CIP GENERATION PROJECT

2012 COMMUNITY BENEFITS PROGRAM

REEF FISH MONITORING PROJECT

YEAR 5 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 study and document changes if any, in coral reef fish communities in the Barbers Point - Kahe Point area. This document is the fifth annual report for this effort covering the period from December 2007 through November 2012 with a focus on the surveys completed in 2012. 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 which continues today. 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 twenty 2007-2012 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 143 species of fishes encountered in the twenty 2007-2012 surveys, twenty-three species are herbivores, fourteen are planktivores, seven are omnivores, eight are coral feeders and 91 are carnivores. Fifteen of the sixteen monitored locations are established on natural substratum where 86% of the fish standing crop is comprised of herbivores and carnivores. However, at one station established on the Kahe Generating Station warm-water discharge pipe, herbivores are largely replaced by planktivores but carnivores remain important as elsewhere. The reasons for this shift in dominance is due to the thermally-elevated discharge creating a unidirectional current and the high degree of shelter space afforded by the steel and armor rock covering the discharge pipe.

This study was undertaken to follow changes in coral reef fish communities as part of the environmental monitoring program related to the development of the CIP electrical generation facility and the data collected in the first year represent the preconstruction baseline (December 2007 - December 2008), while data collected in the second year represents the construction phase (January - September 2009) and the data collected in the third through fifth years (2010-2012) represent the operational phase of the plant. The sixteen stations geographically fall into four groups along the 7.9 km of coastline; on the southeast are four stations offshore of the generation plant at Campbell Industrial Park (station nos. 1-4), three stations seaward of Ko'Olina Resort (nos. 5-7), five stations fronting the Kahe generation facility (nos. 8-12) and three stations north of Kahe Point (13-15). Statistical analysis of the fish

community parameters measured in this study (i.e., number of species, number of individuals and standing crop) on natural substratum found that the diversity of fish species, the number of individual fish as well as the standing crop to be significantly greatest at the three Ko'Olina stations over those in the other three groups over the 2007-2012 survey period. These three measures were least (or nearly so) at the four stations offshore of Campbell Industrial Park and these differences are attributed to better benthic community development offshore of Ko'Olina than elsewhere. The data from stations offshore of Kahe and from those to the north were between the Ko'Olina and Campbell Industrial Park means. The above analysis excluded data from station 16 (the Kahe discharge pipe) because it is a man-made structure and not comprised of natural substratum as present at all other stations. However, to better understand the differences among the sixteen stations, the three fish community measures (mean number of species per transect, mean number of individuals per transect and mean estimated biomass per transect) were statistically examined comparing all stations. Two findings emerge; (1) the Kahe discharge pipe station had a non-significant greater number of species present and a clearly-separable significantly greater mean number of fish individuals and standing crop over all other stations and (2) the means for all parameters from all other stations were not statistically separable except for three stations (numbers 1, 11 and 14) where the number of fish species was significantly less than all other stations. Thus the development in the fish communities at the fifteen stations situated on natural substratum monitored in this study pales relative to that found on the man-made Kahe discharge pipe.

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 earlier fish community data (1976-1984) to present (2007-2012) 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 documented 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 in 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 36 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 2007-2012 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 2012. Data were initially collected in 2008 representing the preconstruction baseline, in 2009 representing the "construction period" of the generating facility and in 2010 representing the commencement of the operational phase of the plant and continuing through 2012. The 2008 information was presented in Brock (2009), the "during construction" information was given in Brock (2010) and data collected since the commencement of plant operations in 2010 is given in Brock (2011), for 2011 in Brock (2012) and the continuing operational phase data for 2012 are presented herein.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

4. The Impact of Hurricane Iniki

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

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

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

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

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

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

METHODS

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

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

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

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

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

RESULTS AND DISCUSSION

1. Station Locations

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

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

(Station 15, Table 1) approximately 70 m north of Station 14 has been established for the present monitoring program. Finally Station 16 was established on the Kahe discharge pipe directly offshore of the generating facility in water from 5 to 7 m in depth.

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

2. The 2007-2008 (Preconstruction) Data

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

3. The 2009 During Construction Data

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

4. The 2010, 2011 and 2012 Operational Phase Data

In 2010 field surveys were carried out on 29 March, 14 May, 12 August and 29 October representing the first year of operations of the new generating facility at Campbell Industrial Park. However, the splitting of data into "preconstruction", "during construction" and operational periods is arbitrary because the construction and operation of the new generation facility is situated well inland of the ocean and its operation has no input to the sea. The 2011 surveys were carried out on 25 February, 16 June, 29 July and 23 November and the 2012 surveys were completed on 2 May, 23 May, 23 July and 2 November 2012. Again, inclement weather (surf) precluded the timely collection of data in the first quarter 2012 thus once the weather became favorable in late April, the first quarter field sampling was carried out on 2 May followed by the second quarter field work being done on 23 May 2012. The 2012 data are presented below along with a comparative analysis of all data to date.

The complete data set from the four 2012 surveys is given in Appendix 1 and this information is summarized in Table 2 along with the earlier (2007-2011) 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 twenty 2007-2012 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 twenty 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 twenty sample dates, there are no significant differences. Thus at this level of analysis (i.e., grand means), there is no statistical separation among the dates which suggests a level of stability in the fish communities at these sample sites.

Station 16 established on the terminus of the Kahe Generating Station discharge pipe is discussed separately because it is a man-made structure deployed in an area of sand bottom and having a 3,193.5 m^3 x 10^3/day seawater discharge at its terminus. The topographical relief afforded by the steel and basalt rock substratum as well as coverage by corals is considerably more attractive to many fishes than the nearby surrounding natural reefs and the discharge of thermally-elevated water serves to attract many fishes. These features result in 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 twenty recent December 2007 - November 2012 surveys were assigned to one of five trophic categories or feeding guilds. As noted above, these groups are herbivores (species that feed on algae), planktivores or species that feed up in the water column on zooplankton, omnivores that feed both on plant material as well as small animals, coral feeders which are a specialized group feeding on coral tissue and mucous, and the carnivores which are species feeding on fishes and invertebrates found on coral reefs. In the five surveys carried out during the preconstruction (2007-2008) period there were 113 species of fishes encountered at the sixteen sample sites. The three during plant construction surveys completed in 2009 found 107 species of fishes at these sixteen sample sites. In the four operational phase 2010 surveys, there were 109 species of fishes recorded at the sixteen sites, in 2011, 106 species and in 2012, 100 species of fishes were sighted at the sixteen sites. In total among the twenty surveys, 143 species of fishes have been recorded among the sixteen survey sites. Fifty-seven percent or 81 species encountered were in common among the twenty surveys carried out over the five years. These data suggest a reasonable level of stability in these fish communities.

Of the 143 species of fishes recorded over the twenty surveys, sixty-four percent (or 91 species) are carnivores, sixteen percent (or 23 species) are herbivores, ten percent (or 14 species) are planktivores, five percent (or 7 species) are omnivores and five percent or eight species are coral feeders. The assignment of fish species to the five trophic categories are given in Appendix 1 of this report as well as in Brock (2009, 2010, 2011, 2012) for species encountered on each transect and earlier survey dates. Table 4 summarizes the feeding guild information by survey date providing the mean percent contribution by weight of each trophic category for stations in two groups; the first group includes stations 1 through 15 (natural substratum) and the second group considers only station 16 (the Kahe outfall station). Although the data in Table 4 are in summary form, two facts emerge, (1) that the majority (here 86%) of the weight of fishes censused at the first fifteen stations is comprised of herbivores and carnivores and (2) the importance of herbivores is largely replaced by planktivores at the Kahe outfall station (station 16) but carnivores remain important at Station 16 as they are elsewhere. The large volume of thermally-elevated water (3193.5 m^3 $x10^3$/day) is probably serving both as a source of food (entrained particles that have passed through the plant) as well as a warm and strong unidirectional current serving to attract and hold planktivorous species that naturally orient into the current seeking food. In addition and as mentioned above, the steel and armor rock superstructure that covers the discharge pipe along with high coral coverage provides habitat shelter and for some fish species a suitable substratum for spawning. A considerable part of the planktivore biomass at station 16 is comprised of two sergeant major or mamo species (*Abudefduf abdominalis* and the recently recognized *Abudefduf vaigiensis*) both of which not only feed in the discharge plume and environs, but also lay demersal eggs on the rocky substratum overlaying the discharge pipe. These two species along with the paletail unicornfish or kala lolo (*Naso brevirostris*) dominate the planktivore biomass at this site together comprising almost 44% of the total estimated standing crop present based on the 2008-2012 data.

4. Differences in Fish Community Structure in the Study Area

This study was undertaken to follow changes in coral reef fish communities as part of the environmental monitoring program related to the development of the CIP generation facility. Sixteen sites spread along 7.9 km of coastline are monitored (Figure 1); referring to Figure 1, these sites geographically fall into four groups: on the southeast are four stations offshore of Campbell Industrial Park and the generation plant (station nos. 1-4 or East 1 through 4), three stations seaward of Ko'Olina Resort (station nos. 5-7 or Ko'Olina 1 and 2 as well as HECO 1D), five stations fronting the Kahe generation facility (station nos. 8-12 or HECO 5B, 7B, 7C, 7D, and 7E) and three stations to the north of Kahe Point (station nos.13-15 or HECO 10C, Nanakuli 1 and 2). Because station 16 (the Kahe discharge pipe) is a man-made structure and not natural substratum like the other fifteen monitored sites, it is excluded from the present analysis.

The question, "Are there any statistically significant differences among the mean number of fish species per transect, the mean number of individual fish per transect or the mean estimated standing crop (in g/m^2) per transect among the four above geographic groups of stations established on natural substratum and sampled in the 2007-12 period?" can be answered again using the Kruskal-Wallis ANOVA and the SNK Test. The results of these statistical procedures are given in Table 5. As noted previously, the Kruskal-Wallis ANOVA can discern whether means differ significantly but cannot separate those that are thus the SNK Test is used to demonstrate which means differ significantly from the others. In all cases the ANOVA noted significant differences exist among the four areas (i.e., CIP, Ko'Olina, Kahe and Nanakuli) for all three parameters (i.e., mean number of fish species per transect, mean number of individual fish per transect and mean standing crop of fishes per transect). The SNK Test demonstrated that the mean number of fish species, individuals and standing crops are significantly greater and statistically separable at the Ko'Olina group of stations over the three other station groups, all of which were related (Table 5). Coral community development (coverage) appears to be greater at the three Ko'Olina stations than found at any of the other transect sites and may be responsible for the greater diversity of species, numbers of individuals and standing crops present there.

