.63			
C	Cheilinus bimaculatus	10	KAHE 7 -C	2	19.27			
C	Thalassoma duperrey	10	KAHE 7 -C	3	164.85			
C	Thalassoma duperrey	10	KAHE 7 -C	4	109.56			
C	Coris venusta	10	KAHE 7 -C	1	9.39			
C	Coris venusta	10	KAHE 7 -C	1	48.38			
C	Halichoeres ornatissimus	10	KAHE 7 -C	1	9.52			
C	Zanclus cornutus	10	KAHE 7 -C	2	208.32			
C	Sufflamen bursa	10	KAHE 7 -C	1	144.65			
C	Sufflamen bursa	10	KAHE 7 -C	5	429.37	42	2503.53	41.4
CF	Chaetodon multicinctus	10	KAHE 7 -C	2	13.31	2	13.31	0.2
H	Acanthurus nigrofuscus	10	KAHE 7 -C	1	7.52			
H	Acanthurus nigrofuscus	10	KAHE 7 -C	1	54.25			
H	Acanthurus olivaceus	10	KAHE 7 -C	4	375.08			
H	Acanthurus olivaceus	10	KAHE 7 -C	5	237.38			
H	Ctenochaetus strigosus	10	KAHE 7 -C	1	3.09			
H	Ctenochaetus strigosus	10	KAHE 7 -C	1	7.58			
H	Naso unicornis	10	KAHE 7 -C	1	190.74	14	875.64	14.5
O	Cantherhines sandwichiensis	10	KAHE 7 -C	1	82.05			
O	Canthigaster coronata	10	KAHE 7 -C	1	7.59			
O	Canthigaster jactator	10	KAHE 7 -C	2	7.12	4	96.77	1.6
P	Chromis vanderbilti	10	KAHE 7 -C	82	25.90			
P	Chromis hanui	10	KAHE 7 -C	3	2.24			
P	Naso brevirostris	10	KAHE 7 -C	65	2530.09	150	2558.23	42.3
		10	KAHE 7 -C	212	6047.4834	212	6047.48343	100
C	Parupeneus multifasciatus	11	KAHE 7 -D	2	310.84			
C	Plectroglyphidodon johnstonianu	11	KAHE 7 -D	2	1.72			
C	Cheilinus bimaculatus	11	KAHE 7 -D	1	4.10			
C	Cheilinus bimaculatus	11	KAHE 7 -D	1	19.37			
C	Thalassoma duperrey	11	KAHE 7 -D	3	9.45			
C	Coris venusta	11	KAHE 7 -D	1	2.55			
C	Stethojulis balteata	11	KAHE 7 -D	1	0.45			
C	Stethojulis balteata	11	KAHE 7 -D	1	4.00			
C	Macropharyngodon geoffroy	11	KAHE 7 -D	1	5.75			
C	Sufflamen bursa	11	KAHE 7 -D	1	144.65	14	502.89	96.6
O	Canthigaster jactator	11	KAHE 7 -D	3	10.69	3	10.69	2.1
P	Chromis vanderbilti	11	KAHE 7 -D	23	7.27	23	7.27	1.4
		11	KAHE 7 -D	40	520.8390	40	520.839025	100

GRO	SPECIES	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
	21-Jul-09							
C	Parupeneus multifasciatus	12	KAHE 7 - E	14	43.67			
C	Parupeneus multifasciatus	12	KAHE 7 - E	2	192.16			
C	Parupeneus multifasciatus	12	KAHE 7 - E	12	132.62			
C	Parupeneus multifasciatus	12	KAHE 7 - E	1	155.42			
C	Parupeneus multifasciatus	12	KAHE 7 - E	4	108.47			
C	Parupeneus multifasciatus	12	KAHE 7 - E	1	54.40			
C	Forcipiger flavissimus	12	KAHE 7 - E	1	9.15			
C	Plectroglyphidodon johnstonianu	12	KAHE 7 - E	4	6.89			
C	Paracirrhites arcatus	12	KAHE 7 - E	8	64.94			
C	Cirrhitops fasciatus	12	KAHE 7 - E	1	8.23			
C	Labroides phthirophagus	12	KAHE 7 - E	1	0.63			
C	Cheilinus bimaculatus	12	KAHE 7 - E	1	19.37			
C	Thalassoma duperrey	12	KAHE 7 - E	2	54.78			
C	Thalassoma duperrey	12	KAHE 7 - E	2	22.33			
C	Thalassoma duperrey	12	KAHE 7 - E	2	194.10			
C	Thalassoma duperrey	12	KAHE 7 - E	2	109.90			
C	Coris venusta	12	KAHE 7 - E	8	20.43			
C	Coris venusta	12	KAHE 7 - E	4	37.55			
C	Pseudojuloides cerasinus	12	KAHE 7 - E	1	11.16			
C	Stethojulis balteata	12	KAHE 7 - E	2	71.53			