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

The final statistical analysis of the 2007-2012 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 2007-2012?" and the results are given in Table 6. Referring to Table 6, two simple facts emerge: (1) the Kahe discharge pipe station has a greater (but insignificant) mean number of fish species, individuals (significantly greater) and standing crop (significantly greater) over all other stations and (2) the means from all of the other fifteen stations (located on natural substratum) are all related due to overlap in the SNK Test results except for three stations (numbers 1, 11 and 14) where little shelter space is present and the number of fish species least. Again this obviously greater mean number of species, and significantly greater number individuals and standing crop at the Kahe discharge pipe is related to the presence of ample shelter, a unidirectional flow of thermally-elevated water and sufficient food resources present relative to all other stations which are located on natural substratum.

5. Fishery Resources

Appendix 1 in this report as well as in Brock (2009, 2010, 2011, 2012) provides lists of all fish species seen over the twenty 2007-2012 surveys. In these lists are both species that are sought-after by commercial, subsistence and recreational fishers as well as species that are usually not. In the usually sought-after group of species, most of the individual fishes encountered on the transects were juveniles but occasionally adult individual fishes were seen. Among the species seen include a number of small schools of the mackerel scad or opelu (*Decapterus macarellus*) especially around stations fronting the Kahe Generating facility in the December 2007 survey and scattered through the various stations and sample dates were seen adults of the moano kea (*Parupeneus cyclostomus*), omilu (*Caranx melampygus*), smaller individuals (papio) of the barred jack (*Carangoides ferdau*), lemon spot jack (*C. orthogrammus*), ulua aukea (*Caranx ignobilis*), pa'opa'o (*Gnathanodon speciosus*). Adults of other species seen include the lai (*Scomberoides lysan*), uku (*Aprion virescens*), wahanui (*Aphareus furca*), the introduced ta'ape (*Lutjanus kasmira*) especially at stations 13 and 16 and to'au (*Lutjanus fulvus*), weke (*Mulloidichthys flavolineatus*), weke'ula (*M. vanicolensis*), munu (*Parupeneus insularis*), moano (*P. multifasciatus*), malu (*P. pleurostigma*) kumu (*P. porphyreus*), nenue (*Kyphosus sandwicensis*), a'awa (*Bodianus bilunulatus*), kupoupou (*Cheilio inermis*), po'ou (*Oxycheilinus unifasciatus*), laenihi (*Iniistius umbrilatus*), the parrotfishes or uhus (*Scarus rubroviolaceus, S. psittacus, S. sordidus, S. perspicillatus, Calotomus carolinus*), the surgeonfishes including paku'iku'i (*Acanthurus achilles*), palani (*A. dussumieri*), maikoiko (*A. leucoparieus*), ma'i'i'i (*A. nigrofuscus*), maiko (*A. nigroris*), na'ena'e (*A. olivaceus*), manini (*A. triostegus*), pualu (*A. xanthopterus* and *A. blochii*), kole (*Ctenochaetus strigosus*), kala lolo (*Naso brevirostris*), kala holo (*N. hexacanthus*), umaumalei (*N. lituratus*), kala (*N. unicornis*), paki'i (*Bothus pantherinus*), humuhumu ele'ele (*Melichthys niger*), humuhumu hi'ukole (*M. vidua*) and the loulu (*Aluterus scriptus*). Besides these species as adults, juveniles of these and other species

(e.g., the mu - *Monotaxis grandoculis*) were seen. Many of the adult individual fishes in the highly sought-after group were seen at varying distances away from the actual census areas, thus some species do not appear in the station counts (Appendix 1).

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

Many coral reef species other than fish are caught and consumed by people; among these are specific algae and a number of invertebrates. Some individuals are interested in the collection of shells and when these usually cryptic species are seen at a station, they are so noted. Two species of molluscs have been seen on several occasions in the 2007-2012 surveys; these are the tiger cowry (*Cypraea tigris*) and the triton shell (*Charonia tritonis*). A species important in the making of fishing lures is the pearl oyster or pa (*Pinctado margaritifera*) which is protected by law and is commonly seen at many of the survey sites. The octopus or he’e (*Octopus cyanea*) was occasionally encountered at some of the stations. Individual he’e ranged from less than a pound in weight up to an estimated four pounds. The sought-after alga, limu kohu (*Asparagopsis taxiformis*) is seasonally common at many of the stations sampled in this study.

6. Standing Crops

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

habitats (e.g., sand flats) usually result in lower estimated standing crops (0.2 to 20 g/m^2). Local studies (Brock and Norris 1989) suggest that with the manipulation (increasing) of habitat space or food resources (Brock 1987), fish standing crops may approach 2,000 g/m^2. Thus under certain circumstances, coral reefs may be able to support much larger standing crops of fishes than previously realized.

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

The 29 March 2010 survey noted only one station with an estimated standing crop greater than 200 g/m^2; this was station 16 where the standing crop was 561 g/m^2 and the opelu (*Decapterus macarellus*) comprised 26% and the kala lolo (*Naso brevirostris*) made up 24% of the total estimated standing crop at this station. The 14 May survey encountered estimated standing crops in excess of 200 g/m^2 at two stations; station 5 noted a biomass of 242 g/m^2 with

the na'ena'e (*Acanthurus olivaceus*) contributing 62% of this estimated weight and the kole (*Ctenochaetus strigosus*) adding another 13% to the total weight at this station. The estimated standing crop at station 16 was 390 g/m^2 and the two mamo species (*Abudefduf abdominalis* and *A. viagiensis*) contributed 35% of this estimated weight and the kala lolo (*Naso brevirostris*) added 25% to the total at this station. In the 12 August 2010 survey the standing crop at station 15 was estimated to be 207 g/m^2 and the whitebar surgeonfish or maiko'iko (*Acanthurus leucoparieus*) provided 27% of this total and the na'ena'e (*Acanthurus olivaeus*) added 52% to the standing crop at this station. Again the estimated biomass at station 16 in the August 2010 survey was elevated (603 g/m^2) and five species were important contributors: the opelu (*Decapterus macarellus* - 25%), the two mamo species (*Abudefduf abdominalis* and *A. viagiensis* - 13%), the hinalea lauwili (*Thalassoma duperrey* - 18%) and the kala lolo (*Naso brevirostris* - 11%). The 29 October 2010 survey found three stations with estimated standing crops in excess of 200 g/m^2. The standing crop at station 7 was estimated to be 245 g/m^2 and the humuhumu ele'ele (*Melichthys niger*) added 49% to the total and the red weke or weke'ula (*Mulloides vanicolensis*) contributed 26%. At station 9 the standing crop was estimated to be 730 g/m^2 where a large school of white weke (*Mulloides flavolineatus*) in the transect area made up 99% of the biomass at this station. Finally at station 16 the biomass was estimated to be 554 g/m^2 and several schools of opelu (*Decapterus macarellus*) made up 41% of the total and a school of blue-lined snapper or ta'ape (*Lutjanus kasmira*) added 23% to the total at this station.

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

In the four 2012 surveys, all standing crop estimates at stations in the 2 May and 23 July surveys were less than 200 g/m^2. However in the 23 May 2012 survey at station 16 the standing crop of fishes was estimated to be 214 g/m^2 and the species contributing heavily to this biomass include the Indo-Pacific sergeant (*Abudefduf vaigensis*) which added 19% to the station total. In the 2 November 2012 survey, the standing crop again at station 16 was estimated to be 334 g/m^2 and a school of mackerel scad or opelu (*Decapterus macarellus*) contributed 50% to this biomass and the hinalea lauwili (*Thalassoma duperrey*) added 14% and the Indo-Pacific sergeant (*Abudefduf vaigensis*) accounted for 11% of the total at this station.

A simple review of the above data finds that the same species often contribute substantially to the estimated standing crops at the same stations over time. A major reason for this is despite many stations not having a high degree of topographic complexity present in the 4 x 50 m transect area, it may be present in the near vicinity. Since many of the fishes encountered on a transect such as the na'ena'e (*Acanthurus oliveceus*) and the palukaluka (*Scarus rubroviolaceus*) move and forage over areas considerably larger than the census area, they often will pass through the census area while it is being conducted and are thus counted.

7. Comparative Analysis of Early HECO Biological Data to the 2007-2012 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 2007-2012 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 2007-2012 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 (2007-2012) 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 2007-2012 dataset. Despite the mean estimated standing crop (here 50 g/m^2) being greater in 2007-2012 than in 1984 (26 g/m^2), the Kruskal-Wallis ANOVA failed to find any statistically significant differences ($p>0.30$, 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 36-year period (1976-2012) at seven monitoring stations fronting the Kahe Generating facility despite the imposition of three major storm events. These data suggest that the fish communities have to some extent recovered from these disturbances.

8. Federally Protected Species

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

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

preferences may be due to the ubiquitous distribution of these algal species.

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

Green turtles were observed on eleven of the twenty surveys completed to date. All of these turtles were juveniles (i.e., having a carapace length estimated to be less than 75 cm) except for a pair of adults (estimated straight-line carapace lengths = 90 cm) in the 10 August 2010 survey at station 9. Some turtles were sleeping while others were observed 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. During the August 2010 and 16 June 2011 surveys this same depression was occupied by a ~65 cm sleeping juvenile turtle. On the 23 November 2011 survey two turtles (~ 60 cm and ~70 cm) were found in this same depression sleeping and on the 23 May 2012 survey this depression was occupied by an ~75 cm resting turtle. In the 25 November 2008 survey six green turtles were found resting on the bottom in a depression just seaward of station 5 and again on the 23 May 2012 survey a single juvenile turtle (~70 cm) was observed at station 16 (the Kahe Generating Station warm-water discharge) swimming in a northwest direction. 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 observed 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 observed in subsequent surveys.

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

Spinner porpoises are occasionally seen in the Kahe Point area and were first encountered there in this study on the 30 May 2008 survey where three pods were seen each having about 35 individuals present. In the 14 May 2010 survey a pod of about 30 individuals passed by during a census at station 10 and in the 23 July 2012 survey a small pod of approximately 20 porpoises were seen traveling northwest seaward of stations 5 and 6. Hawaiian spinner porpoises are known to rest in shallow bays during the day and at night move offshore to feed on midwater fishes and squids that rise to the surface to forage.

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

As noted and documented above, the three early storm events (1980, 1982 and 1992) all impacted marine communities offshore of the Barbers Point - Kahe Point areas. These impacts were probably greatest on the coral communities which due to their sessile nature, must withstand the wave forces impinging on them or perish. Corals are relatively slow-growing and depending on the species, individual colonies may live for a considerable time and in doing so create habitat for fishes and other reef species. If disturbance to the coral community is relatively frequent, surviving corals probably do not contribute much to the three-dimensional structure of the habitat, thus keeping the fish community development in an earlier successional stage than it might otherwise be. Storms not only directly impact the living resources but also the geological status of reef areas. As noted by the early HECO studies, considerable sand movement occurred with the first two major storms such that today much of the area west of the Kahe facility's ocean outfall is now nearly devoid of sand leaving a near-featureless hard bottom that is scoured with passing small wave events which retards benthic and fish community development. A similar situation exists east of the Barbers Point Harbor entrance channel where considerable hard (limestone) substratum is present with much of it having poor benthic community development. This again results in a poorly developed resident fish community which is what we see in much of the area today and did so forty years ago (personal observations). Thus the measures of fish community development used here (the diversity of species and numbers of individuals present as well as the standing crop) do not suggest well-developed resident fish communities at many of the survey 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 36 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 36 years of well-documented environmental history for the Barbers Point - Kahe Point area (completed largely by the HECO

environmental program), provides much of the explanation to the degree of development of resident fish communities we encounter in the area today.

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

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

TABLE 2. Summary of the fish censuses carried out at sixteen locations on twenty surveys over the December 2007 - November 2012 period. The percent of the total biomass is that assigned to each of five trophic categories: herbivores, planktivores, omnivores, carnivores and coral feeders is also given. Note that these percentages are rounded to the nearest whole number.

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

TABLE 2. Continued

Sample Date	Transect No.	No. Species	No. Individuals	Biomass g/m2	% Total Biomass (g) Herb.	Plankt.	Omni	Carni	CF
19-Aug-08	1	19	155	13	1		9	90	
	2	20	280	120	85		2	13	
	3	23	231	40	27		5	66	2
	4	26	415	108	43	8	6	43	
	5	24	227	69	67		9	22	2
	6	35	302	165	79	1	6	14	
	7	24	213	65	9		56	35	
	8	27	463	39	49	1	2	47	
	9	23	235	34	56	4	6	34	
	10	39	201	33	9	1	5	85	
	11	32	126	41	1	2	23	57	17
	12	23	514	33	19	2	13	56	10
	13	21	385	63	45	16	4	35	
	14	19	192	8	4	1		95	
	15	15	104	16	44	1	2	47	6
	16	37	1023	396	3	55	1	41	
25-Nov-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
11-May-09	1	11	108	12	22		1	77	
	2	18	231	41	27		1	68	4
	3	26	224	65	64		7	27	2
	4	25	328	61	58		3	36	3
	5	31	383	224	87		3	9	1
	6	30	240	153	86	2	4	6	2
	7	26	263	51	31	1	45	22	1
	8	27	363	35	56	4	9	30	1
	9	15	88	20	51		1	48	
	10	20	159	22	32	1	14	52	1
	11	4	9	12			7	93	
	12	24	267	20	13	1	11	74	1
	13	28	459	147	20	8	1	71	
	14	11	43	6	25		8	67	
	15	17	194	174	87		1	12	
	16	39	1333	425	35	22	6	37	
21-Jul-09	1	17	141	18	2		9	81	8
	2	25	389	73	52			43	4
	3	31	301	80	26	5	31	34	4
	4	27	506	209	80		4	15	1
	5	39	582	267	65	5	6	23	1
	6	37	354	188	74	2	7	16	1
	7	33	589	155	28	2	49	21	
	8	26	800	47	47	2	7	44	
	9	27	204	70	6	4	3	87	
	10	24	212	30	15	42	2	41	
	11	10	40	12		1	2	97	
	12	26	432	20	18	6	18	46	12
	13	24	405	145	7	11	1	81	
	14	15	111	9	1	1	2	96	
	15	21	258	140	77	6	7	8	2
	16	40	1605	431	5	36	3	56	
29-Mar-10	1	17	162	30	56	0	9	25	10
	2	22	315	33	34	0	4	57	5
	3	27	197	45	70	1	10	17	2
	4	24	324	105	65	0	2	32	1
	5	31	312	129	76	4	8	10	2
	6	29	313	176	85	1	5	9	1
	7	26	336	67	26	0	46	28	0
	8	29	265	56	51	2	5	42	
	9	19	83	18	23	2	0	74	1
	10	13	53	10	40	0	21	38	
	11	10	28	14	1	0	4	95	
	12	24	245	54	7	54	15	23	0
	13	34	312	69	18	14	6	62	0
	14	11	101	7	31	0	2	65	2
	15	24	149	77	75		4	20	1
	16	29	1192	561	24	27	2	47	

TABLE 2. Continued

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

TABLE 2. Continued

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

TABLE 2. Continued

Sample Date	Transect No.	No. Species	No. Individuals	Biomass g/m2	% Total Biomass (g) Herb.	Plankt.	Omni	Carni	CF
23-Nov-11	1	15	179	161	92		0	8	0
	2	22	348	263	88		0	11	1
	3	38	320	379	92		2	5	1
	4	26	360	166	81	0	4	14	1
	5	29	320	122	83	0	3	13	0
	6	30	291	188	85	0	3	11	1
	7	26	244	68	16	0	64	19	1
	8	27	343	32	45	7	5	41	1
	9	23	102	29	61	0	4	34	0
	10	20	85	19	40	0	5	53	2
	11	13	26	50	5		10	86	
	12	34	691	24	30	4	21	44	1
	13	35	1253	318	1	6	2	91	
	14	12	44	7	56	0	1	43	
	15	17	85	16	56	0	17	21	6
	16	28	1318	681	10	19	0	70	0
02-May-12	1	9	74	16	6		7	87	
	2	13	130	27	59	0	0	40	1
	3	23	137	65	66	7	3	23	2
	4	26	251	128	52	5	3	41	
	5	29	227	93	73	0	3	22	1
	6	35	276	147	75	2	4	18	1
	7	25	315	82	17	0	43	40	0
	8	31	371	130	56	0	4	39	0
	9	21	116	20	32	1	12	54	1
	10	15	78	16	20	0	7	71	1
	11	11	31	67	79		0	20	0
	12	28	262	50	31	1	16	52	1
	13	35	339	173	7	4	3	85	0
	14	14	89	9	20	0	1	79	
	15	20	150	54	84	0	4	12	
	16	26	568	143	20	40	6	33	0
23-May-12	1	15	105	52	84	0	0	16	
	2	15	194	53	60	0	3	36	1
	3	23	176	75	69	0	4	26	2
	4	18	357	49	36	1	11	53	
	5	28	211	57	73	0	4	22	1
	6	32	259	163	85	1	6	8	0
	7	19	247	48	39	1	21	40	
	8	22	270	42	36	0	5	58	0
	9	17	59	20	25	0	5	70	0
	10	13	36	10	65		10	23	1
	11	9	23	30	44		0	56	
	12	18	211	27	9	1	32	57	1
	13	28	211	71	5	6	5	84	
	14	11	89	4	52	2	1	45	
	15	17	118	19	23	0	23	54	
	16	23	846	214	14	27	2	58	0

TABLE 2. Continued

Sample Date	Transect No.	No. Species	No. Individuals	Biomass g/m2	% Total Biomass (g) Herb.	Plankt.	Omni	Carni	CF
23-Jul-12	1	23	274	189	67	0	0	32	0
	2	18	187	55	63	0	2	35	0
	3	21	114	39	65		13	21	2
	4	19	344	36	16	1	15	68	
	5	30	185	46	60	1	10	26	3
	6	30	184	134	79	1	3	16	0
	7	24	249	50	26	0	54	20	0
	8	29	212	41	57	0	3	39	1
	9	25	81	26	43	0	6	51	1
	10	13	64	9	16	1	11	71	1
	11	9	20	82	1	2		97	
	12	24	274	32	5	1	35	55	4
	13	34	439	92	2	14	5	78	1
	14	15	54	6	1	0	1	97	
	15	19	102	88	80	11	3	5	1
	16	30	685	153	28	44	4	25	0
02-Nov-12	1	18	201	86	76	0	2	22	
	2	17	224	52	57	0	2	40	0
	3	24	147	109	86		2	11	1
	4	22	285	51	54	0	21	24	1
	5	30	259	137	78		4	17	1
	6	31	249	139	74	0	5	19	1
	7	30	662	182	25	1	25	49	0
	8	24	348	93	79	4	3	12	1
	9	32	219	155	8	0	1	91	0
	10	19	60	21	12	2	10	74	2
	11	8	14	20		0	10	90	
	12	33	530	29	26	16	15	43	1
	13	32	467	186	4	7	3	87	0
	14	16	68	6	23		4	72	
	15	23	200	108	86	0	4	10	1
	16	33	1316	334	4	23	1	73	0

TABLE 3. Results of the Kruskal-Wallis ANOVA and the Student-Neuman-Keuls (SNK) Test addressing the question , "Are there any statistically significant differences among the mean number of fish species seen per transect,the mean number of individual fish censused per transect or the mean estimated total standing crop (in g.m2) per transect for the 15 stations among the twenty 2007-2012 sample periods?" The Kruskal-Wallis result is given as a "p" value at the top of the entry where (p>0.05 or less for significance). The SNK Test is used to separate means that are significantly different from one another. In the body of the table are given the sample date and mean for a given parameter on that date. Letters are used to show differences with the SNK Test; letters with the same designation show means and sample dates that are related and changes in letter designation show where significant differences exist. Overlaps in letters indicate a lack of significant differences and in such cases, only the extremes may be significantly different.