C	Stethojulis balteata	12	KAHE 7 - E	1	72.39			
C	Macropharyngodon geoffroy	12	KAHE 7 - E	2	11.50			
C	Zanclus cornutus	12	KAHE 7 - E	2	109.80			
C	Sufflamen bursa	12	KAHE 7 - E	4	343.49	82	1854.89	45.7
CF	Chaetodon multicinctus	12	KAHE 7 - E	2	1.65			
CF	Chaetodon multicinctus	12	KAHE 7 - E	4	26.63			
CF	Cantherhines dumerili	12	KAHE 7 - E	1	442.38	7	470.66	11.6
H	Acanthurus nigrofuscus	12	KAHE 7 - E	1	1.04			
H	Acanthurus nigrofuscus	12	KAHE 7 - E	8	113.70			
H	Acanthurus olivaceus	12	KAHE 7 - E	1	563.17			
H	Acanthurus olivaceus	12	KAHE 7 - E	1	47.48			
H	Zebrasoma flavescens	12	KAHE 7 - E	2	3.38	13	728.77	18.0
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	4	14.25	8	738.98	18.2
P	Chaetodon miliaris	12	KAHE 7 - E	1	0.88			
P	Chromis vanderbilti	12	KAHE 7 - E	300	94.77			
P	Chromis hanui	12	KAHE 7 - E	17	12.69			
P	Naso brevirostris	12	KAHE 7 - E	4	155.70	322	264.04	6.5
		12	KAHE 7 - E	432	4057.3428	432	4057.34281	100
C	Aulostomus chinensis	13	KAHE 10	1	68.53			
C	Lutjanus kasmira	13	KAHE 10	104	19827.27			
C	Mulloides vanicolensis	13	KAHE 10	2	49.47			
C	Parupeneus multifasciatus	13	KAHE 10	1	54.40			
C	Parupeneus multifasciatus	13	KAHE 10	2	310.84			
C	Parupeneus multifasciatus	13	KAHE 10	4	384.33			
C	Parupeneus cyclostomus	13	KAHE 10	2	99.93			
C	Plectroglyphidodon johnstonianu	13	KAHE 10	1	1.72			
C	Plectroglyphidodon imparipennis	13	KAHE 10	1	0.86			
C	Paracirrhites arcatus	13	KAHE 10	1	8.12			
C	Thalassoma duperrey	13	KAHE 10	8	776.42			
C	Thalassoma duperrey	13	KAHE 10	4	44.65			
C	Thalassoma duperrey	13	KAHE 10	14	383.47			
C	Thalassoma duperrey	13	KAHE 10	16	879.18			
C	Stethojulis balteata	13	KAHE 10	3	107.29			
C	Stethojulis balteata	13	KAHE 10	4	57.64			
C	Sufflamen bursa	13	KAHE 10	3	257.62	171	23311.74	80.6
H	Calotomus carolinus	13	KAHE 10	1	1288.03			
H	Acanthurus triostegus	13	KAHE 10	1	17.17			
H	Acanthurus nigrofuscus	13	KAHE 10	2	47.79			
H	Acanthurus nigrofuscus	13	KAHE 10	4	56.85			

	21-Jul-09					GROUP	GROUP	GROUP
GRO	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	BIOMASS	PERCENT
H	Acanthurus olivaceus	13	KAHE 10	8	379.82			
H	Acanthurus olivaceus	13	KAHE 10	2	187.54			
H	Acanthurus blochii	13	KAHE 10	2	58.06	20	2035.26	7.0
O	Stegastes fasciolatus	13	KAHE 10	7	103.34			
O	Melichthys vidua	13	KAHE 10	1	199.03			
O	Cantherhines sandwichiensis	13	KAHE 10	1	82.05	9	384.42	1.3
P	Dascyllus albisella	13	KAHE 10	38	117.36			
P	Abudefduf abdominalis	13	KAHE 10	91	2851.26			
P	Chromis vanderbilti	13	KAHE 10	40	12.64			
P	Chromis ovalis	13	KAHE 10	35	207.61			
P	Chromis hanui	13	KAHE 10	1	0.75	205	3189.61	11.0
		13	KAHE 10	405	28921.0411	405	28921.0411	100
C	Parupeneus multifasciatus	14	Nanakuli 1	2	22.10			
C	Parupeneus cyclostomus	14	Nanakuli 1	1	24.80			
C	Plectroglyphidodon imparipennis	14	Nanakuli 1	6	5.17			
C	Thalassoma duperrey	14	Nanakuli 1	5	136.95			
C	Thalassoma duperrey	14	Nanakuli 1	4	219.80			
C	Thalassoma duperrey	14	Nanakuli 1	14	44.11			