1. Mean Number of Fish Species Per Transect (p>0.56, n.s.)

Date	[n]	Mean	SNK Grouping
Jul-09	15	25.5	A
Aug-10	15	24.9	A
Aug-08	15	24.7	A
Oct-10	15	24.6	A
Nov-11	15	24.5	A
Nov-08	15	23.9	A
Nov-12	15	23.9	A
Jul-11	15	23.5	A
May-10	15	23.0	A
Dec-07	15	22.8	A
Mar-10	15	22.7	A
May-08	15	22.6	A
May-12	15	22.3	A
Jul-12	15	22.2	A
Jun-11	15	22.0	A
Mar-09	15	20.9	A
May-09	15	20.9	A
Apr-08	15	20.3	A
bMay-12	15	19.0	A
Feb-11	15	17.7	A

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

TABLE 3. Continued.

2. Mean Number of Individual Fish Per Transect (p>0.53, n.s.)

YEAR	[n]	Mean	SNK Grouping
Jul-09	15	355	A
Nov-11	15	313	A
Jun-11	15	275	A
Jul-11	15	274	A
Aug-08	15	270	A
Nov-08	15	265	A
Nov-12	15	262	A
Oct-10	15	260	A
Apr-08	15	255	A
Aug-10	15	246	A
Dec-07	15	246	A
May-10	15	227	A
May-09	15	224	A
May-12	15	190	A
Jul-12	15	186	A
May-08	15	222	A
Mar-10	15	213	A
Mar-09	15	195	A
Feb-11	15	177	A
bMay-12	15	171	A

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

3. Mean Total Standing Crop of Fish Per Per Transect (p>0.77, n.s.)

YEAR	[n]	Mean	SNK Grouping
Dec-07	12	25969	A
Nov-11	15	24047	A
Oct-10	15	23517	A
Jul-11	15	19978	A
Jul-09	15	19389	A
Nov-12	15	18110	A
Jun-11	15	16764	A
May-10	15	16578	A
Aug-10	15	16463	A
Apr-08	15	15984	A
Nov-08	15	14174	A
May-09	15	13782	A
May-12	15	13637	A
Mar-10	15	11747	A
Mar-09	15	11705	A
Jul-12	15	11490	A
Aug-08	15	10883	A
May-08	15	10531	A
Feb-11	15	9469	A
bMay-12	15	9275	A

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

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

PART A. Stations 1 - 15:

Mean Percent by Weight

Date	[n]	Herbivore	Planktivore	Omnivore	Coral Feeder	Carnivore
27-Dec-07	12	35	2	8	5	50
04-Apr-08	15	35	2	8	4	51
30-May-08	15	37	7	14	3	39
19-Aug-08	15	36	2	10	3	49
25-Nov-08	15	43	5	6	4	42
19-Mar-09	15	35	1	7	2	55
11-May-09	15	44	1	8	1	46
21-Jul-09	15	33	6	10	2	49
29-Mar-10	15	44	5	9	2	40
19-May-10	15	51	6	9	1	33
12-Aug-10	15	49	7	10	1	33
29-Oct-10	15	41	1	9	1	48
25-Feb-11	15	30	6	15	1	54
16-Jun-11	15	46	6	7	1	41
29-Jul-11	15	36	4	11	1	50
23-Nov-11	15	55	2	9	1	33
02-May-12	15	42	2	8	1	48
23-May-12	15	48	1	8	1	42
23-Jul-12	15	36	2	12	1	50
02-Nov-12	15	46	3	8	1	47
Grand Means		41.1	3.6	9.3	1.9	45.0

PART B. Stations 16 (Outfall Pipe) Only:

Mean Percent by Weight

Date	[n]	Herbivore	Planktivore	Omnivore	Coral Feeder	Carnivore
30-May-08	1	8	43	2		47
19-Aug-08	1	3	55	1		41
25-Nov-08	1	10	49	1	>1	39
19-Mar-09	1	32	34	2	>1	32
11-May-09	1	35	22	6		37
21-Jul-09	1	5	36	3		56
29-Mar-10	1	24	27	2		47
19-May-10	1	13	63	8		16
12-Aug-10	1	14	27	1		58
29-Oct-10	1	7	16	1		76
25-Feb-11	1	8	32	2	>1	59
16-Jun-11	1	17	59	6	>1	17
29-Jul-11	1	4	25	1	>1	70
23-Nov-11	1	10	19	>1	>1	70
02-May-12	1	20	40	6	>1	33
23-May-12	1	14	27	2	>1	58
23-Jul-12	1	28	44	4	>1	24
02-Nov-12	1	4	23	1	>1	73
Grand Means		14.2	35.7	2.9	0.3	47.4

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 2007-2012 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	57	29.8	A
Nanakuli	60	21.5	B
Kahe	100	21.0	B
CIP	80	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 twenty sample periods.

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

Station Group	(n)	Mean	SNK Grouping
Ko'Olina	57	322	A
Nanakuli	60	242	B
Kahe	100	221	B
CIP	80	208	B

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

TABLE 5. Continued.

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

Station Group	(n)	Mean	SNK Grouping
Ko'Olina	57	133	A
Nanakuli	60	79	B
CIP	80	77	B
Kahe	100	51	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 twenty periods in 2007-2012?" 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 2007-12 ($p < 0.0001$, Significant)

Station Group	[n]	Mean	SNK Grouping			
16 (Pipe)	18	34	A			
6 (Ko'Olina 2)	19	33	A	B		
5 (Ko'Olina 1)	19	31	A	B	C	
13 (HECO 10C)	20	30		B	C	D
12 (HECO 7E)	20	28	E		C	D
8 (HECO 5B)	20	27	E	F		D
7 (HECO 1D)	19	26	E	F		
3 (East 3)	20	25	E	F	G	
4 (East 4)	20	23		F	G	H
9 (HECO 7B)	20	22	I		G	H
15 (Nana-2)	20	21	I			H
2 (East 2)	20	18	I			
10 (HECO 7C)	20	18	I			
1 (East 1)	20	15		J		
14 (Nana-1)	20	14		J		
11 (HECO 7D)	20	11			K	

Interpretation:

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

TABLE 6. Continued.

2. Mean Number of Individual Fish Censused Per Station in 2007-12 (p < 0.0001, Significant)

Station Group	[n]	Mean	Grouping			
16 (Pipe)	18	1168	A			
13 (HECO 10C)	20	462		B		
12 (HECO 7E)	20	389		B	C	
8 (HECO 5B)	20	385		B	C	
7 (HECO 1D)	19	361		B	C	
5 (Ko'Olina 1)	19	317			C	D
4 (East 4)	20	306			C	D
6 (Ko'Olina 2)	19	285	E		C	D
2 (East 2)	20	213	E	F		D
3 (East 3)	20	189	E	F		
9 (HECO 7B)	20	175	E	F		
15 (Nana-2)	20	167	E	F		
1 (East 1)	20	126		F	G	
10 (HECO 7C)	20	119		F	G	
14 (Nana-1)	20	97		F	G	
11 (HECO 7D)	20	38			G	

Interpretation:
The Kruskal-Wallis ANOVA noted statistically significant differences in the mean number of individual fish censused among the 16 transects over the twenty surveys in 2007-12. 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 2007-12 (p < 0.0001, Significant)

Station Group	[n]	Mean	Grouping			
16 (Pipe)	18	402	A			
6 (Ko'Olina 2)	19	170		B		
13 (HECO 10C)	20	136		B	C	
5 (Ko'Olina 1)	19	126		B	C	D
9 (HECO 7B)	20	117		B	C	D
7 (HECO 1D)	19	103	E	B	C	D
3 (East 3)	20	95	E		C	D
15 (Nana-2)	20	91	E		C	D
4 (East 4)	20	86	E	F	C	D
2 (East 2)	20	75	E	F	C	D
1 (East 1)	20	52	E	F		D
8 (HECO 5B)	20	50	E	F		D
12 (HECO 7E)	20	31	E	F		
10 (HECO 7C)	20	30	E	F		
11 (HECO 7D)	20	28	E	F		
14 (Nana-1)	20	8		F		

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 fifteen years encompassing a 36-year period (i.e., 1976-1984 and 2007-2012 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 ($p>0.55$, n.s.)

YEAR	[n]	Mean	SNK Grouping
1976	3	29.0	A
1977	3	26.0	A
1979	6	24.3	A
1978	3	24.0	A
2007	7	23.7	A
2008	7	23.5	A
1984	7	23.4	A
1980	6	23.2	A
2010	7	22.3	A
2011	7	22.1	A
2012	7	21.1	A
2009	7	21.1	A
1981	6	19.2	A
1982	6	17.7	A
1983	6	15.8	A

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

TABLE 7. Continued.

2. Mean Number of Individual Fish Per Transect (p>0.59, n.s.)

YEAR	[n]	Mean	SNK Grouping
2008	7	303.1	A
2007	7	302.3	A
2011	7	276.7	A
2009	7	271.7	A
1980	6	250.3	A
2010	7	232.3	A
2012	7	215.4	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 fifteen years of sampling. Note that the hierarchy of annual mean number of individual fish censused does not parallel that for the annual mean number of species counted at these stations. In other words, the impact of the two storm events (1980 and 1982) produced a different result with respect to the number of individual fish and the number of species counted.

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


Nana Control 2
Nana Control 1
Station 10C
Station 7D
Station 7E
Station 7C
Station 7B
Outfall Pipe
Station 5B
Station 1D
Ko Olina 2
Ko Olina 1
EAST 3
EAST 2
EAST 4
EAST 1
NANAKULI
MAKAKILO CITY
KALAELOA AIRPORT
Barbers Point Harbor
CORAL PIT
Kalaeloa
Map created with TOPO! ©2006 National Geographic
NATIONAL GEOGRAPHIC
0.0 0.5 1.0 miles
0.0 0.5 1.0 1.5 km
TN MN
10°
05/13/09

APPENDIX 1. Results of fish censuses carried out on each of four 2012 surveys carried out on 2 May, 23 May, 23 July and 2 November 2012. Data from the earlier surveys that comprise the first annual report are given in Brock (2009), second annual report (Brock 2010), third annual report (Brock 2011) and Brock (2012) provides the fourth year data set. In the body of the table are given the list of fish species seen at each station, the trophic or feeding guild category for each species (where C=carnivore, H=herbivore, O=omnivore, P=planktivore and CF=coral feeder), the station number (here 1 through 16) as well as station name, the number of individuals of each species censused as well as the biomass (in grams) for each. Also given for each of the five trophic categories is a summary of the total number of individual fishes, the total standing crop and the percent of the total standing crop for each trophic category. Note that the total standing crop is given in grams and the area censused at each station is 200 m^2 except for station 11 (old HECO Station 7-D) which the census area is 10.5 m long and 4 m wide or 42 m^2. Biomass estimates for each species are based on species-specific regression coefficients using linear regression techniques (Ricker 1975, Brock and Norris 1989).

2 MAY 2012 FIELD DATA

02-May-12

GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Cirrhitops fasciatus	1	EAST1	1	8.23			
C	Thalassoma duperrey	1	EAST1	15	410.86			
C	Thalassoma duperrey	1	EAST1	15	824.23			
C	Thalassoma duperrey	1	EAST1	12	133.96			
C	Thalassoma duperrey	1	EAST1	8	776.42			
C	Thalassoma duperrey	1	EAST1	8	25.20			
C	Stethojulis balteata	1	EAST1	3	107.29			
C	Stethojulis balteata	1	EAST1	1	14.41			
C	Rhinecanthus rectangulus	1	EAST1	2	171.75			
C	Rhinecanthus rectangulus	1	EAST1	1	45.36			
C	Sufflamen fraenatus	1	EAST1	1	329.34	67	2847.04	87.2
H	Acanthurus nigrofuscus	1	EAST1	1	14.21			
H	Naso unicornis	1	EAST1	1	190.74	2	204.96	6.3
O	Melichthys vidua	1	EAST1	1	199.03			
O	Canthigaster jactator	1	EAST1	4	14.25	5	213.28	6.5
	TOTAL	1	EAST1	74	3265.28	74	3265.28	100
C	Parupeneus multifasciatus	2	EAST2	1	27.12			
C	Parupeneus multifasciatus	2	EAST2	1	155.42			
C	Parupeneus multifasciatus	2	EAST2	1	54.40			
C	Parupeneus multifasciatus	2	EAST2	1	96.08			
C	Plectroglyphidodon johnstonian	2	EAST2	1	1.72			
C	Plectroglyphidodon imparipenni	2	EAST2	1	0.86			
C	Paracirrhites arcatus	2	EAST2	3	24.35			
C	Thalassoma duperrey	2	EAST2	13	714.34			
C	Thalassoma duperrey	2	EAST2	9	246.51			
C	Thalassoma duperrey	2	EAST2	4	44.65			
C	Thalassoma duperrey	2	EAST2	5	485.26			
C	Stethojulis balteata	2	EAST2	4	143.05			
C	Stethojulis balteata	2	EAST2	2	28.82			
C	Halichoeres ornatissimus	2	EAST2	1	9.52			
C	Rhinecanthus rectangulus	2	EAST2	1	85.87	48	2117.99	39.7
CF	Chaetodon unimaculatus	2	EAST2	2	50.61	2	50.61	0.9
H	Acanthurus nigrofuscus	2	EAST2	13	705.28			
H	Acanthurus nigrofuscus	2	EAST2	18	255.83			
H	Acanthurus nigrofuscus	2	EAST2	38	908.09			
H	Naso lituratus	2	EAST2	1	448.94			
H	Naso lituratus	2	EAST2	1	622.36			
H	Naso lituratus	2	EAST2	1	205.99	72	3146.48	59.0
O	Canthigaster jactator	2	EAST2	4	14.25	4	14.25	0.3
P	Chromis vanderbilti	2	EAST2	4	1.26	4	1.26	0.02
	TOTAL	2	EAST2	130	5330.59	130	5330.59	100
C	Cephalopholis argus	3	EAST3	1	1077.13			
C	Parupeneus multifasciatus	3	EAST3	1	54.40			
C	Parupeneus multifasciatus	3	EAST3	2	192.16			
C	Plectroglyphidodon johnstonian	3	EAST3	3	5.17			
C	Paracirrhites arcatus	3	EAST3	4	32.47			
C	Paracirrhites forsteri	3	EAST3	1	39.65			
C	Thalassoma duperrey	3	EAST3	4	44.65			
C	Thalassoma duperrey	3	EAST3	7	384.64			
C	Thalassoma duperrey	3	EAST3	9	246.51			
C	Thalassoma duperrey	3	EAST3	3	291.16			
C	Coris gaimard	3	EAST3	1	22.07			
C	Sufflamen bursa	3	EAST3	1	85.87			
C	Sufflamen fraenatus	3	EAST3	1	461.25	38	2937.13	22.6
CF	Chaetodon unimaculatus	3	EAST3	2	50.61			
CF	Chaetodon ornatissimus	3	EAST3	2	138.00			
CF	Chaetodon multicinctus	3	EAST3	4	52.12	8	240.73	1.8
H	Calotomus carolinus	3	EAST3	1	34.69			
H	Scarus rubroviolaceus	3	EAST3	1	43.92			
H	Acanthurus triostegus	3	EAST3	1	46.32			
H	Acanthurus nigrofuscus	3	EAST3	18	255.83			
H	Acanthurus nigrofuscus	3	EAST3	8	60.20			
H	Acanthurus nigrofuscus	3	EAST3	23	549.63			
H	Acanthurus olivaceus	3	EAST3	3	785.00			
H	Acanthurus olivaceus	3	EAST3	11	6194.87			
H	Ctenochaetus strigosus	3	EAST3	1	15.20			
H	Ctenochaetus strigosus	3	EAST3	4	107.38			
H	Naso lituratus	3	EAST3	1	448.94	72	8541.97	65.6
O	Stegastes fasciolatus	3	EAST3	3	44.29			
O	Melichthys vidua	3	EAST3	1	296.24			
O	Canthigaster jactator	3	EAST3	5	17.81	9	358.34	2.8
P	Naso brevirostris	3	EAST3	9	660.22			
P	Naso brevirostris	3	EAST3	1	278.71	10	938.93	7.2
	TOTAL	3	EAST3	137	13017.10	137	13017.10	100

02-May-12

GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Cephalopholis argus	4	EAST4	1	638.29			
C	Parupeneus pleurostigma	4	EAST4	6	348.05			
C	Parupeneus multifasciatus	4	EAST4	5	272.00			
C	Parupeneus multifasciatus	4	EAST4	3	81.35			
C	Parupeneus multifasciatus	4	EAST4	13	2020.49			
C	Parupeneus multifasciatus	4	EAST4	2	192.16			
C	Chaetodon lunula	4	EAST4	1	35.99			
C	Plectroglyphidodon johnstonian	4	EAST4	3	5.17			
C	Paracirrhites arcatus	4	EAST4	4	32.47			
C	Labroides phthirophagus	4	EAST4	9	5.65			
C	Thalassoma duperrey	4	EAST4	19	1044.03			
C	Thalassoma duperrey	4	EAST4	27	301.41			
C	Thalassoma duperrey	4	EAST4	24	657.37			
C	Thalassoma duperrey	4	EAST4	8	776.42			
C	Coris venusta	4	EAST4	2	96.76			
C	Stethojulis balteata	4	EAST4	2	71.53			
C	Stethojulis balteata	4	EAST4	1	72.39			
C	Halichoeres ornatissimus	4	EAST4	1	25.14			
C	Halichoeres ornatissimus	4	EAST4	1	16.45			
C	Halichoeres ornatissimus	4	EAST4	1	9.52			
C	Diodon hystrix	4	EAST4	1	2460.58			
C	Diodon holocanthus	4	EAST4	1	1208.51	135	10371.72	40.7
H	Acanthurus triostegus	4	EAST4	1	46.32			
H	Acanthurus nigrofuscus	4	EAST4	18	255.83			
H	Acanthurus nigrofuscus	4	EAST4	21	501.84			
H	Acanthurus nigrofuscus	4	EAST4	2	108.50			
H	Acanthurus nigrofuscus	4	EAST4	2	15.05			
H	Acanthurus olivaceus	4	EAST4	19	10700.23			
H	Acanthurus blochii	4	EAST4	1	232.24			
H	Acanthurus blochii	4	EAST4	3	1360.78			
H	Ctenochaetus strigosus	4	EAST4	1	15.20	68	13235.99	51.9
O	Stegastes fasciolatus	4	EAST4	1	14.76			
O	Melichthys niger	4	EAST4	3	490.01			
O	Melichthys vidua	4	EAST4	1	199.03			
O	Canthigaster coronata	4	EAST4	1	7.59			
O	Canthigaster jactator	4	EAST4	7	24.93	13	736.33	2.9
P	Chaetodon miliaris	4	EAST4	2	42.34			
P	Chromis vanderbilti	4	EAST4	29	9.16			
P	Naso brevirostris	4	EAST4	4	1114.83	35	1166.32	4.6
	TOTAL	4	EAST4	251	25510.36	251	25510.36	100
C	Adioryx tiere	5	KO1	1	265.90			
C	Myripristis amaenus	5	KO1	3	422.43			
C	Lutjanus fulvus	5	KO1	1	525.17			
C	Parupeneus multifasciatus	5	KO1	2	108.80			
C	Parupeneus multifasciatus	5	KO1	2	310.84			
C	Parupeneus multifasciatus	5	KO1	1	340.44			
C	Parupeneus bifasciatus	5	KO1	1	59.77			
C	Parupeneus bifasciatus	5	KO1	1	107.31			
C	Forcipiger flavissimus	5	KO1	1	9.15			
C	Chaetodon lunula	5	KO1	3	107.98			
C	Plectroglyphidodon johnstonian	5	KO1	8	13.77			
C	Paracirrhites arcatus	5	KO1	5	40.59			
C	Labroides phthirophagus	5	KO1	2	1.26			
C	Thalassoma duperrey	5	KO1	9	494.54			
C	Thalassoma duperrey	5	KO1	11	301.30			
C	Thalassoma duperrey	5	KO1	5	55.82			
C	Thalassoma duperrey	5	KO1	5	485.26			
C	Gomphosus varius	5	KO1	2	45.20			
C	Gomphosus varius	5	KO1	1	11.04			
C	Stethojulis balteata	5	KO1	1	35.76			
C	Stethojulis balteata	5	KO1	1	72.39			
C	Zanclus cornutus	5	KO1	1	104.16			
C	Sufflamen bursa	5	KO1	1	85.87			
C	Sufflamen bursa	5	KO1	1	144.65	69	4149.40	22.4
CF	Chaetodon multicinctus	5	KO1	6	78.18			
CF	Chaetodon multicinctus	5	KO1	2	45.11			
CF	Cantherhines dumerili	5	KO1	1	117.96	9	241.26	1.3
H	Calotomus carolinus	5	KO1	1	72.28			
H	Scarus sordidus	5	KO1	1	234.65			
H	Acanthurus triostegus	5	KO1	3	138.95			
H	Acanthurus leucopareius	5	KO1	2	265.40			
H	Acanthurus leucopareius	5	KO1	2	133.48			
H	Acanthurus nigrofuscus	5	KO1	14	759.53			
H	Acanthurus nigrofuscus	5	KO1	12	170.55			
H	Acanthurus nigrofuscus	5	KO1	20	477.94			
H	Acanthurus olivaceus	5	KO1	12	6758.04			
H	Acanthurus olivaceus	5	KO1	7	1831.67			
H	Ctenochaetus strigosus	5	KO1	33	2173.54			
H	Ctenochaetus strigosus	5	KO1	1	7.58			
H	Ctenochaetus strigosus	5	KO1	1	15.20			
H	Ctenochaetus strigosus	5	KO1	15	402.66			
H	Zebrasoma flavescens	5	KO1	2	106.56	126	13548.04	73.0
O	Stegastes fasciolatus	5	KO1	7	103.34			
O	Melichthys niger	5	KO1	3	490.01			
O	Canthigaster jactator	5	KO1	4	14.25	14	607.60	3.3
P	Chromis vanderbilti	5	KO1	9	2.84	9	2.84	0.02
	TOTAL	5	KO1	227	18549.13	227	18549.13	100