C	Thalassoma duperrey	14	Nanakuli 1	8	89.31			
C	Thalassoma duperrey	14	Nanakuli 1	1	97.05			
C	Thalassoma purpureum	14	Nanakuli 1	1	100.89			
C	Coris venusta	14	Nanakuli 1	1	48.38			
C	Stethojulis balteata	14	Nanakuli 1	5	72.04			
C	Stethojulis balteata	14	Nanakuli 1	4	16.00			
C	Stethojulis balteata	14	Nanakuli 1	1	35.76			
C	Macropharyngodon geoffroy	14	Nanakuli 1	1	0.77			
C	Rhinecanthus rectangulus	14	Nanakuli 1	2	90.72			
C	Rhinecanthus rectangulus	14	Nanakuli 1	3	257.62			
C	Rhinecanthus rectangulus	14	Nanakuli 1	3	433.95	62	1695.43	96.5
H	Acanthurus nigrofuscus	14	Nanakuli 1	1	1.04			
H	Acanthurus nigrofuscus	14	Nanakuli 1	1	14.21			
H	Ctenochaetus strigosus	14	Nanakuli 1	1	1.75	3	17.00	1.0
O	Stegastes fasciolatus	14	Nanakuli 1	3	2.59			
O	Canthigaster jactator	14	Nanakuli 1	2	7.12			
O	Canthigaster rivulata	14	Nanakuli 1	1	22.05	6	31.76	1.8
P	Chromis vanderbilti	14	Nanakuli 1	40	12.64	40	12.64	0.7
		14	Nanakuli 1	111	1756.8291	111	1756.82906	100
C	Aulostomus chinensis	15	Nanakuli 2	1	210.62			
C	Parupeneus multifasciatus	15	Nanakuli 2	1	96.08			
C	Parupeneus multifasciatus	15	Nanakuli 2	1	3.12			
C	Thalassoma duperrey	15	Nanakuli 2	4	12.60			
C	Thalassoma duperrey	15	Nanakuli 2	2	194.10			
C	Thalassoma duperrey	15	Nanakuli 2	7	384.64			
C	Thalassoma duperrey	15	Nanakuli 2	6	164.34			
C	Thalassoma duperrey	15	Nanakuli 2	5	55.82			
C	Gomphosus varius	15	Nanakuli 2	1	39.39			
C	Gomphosus varius	15	Nanakuli 2	1	11.04			
C	Coris gaimard	15	Nanakuli 2	2	9.40			
C	Macropharyngodon geoffroy	15	Nanakuli 2	1	5.75			
C	Sufflamen bursa	15	Nanakuli 2	1	85.87			
C	Diodon holocanthus	15	Nanakuli 2	1	908.34	34	2181.12	7.8
CF	Cantherhines dumerili	15	Nanakuli 2	1	442.38	1	442.38	1.6
H	Acanthurus triostegus	15	Nanakuli 2	8	1500.82			
H	Acanthurus triostegus	15	Nanakuli 2	4	185.26			
H	Acanthurus triostegus	15	Nanakuli 2	3	300.04			
H	Acanthurus leucopareius	15	Nanakuli 2	14	3257.45			
H	Acanthurus leucopareius	15	Nanakuli 2	5	663.50			
H	Acanthurus nigrofuscus	15	Nanakuli 2	32	764.71			
H	Acanthurus nigrofuscus	15	Nanakuli 2	2	108.50			
H	Acanthurus nigrofuscus	15	Nanakuli 2	30	426.38			

GRO	SPECIES 21-Jul-09	RB	STATION	NO.	BIOMASS	GROUP No. Indiv.	GROUP BIOMASS	GROUP PERCENT
H	Acanthurus olivaceus	15	Nanakuli 2	9	5068.53			
H	Acanthurus olivaceus	15	Nanakuli 2	3	2329.81			
H	Acanthurus blochii	15	Nanakuli 2	7	1625.68			
H	Acanthurus blochii	15	Nanakuli 2	8	3628.75			
H	Acanthurus blochii	15	Nanakuli 2	16	1567.62			
H	Ctenochaetus strigosus	15	Nanakuli 2	3	45.60			
H	Ctenochaetus strigosus	15	Nanakuli 2	1	3.09			
H	Zebrasoma flavescens	15	Nanakuli 2	4	213.12	149	21688.87	77.5
O	Stegastes fasciolatus	15	Nanakuli 2	3	44.29			
O	Melichthys niger	15	Nanakuli 2	7	1736.22			
O	Melichthys niger	15	Nanakuli 2	2	326.67			
O	Canthigaster jactator	15	Nanakuli 2	4	14.25	16	2121.43	7.6
P	Chromis vanderbilti	15	Nanakuli 2	26	8.21			
P	Naso brevirostris	15	Nanakuli 2	23	895.26			