02-May-12

GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Adioryx spinifer	6	KO2	1	1219.20			
C	Cephalopholis argus	6	KO2	1	1355.30			
C	Parupeneus multifasciatus	6	KO2	1	54.40			
C	Parupeneus multifasciatus	6	KO2	4	108.47			
C	Chaetodon ephippium	6	KO2	1	48.39			
C	Plectroglyphidodon johnstonian	6	KO2	4	6.89			
C	Paracirrhites arcatus	6	KO2	1	8.12			
C	Bodianus bilunulatus	6	KO2	1	1141.37			
C	Labroides phthirophagus	6	KO2	4	2.51			
C	Thalassoma duperrey	6	KO2	5	485.26			
C	Thalassoma duperrey	6	KO2	6	164.34			
C	Thalassoma duperrey	6	KO2	2	109.90			
C	Gomphosus varius	6	KO2	1	39.39			
C	Zanclus cornutus	6	KO2	1	104.16			
C	Sufflamen bursa	6	KO2	1	144.65			
C	Sufflamen bursa	6	KO2	1	85.87			
C	Sufflamen fraenatus	6	KO2	1	144.65	36	5222.87	17.8
CF	Chaetodon unimaculatus	6	KO2	4	101.22			
CF	Chaetodon ornatissimus	6	KO2	2	138.00			
CF	Chaetodon quadrimaculatus	6	KO2	2	50.61			
CF	Chaetodon multicinctus	6	KO2	6	78.18	14	368.01	1.3
H	Calotomus carolinus	6	KO2	1	1288.03			
H	Scarus psittacus	6	KO2	2	75.75			
H	Scarus psittacus	6	KO2	1	79.27			
H	Scarus psittacus	6	KO2	2	482.85			
H	Scarus psittacus	6	KO2	1	144.94			
H	Scarus psittacus	6	KO2	1	786.15			
H	Acanthurus triostegus	6	KO2	10	463.15			
H	Acanthurus triostegus	6	KO2	22	2200.31			
H	Acanthurus nigrofuscus	6	KO2	10	142.13			
H	Acanthurus nigrofuscus	6	KO2	6	325.51			
H	Acanthurus nigrofuscus	6	KO2	17	127.92			
H	Acanthurus nigrofuscus	6	KO2	30	716.91			
H	Acanthurus nigroris	6	KO2	4	95.59			
H	Acanthurus nigroris	6	KO2	8	434.02			
H	Acanthurus olivaceus	6	KO2	17	9573.89			
H	Acanthurus olivaceus	6	KO2	2	523.33			
H	Acanthurus dussumieri	6	KO2	2	653.19			
H	Acanthurus blochii	6	KO2	2	907.19			
H	Acanthurus blochii	6	KO2	4	622.33			
H	Acanthurus blochii	6	KO2	3	87.09			
H	Acanthurus blochii	6	KO2	3	36.74			
H	Ctenochaetus strigosus	6	KO2	8	1057.07			
H	Ctenochaetus strigosus	6	KO2	6	161.06			
H	Ctenochaetus strigosus	6	KO2	1	65.86			
H	Ctenochaetus strigosus	6	KO2	2	30.40			
H	Ctenochaetus strigosus	6	KO2	9	68.18			
H	Zebrasoma flavescens	6	KO2	1	9.48			
H	Zebrasoma flavescens	6	KO2	4	213.12			
H	Naso lituratus	6	KO2	1	622.36	180	21993.84	74.9
O	Stegastes fasciolatus	6	KO2	2	29.53			
O	Melichthys niger	6	KO2	2	326.67			
O	Melichthys niger	6	KO2	2	496.06			
O	Melichthys vidua	6	KO2	1	199.03			
O	Canthigaster jactator	6	KO2	9	32.06	16	1083.35	3.7
P	Abudefduf abdominalis	6	KO2	22	689.32			
P	Chromis vanderbilti	6	KO2	5	1.58			
P	Chromis hanui	6	KO2	3	2.24	30	693.14	2.4
	TOTAL	6	KO2	276	29361.20	276	29361.20	100
C	Parupeneus multifasciatus	7	KAHE1D	1	96.08			
C	Forcipiger flavissimus	7	KAHE1D	1	9.15			
C	Plectroglyphidodon johnstonian	7	KAHE1D	6	10.33			
C	Cirrhitus pinnulatus	7	KAHE1D	1	90.86			
C	Bodianus bilunulatus	7	KAHE1D	1	648.58			
C	Labroides phthirophagus	7	KAHE1D	2	1.26			
C	Thalassoma duperrey	7	KAHE1D	29	2814.51			
C	Thalassoma duperrey	7	KAHE1D	30	1648.47			
C	Thalassoma duperrey	7	KAHE1D	13	145.12			
C	Thalassoma duperrey	7	KAHE1D	22	602.59			
C	Gomphosus varius	7	KAHE1D	3	67.80			
C	Gomphosus varius	7	KAHE1D	3	33.12			
C	Gomphosus varius	7	KAHE1D	1	39.39			
C	Coris gaimard	7	KAHE1D	1	83.79			
C	Sufflamen bursa	7	KAHE1D	1	45.36			
C	Sufflamen bursa	7	KAHE1D	2	171.75	117	6508.16	39.9
CF	Chaetodon multicinctus	7	KAHE1D	4	52.12			
CF	Pervagor melanocephalus	7	KAHE1D	1	9.75	5	61.87	0.4
H	Centropyge potteri	7	KAHE1D	1	10.62			
H	Scarus sordidus	7	KAHE1D	3	107.98			
H	Scarus psittacus	7	KAHE1D	5	189.36			
H	Scarus psittacus	7	KAHE1D	3	43.84			
H	Acanthurus triostegus	7	KAHE1D	1	46.32			
H	Acanthurus nigrofuscus	7	KAHE1D	12	170.55			
H	Acanthurus nigrofuscus	7	KAHE1D	26	621.32			
H	Acanthurus nigrofuscus	7	KAHE1D	9	488.27			
H	Acanthurus olivaceus	7	KAHE1D	17	335.64			
H	Acanthurus olivaceus	7	KAHE1D	9	427.29			
H	Ctenochaetus strigosus	7	KAHE1D	7	187.91			
H	Ctenochaetus strigosus	7	KAHE1D	4	60.79			
H	Zebrasoma flavescens	7	KAHE1D	3	78.09	100	2767.99	17.0
O	Stegastes fasciolatus	7	KAHE1D	7	103.34			
O	Melichthys niger	7	KAHE1D	40	6533.42			
O	Melichthys vidua	7	KAHE1D	1	124.35			
O	Melichthys vidua	7	KAHE1D	1	199.03			
O	Canthigaster jactator	7	KAHE1D	4	8.82			
O	Canthigaster jactator	7	KAHE1D	2	7.12	55	6976.08	42.7
P	Chromis vanderbilti	7	KAHE1D	38	12.00	38	12.00	0.1
	TOTAL	7	KAHE1D	315	16326.12	315	16326.12	100

02-May-12

GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Mulloides flavolineatus	8	KAHE5B	7	4329.85			
C	Mulloides flavolineatus	8	KAHE5B	9	3286.88			
C	Parupeneus multifasciatus	8	KAHE5B	2	192.16			
C	Parupeneus multifasciatus	8	KAHE5B	1	54.40			
C	Parupeneus multifasciatus	8	KAHE5B	1	155.42			
C	Parupeneus multifasciatus	8	KAHE5B	6	162.70			
C	Plectroglyphidodon johnstonian	8	KAHE5B	8	13.77			
C	Plectroglyphidodon imparipenni	8	KAHE5B	1	0.86			
C	Paracirrhites arcatus	8	KAHE5B	4	32.47			
C	Thalassoma duperrey	8	KAHE5B	2	109.90			
C	Thalassoma duperrey	8	KAHE5B	10	111.63			
C	Thalassoma duperrey	8	KAHE5B	10	273.90			
C	Thalassoma duperrey	8	KAHE5B	11	122.80			
C	Thalassoma duperrey	8	KAHE5B	8	25.20			
C	Thalassoma duperrey	8	KAHE5B	4	388.21			
C	Gomphosus varius	8	KAHE5B	1	22.60			
C	Coris venusta	8	KAHE5B	1	23.64			
C	Coris gaimard	8	KAHE5B	1	45.99			
C	Stethojulis balteata	8	KAHE5B	1	35.76			
C	Macropharyngodon geoffroy	8	KAHE5B	2	37.26			
C	Halichoeres ornatissimus	8	KAHE5B	1	25.14			
C	Zanclus cornutus	8	KAHE5B	5	520.79			
C	Rhinecanthus rectangulus	8	KAHE5B	2	90.72			
C	Sufflamen bursa	8	KAHE5B	2	171.75	100	10233.82	39.3
CF	Chaetodon multicinctus	8	KAHE5B	4	52.12			
CF	Chaetodon multicinctus	8	KAHE5B	2	13.31			
CF	Pervagor spilosoma	8	KAHE5B	1	9.75	7	75.18	0.3
H	Calotomus carolinus	8	KAHE5B	2	144.56			
H	Calotomus carolinus	8	KAHE5B	1	2138.86			
H	Calotomus carolinus	8	KAHE5B	1	339.30			
H	Scarus psittacus	8	KAHE5B	2	2874.93			
H	Scarus psittacus	8	KAHE5B	1	79.27			
H	Scarus rubroviolaceus	8	KAHE5B	1	1160.01			
H	Scarus rubroviolaceus	8	KAHE5B	1	43.92			
H	Acanthurus triostegus	8	KAHE5B	1	17.17			
H	Acanthurus nigrofuscus	8	KAHE5B	3	162.76			
H	Acanthurus nigrofuscus	8	KAHE5B	21	501.84			
H	Acanthurus nigrofuscus	8	KAHE5B	8	113.70			
H	Acanthurus olivaceus	8	KAHE5B	7	3942.19			
H	Acanthurus olivaceus	8	KAHE5B	2	39.49			
H	Acanthurus olivaceus	8	KAHE5B	7	1831.67			
H	Acanthurus olivaceus	8	KAHE5B	3	281.31			
H	Naso lituratus	8	KAHE5B	1	36.34			
H	Naso lituratus	8	KAHE5B	1	14.90			
H	Naso unicornis	8	KAHE5B	1	38.92			
H	Naso unicornis	8	KAHE5B	4	762.98	68	14524.11	55.8
O	Stegastes fasciolatus	8	KAHE5B	8	118.11			
O	Melichthys niger	8	KAHE5B	4	653.34			
O	Melichthys vidua	8	KAHE5B	3	373.04			
O	Canthigaster jactator	8	KAHE5B	4	14.25	19	1158.73	4.4
P	Chromis vanderbilti	8	KAHE5B	175	55.28			
P	Chromis hanui	8	KAHE5B	2	1.49	177	56.77	0.2
	TOTAL	8	KAHE5B	371	26048.61	371	26048.61	100
C	Gymnothorax meleagris	9	KAHE7B	1	44.70			
C	Parupeneus pleurostigma	9	KAHE7B	2	196.50			
C	Parupeneus multifasciatus	9	KAHE7B	2	310.84			
C	Parupeneus multifasciatus	9	KAHE7B	1	235.75			
C	Parupeneus multifasciatus	9	KAHE7B	8	216.93			
C	Parupeneus multifasciatus	9	KAHE7B	1	96.08			
C	Forcipiger flavissimus	9	KAHE7B	2	18.30			
C	Thalassoma duperrey	9	KAHE7B	3	291.16			
C	Thalassoma duperrey	9	KAHE7B	2	54.78			
C	Thalassoma duperrey	9	KAHE7B	3	164.85			
C	Zanclus cornutus	9	KAHE7B	1	54.90			
C	Sufflamen bursa	9	KAHE7B	1	144.65			
C	Sufflamen bursa	9	KAHE7B	4	343.49	31	2172.92	54.3
CF	Chaetodon multicinctus	9	KAHE7B	2	13.31			
CF	Chaetodon multicinctus	9	KAHE7B	2	26.06	4	39.37	1.0
H	Acanthurus triostegus	9	KAHE7B	2	92.63			
H	Acanthurus triostegus	9	KAHE7B	1	100.01			
H	Acanthurus nigrofuscus	9	KAHE7B	8	191.18			
H	Acanthurus nigrofuscus	9	KAHE7B	2	28.43			
H	Acanthurus nigrofuscus	9	KAHE7B	2	108.50			
H	Acanthurus olivaceus	9	KAHE7B	5	237.38			
H	Acanthurus olivaceus	9	KAHE7B	3	281.31			
H	Acanthurus blochii	9	KAHE7B	1	29.03			
H	Ctenochaetus strigosus	9	KAHE7B	1	26.84			
H	Naso lituratus	9	KAHE7B	2	72.69			
H	Naso unicornis	9	KAHE7B	2	77.85			
H	Naso unicornis	9	KAHE7B	2	34.39	31	1280.24	32.0
O	Melichthys vidua	9	KAHE7B	1	124.35			
O	Melichthys vidua	9	KAHE7B	1	199.03			
O	Cantherhines sandwichiensis	9	KAHE7B	1	46.04			
O	Cantherhines sandwichiensis	9	KAHE7B	1	82.05			
O	Canthigaster jactator	9	KAHE7B	4	14.25	8	465.71	11.6
P	Dascyllus albisella	9	KAHE7B	10	30.88			
P	Chromis vanderbilti	9	KAHE7B	25	7.90			
P	Chromis hanui	9	KAHE7B	7	5.23	42	44.01	1.1
	TOTAL	9	KAHE7B	116	4002.26	116	4002.26	100

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus pleurostigma	10	KAHE7C	13	754.11			
C	Parupeneus multifasciatus	10	KAHE7C	1	54.40			
C	Parupeneus multifasciatus	10	KAHE7C	1	27.12			
C	Parupeneus multifasciatus	10	KAHE7C	1	340.44			
C	Parupeneus multifasciatus	10	KAHE7C	1	155.42			
C	Paracirrhites arcatus	10	KAHE7C	5	40.59			
C	Cheilinus bimaculatus	10	KAHE7C	1	4.10			
C	Thalassoma duperrey	10	KAHE7C	2	109.90			
C	Thalassoma duperrey	10	KAHE7C	1	3.15			
C	Thalassoma duperrey	10	KAHE7C	1	27.39			
C	Sufflamen bursa	10	KAHE7C	4	578.60			
C	Sufflamen bursa	10	KAHE7C	2	171.75	33	2266.96	71.2
CF	Chaetodon quadrimaculatus	10	KAHE7C	1	7.03			
CF	Chaetodon multicinctus	10	KAHE7C	4	26.63	5	33.65	1.1
H	Acanthurus olivaceus	10	KAHE7C	2	327.03			
H	Naso lituratus	10	KAHE7C	3	217.75			
H	Naso unicornis	10	KAHE7C	1	17.19			
H	Naso unicornis	10	KAHE7C	2	77.85	8	639.83	20.1
O	Melichthys vidua	10	KAHE7C	1	199.03			
O	Canthigaster coronata	10	KAHE7C	2	15.18			
O	Canthigaster jactator	10	KAHE7C	6	21.37	9	235.58	7.4
P	Chromis vanderbilti	10	KAHE7C	23	7.27	23	7.27	0.2
	TOTAL	10	KAHE7C	78	3183.29	78	3183.29	100
C	Gymnothorax meleagris	11	KAHE7D	1	73.65			
C	Parupeneus multifasciatus	11	KAHE7D	1	155.42			
C	Coris venusta	11	KAHE7D	1	142.48			
C	Coris venusta	11	KAHE7D	1	48.38			
C	Sufflamen bursa	11	KAHE7D	1	144.65	5	564.58	20.2
CF	Chaetodon multicinctus	11	KAHE7D	2	13.31	2	13.31	0.5
H	Calotomus carolinus	11	KAHE7D	1	218.67			
H	Acanthurus olivaceus	11	KAHE7D	3	490.55			
H	Acanthurus olivaceus	11	KAHE7D	14	1312.76			
H	Acanthurus blochii	11	KAHE7D	1	29.03			
H	Naso lituratus	11	KAHE7D	1	72.58			
H	Naso unicornis	11	KAHE7D	1	73.36			
H	Naso unicornis	11	KAHE7D	1	17.19	22	2214.15	79.2
O	Canthigaster jactator	11	KAHE7D	2	4.41	2	4.41	0.2
	TOTAL	11	KAHE7D	31	2796.45	31	2796.45	100
C	Aulostomus chinensis	12	KAHE7E	1	68.53			
C	Parupeneus multifasciatus	12	KAHE7E	2	310.84			
C	Parupeneus multifasciatus	12	KAHE7E	28	1523.18			
C	Parupeneus multifasciatus	12	KAHE7E	6	66.31			
C	Parupeneus multifasciatus	12	KAHE7E	20	542.33			
C	Paracirrhites arcatus	12	KAHE7E	1	8.12			
C	Paracirrhites forsteri	12	KAHE7E	1	39.65			
C	Thalassoma duperrey	12	KAHE7E	5	485.26			
C	Thalassoma duperrey	12	KAHE7E	3	164.85			
C	Thalassoma duperrey	12	KAHE7E	6	164.34			
C	Gomphosus varius	12	KAHE7E	1	22.60			
C	Coris venusta	12	KAHE7E	1	23.64			
C	Pseudojuloides cerasinus	12	KAHE7E	3	9.45			
C	Pseudojuloides cerasinus	12	KAHE7E	1	11.16			
C	Zanclus cornutus	12	KAHE7E	1	104.16			
C	Sufflamen bursa	12	KAHE7E	1	19.92			
C	Sufflamen bursa	12	KAHE7E	2	171.75			
C	Sufflamen fraenatus	12	KAHE7E	1	224.79			
C	Diodon holocanthus	12	KAHE7E	1	1208.51	85	5169.40	51.8
CF	Chaetodon multicinctus	12	KAHE7E	1	0.83			
CF	Chaetodon multicinctus	12	KAHE7E	4	26.63			
CF	Chaetodon multicinctus	12	KAHE7E	2	26.06	7	53.51	0.5
H	Calotomus carolinus	12	KAHE7E	1	34.69			
H	Scarus psittacus	12	KAHE7E	1	554.69			
H	Scarus psittacus	12	KAHE7E	1	375.61			
H	Acanthurus triostegus	12	KAHE7E	9	1688.42			
H	Acanthurus nigrofuscus	12	KAHE7E	1	23.90			
H	Acanthurus nigrofuscus	12	KAHE7E	15	112.87			
H	Acanthurus olivaceus	12	KAHE7E	2	187.54			
H	Naso lituratus	12	KAHE7E	1	36.34			
H	Naso unicornis	12	KAHE7E	2	34.39			
H	Naso unicornis	12	KAHE7E	1	5.44	34	3053.88	30.6
O	Melichthys niger	12	KAHE7E	6	980.01			
O	Melichthys vidua	12	KAHE7E	3	597.09			
O	Cantherhines sandwichiensis	12	KAHE7E	1	46.04			
O	Canthigaster coronata	12	KAHE7E	1	7.59			
O	Canthigaster jactator	12	KAHE7E	4	8.82	15	1639.55	16.4
P	Chaetodon kleini	12	KAHE7E	4	26.23			
P	Chromis vanderbilti	12	KAHE7E	108	34.12			
P	Chromis hanui	12	KAHE7E	9	6.72	121	67.07	0.7
	TOTAL	12	KAHE7E	262	9983.41	262	9983.41	100