P	Naso brevirostris	15	Nanakuli 2	9	660.22	58	1563.70	5.6
		15	Nanakuli 2	258	27997.4974	258	27997.4974	100
C	Myripristis amaenus	16	KAHE PIPE	14	1971.32			
C	Aulostomus chinensis	16	KAHE PIPE	1	210.62			
C	Aulostomus chinensis	16	KAHE PIPE	1	88.50			
C	Aulostomus chinensis	16	KAHE PIPE	1	140.29			
C	Cephalopholis argus	16	KAHE PIPE	1	1077.13			
C	Cephalopholis argus	16	KAHE PIPE	2	943.46			
C	Decapterus macarellus	16	KAHE PIPE	65	17507.16			
C	Decapterus macarellus	16	KAHE PIPE	25	2086.12			
C	Lutjanus kasmira	16	KAHE PIPE	1	190.65			
C	Mulloides flavolineatus	16	KAHE PIPE	7	344.88			
C	Parupeneus pleurostigma	16	KAHE PIPE	3	294.74			
C	Parupeneus multifasciatus	16	KAHE PIPE	1	155.42			
C	Parupeneus multifasciatus	16	KAHE PIPE	12	1152.98			
C	Parupeneus cyclostomus	16	KAHE PIPE	2	177.14			
C	Chaetodon lunula	16	KAHE PIPE	4	143.98			
C	Paracirrhites arcatus	16	KAHE PIPE	18	146.12			
C	Paracirrhites forsteri	16	KAHE PIPE	1	39.65			
C	Paracirrhites forsteri	16	KAHE PIPE	1	16.35			
C	Cirrhitops fasciatus	16	KAHE PIPE	1	15.63			
C	Labroides phthirophagus	16	KAHE PIPE	5	3.14			
C	Thalassoma lutescens	16	KAHE PIPE	3	1031.65			
C	Thalassoma lutescens	16	KAHE PIPE	7	1098.95			
C	Thalassoma lutescens	16	KAHE PIPE	1	477.72			
C	Thalassoma duperrey	16	KAHE PIPE	33	903.89			
C	Thalassoma duperrey	16	KAHE PIPE	23	2232.20			
C	Thalassoma duperrey	16	KAHE PIPE	84	4615.71			
C	Thalassoma purpureum	16	KAHE PIPE	4	403.55			
C	Thalassoma purpureum	16	KAHE PIPE	3	766.49			
C	Gomphosus varius	16	KAHE PIPE	18	406.82			
C	Gomphosus varius	16	KAHE PIPE	12	472.73			
C	Gomphosus varius	16	KAHE PIPE	9	99.37			
C	Coris gaimard	16	KAHE PIPE	1	139.13			
C	Stethojulis balteata	16	KAHE PIPE	8	579.11			
C	Anampses cuvier	16	KAHE PIPE	1	188.32			
C	Halichoeres ornatissimus	16	KAHE PIPE	5	82.25			
C	Halichoeres ornatissimus	16	KAHE PIPE	5	22.04			
C	Zanclus cornutus	16	KAHE PIPE	4	416.63			
C	Sufflamen bursa	16	KAHE PIPE	5	429.37			
C	Alutera scripta	16	KAHE PIPE	3	7213.49	395	48284.64	56.0
CF	Pervagor melanocephalus	16	KAHE PIPE	1	2.34	1	2.34	0.0
H	Calotomus carolinus	16	KAHE PIPE	1	339.30			
H	Scarus sordidus	16	KAHE PIPE	45	617.89			
H	Scarus psittacus	16	KAHE PIPE	1	1437.46			
H	Acanthurus nigrofuscus	16	KAHE PIPE	70	1672.79	117	4067.45	4.7
O	Stegastes fasciolatus	16	KAHE PIPE	57	841.50			

	21-Jul-09					GROUP	GROUP	GROUP
GRO	SPECIES	RB	STATION	NO.	BIOMASS	No. Indiv.	BIOMASS	PERCENT
O	Melichthys niger	16	KAHE PIPE	6	1488.19			
O	Melichthys vidua	16	KAHE PIPE	1	199.03	64	2528.72	2.9
P	Dascyllus albisella	16	KAHE PIPE	46	142.06			
P	Abudefduf sordidus	16	KAHE PIPE	3	140.56			
P	Abudefduf abdominalis	16	KAHE PIPE	437	13692.34			
P	Chromis vanderbilti	16	KAHE PIPE	112	35.38			
P	Chromis ovalis	16	KAHE PIPE	75	866.98			
P	Naso brevirostris	16	KAHE PIPE	120	4670.94			
P	Naso brevirostris	16	KAHE PIPE	30	2200.74			
P	Abudefduf vaigiensis	16	KAHE PIPE	205	9604.64	1028	31353.62	36.4
		16	KAHE PIPE	1605	86236.7763	1605	86236.7763	100