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Aulostomus chinensis	13	KAHE10	1	52.00			
C	Lutjanus kasmira	13	KAHE10	70	21496.06			
C	Mulloides flavolineatus	13	KAHE10	12	2299.60			
C	Parupeneus pleurostigma	13	KAHE10	3	174.02			
C	Parupeneus multifasciatus	13	KAHE10	3	81.35			
C	Parupeneus multifasciatus	13	KAHE10	1	235.75			
C	Parupeneus multifasciatus	13	KAHE10	2	192.16			
C	Parupeneus multifasciatus	13	KAHE10	5	272.00			
C	Parupeneus multifasciatus	13	KAHE10	1	155.42			
C	Parupeneus bifasciatus	13	KAHE10	1	59.77			
C	Plectroglyphidodon imparipenni	13	KAHE10	1	0.86			
C	Paracirrhites arcatus	13	KAHE10	5	40.59			
C	Thalassoma duperrey	13	KAHE10	19	1843.99			
C	Thalassoma duperrey	13	KAHE10	26	1428.67			
C	Thalassoma duperrey	13	KAHE10	4	44.65			
C	Thalassoma duperrey	13	KAHE10	15	410.86			
C	Gomphosus varius	13	KAHE10	1	22.60			
C	Coris gaimard	13	KAHE10	2	167.57			
C	Stethojulis balteata	13	KAHE10	2	144.78			
C	Halichoeres ornatissimus	13	KAHE10	1	9.52			
C	Sufflamen bursa	13	KAHE10	1	85.87			
C	Sufflamen bursa	13	KAHE10	2	289.30	178	29507.40	85.4
CF	Chaetodon multicinctus	13	KAHE10	2	26.06	2	26.06	0.1
H	Calotomus carolinus	13	KAHE10	1	339.30			
H	Scarus psittacus	13	KAHE10	3	113.62			
H	Acanthurus triostegus	13	KAHE10	2	34.33			
H	Acanthurus triostegus	13	KAHE10	4	185.26			
H	Acanthurus leucopareius	13	KAHE10	1	66.74			
H	Acanthurus nigrofuscus	13	KAHE10	2	28.43			
H	Acanthurus nigrofuscus	13	KAHE10	8	191.18			
H	Acanthurus nigroris	13	KAHE10	3	307.42			
H	Acanthurus olivaceus	13	KAHE10	1	261.67			
H	Acanthurus olivaceus	13	KAHE10	4	654.07			
H	Acanthurus blochii	13	KAHE10	4	116.12			
H	Ctenochaetus strigosus	13	KAHE10	1	65.86			
H	Ctenochaetus strigosus	13	KAHE10	3	80.53			
H	Naso lituratus	13	KAHE10	1	14.90			
H	Naso unicornis	13	KAHE10	1	38.92	39	2498.35	7.2
O	Stegastes fasciolatus	13	KAHE10	10	259.80			
O	Melichthys niger	13	KAHE10	2	326.67			
O	Melichthys vidua	13	KAHE10	2	398.06			
O	Canthigaster jactator	13	KAHE10	3	10.69	17	995.22	2.9
P	Dascyllus albisella	13	KAHE10	7	21.62			
P	Abudefduf abdominalis	13	KAHE10	28	877.31			
P	Abudefduf vaigensis	13	KAHE10	15	469.99			
P	Chromis vanderbilti	13	KAHE10	21	6.63			
P	Chromis ovalis	13	KAHE10	18	106.77			
P	Chromis ovalis	13	KAHE10	14	35.14	103	1517.46	4.4
	TOTAL	13	KAHE10	339	34544.49	339	34544.49	100
C	Parupeneus multifasciatus	14	NANA1	1	27.12			
C	Parupeneus multifasciatus	14	NANA1	1	96.08			
C	Parupeneus multifasciatus	14	NANA1	1	155.42			
C	Plectroglyphidodon imparipenni	14	NANA1	5	4.31			
C	Paracirrhites arcatus	14	NANA1	1	8.12			
C	Thalassoma duperrey	14	NANA1	14	44.11			
C	Thalassoma duperrey	14	NANA1	7	384.64			
C	Thalassoma duperrey	14	NANA1	2	194.10			
C	Thalassoma duperrey	14	NANA1	7	191.73			
C	Thalassoma duperrey	14	NANA1	10	111.63			
C	Stethojulis balteata	14	NANA1	3	43.23			
C	Stethojulis balteata	14	NANA1	1	4.00			
C	Stethojulis balteata	14	NANA1	1	35.76			
C	Halichoeres ornatissimus	14	NANA1	2	19.05			
C	Rhinecanthus rectangulus	14	NANA1	1	45.36			
C	Rhinecanthus rectangulus	14	NANA1	1	85.87	58	1450.54	79.0
H	Calotomus carolinus	14	NANA1	1	34.69			
H	Acanthurus triostegus	14	NANA1	1	46.32			
H	Acanthurus nigrofuscus	14	NANA1	7	167.28			
H	Acanthurus nigrofuscus	14	NANA1	2	28.43			
H	Acanthurus blochii	14	NANA1	1	56.70			
H	Acanthurus blochii	14	NANA1	1	29.03	13	362.44	19.7
O	Stegastes fasciolatus	14	NANA1	1	7.39			
O	Canthigaster jactator	14	NANA1	3	10.69	4	18.08	1.0
P	Chromis vanderbilti	14	NANA1	14	4.42	14	4.42	0.2
	TOTAL	14	NANA1	89	1835.48	89	1835.48	100

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Gymnothorax meleagris	15	NANA2	1	24.76			
C	Parupeneus multifasciatus	15	NANA2	1	54.40			
C	Parupeneus multifasciatus	15	NANA2	1	96.08			
C	Bodianus bilunulatus	15	NANA2	1	37.87			
C	Thalassoma duperrey	15	NANA2	8	439.59			
C	Thalassoma duperrey	15	NANA2	2	194.10			
C	Thalassoma duperrey	15	NANA2	11	301.30			
C	Thalassoma duperrey	15	NANA2	3	33.49			
C	Gomphosus varius	15	NANA2	1	11.04			
C	Coris venusta	15	NANA2	1	23.64			
C	Halichoeres ornatissimus	15	NANA2	1	25.14			
C	Halichoeres ornatissimus	15	NANA2	1	9.52			
C	Sufflamen bursa	15	NANA2	1	85.87	33	1336.81	12.4
H	Acanthurus leucopareius	15	NANA2	1	132.70			
H	Acanthurus leucopareius	15	NANA2	9	2094.08			
H	Acanthurus nigrofuscus	15	NANA2	14	198.98			
H	Acanthurus nigrofuscus	15	NANA2	41	979.78			
H	Acanthurus nigroris	15	NANA2	18	976.54			
H	Acanthurus olivaceus	15	NANA2	8	4505.36			
H	Ctenochaetus strigosus	15	NANA2	2	53.69			
H	Ctenochaetus strigosus	15	NANA2	2	30.40			
H	Zebrasoma flavescens	15	NANA2	2	106.56	97	9078.09	84.0
O	Stegastes fasciolatus	15	NANA2	1	25.98			
O	Melichthys niger	15	NANA2	2	326.67			
O	Canthigaster jactator	15	NANA2	4	14.25			
O	Canthigaster rivulata	15	NANA2	2	15.18	9	382.08	3.5
P	Chromis vanderbilti	15	NANA2	9	2.84			
P	Chromis hanui	15	NANA2	2	1.49	11	4.34	0.04
	TOTAL	15	NANA2	150	10801.31	150	10801.31	100
C	Decapterus macarellus	16	PIPE	35	2920.56			
C	Lutjanus kasmira	16	PIPE	5	549.79			
C	Lutjanus kasmira	16	PIPE	5	286.76			
C	Mulloides flavolineatus	16	PIPE	1	83.44			
C	Parupeneus multifasciatus	16	PIPE	2	192.16			
C	Parupeneus cyclostomus	16	PIPE	1	49.96			
C	Labroides phthirophagus	16	PIPE	2	1.26			
C	Thalassoma duperrey	16	PIPE	51	4949.65			
C	Thalassoma duperrey	16	PIPE	2	109.90			
C	Gomphosus varius	16	PIPE	1	22.60			
C	Gomphosus varius	16	PIPE	1	62.03			
C	Zanclus cornutus	16	PIPE	1	54.90			
C	Sufflamen bursa	16	PIPE	2	171.75			
C	Sufflamen bursa	16	PIPE	1	45.36	110	9500.13	33.3
CF	Chaetodon multicinctus	16	PIPE	2	26.06			
CF	Cantherhines dumerili	16	PIPE	2	62.91	4	88.97	0.3
H	Calotomus carolinus	16	PIPE	1	34.69			
H	Scarus sordidus	16	PIPE	4	304.05			
H	Scarus sordidus	16	PIPE	3	420.02			
H	Scarus sordidus	16	PIPE	1	1427.57			
H	Scarus psittacus	16	PIPE	1	1873.52			
H	Scarus psittacus	16	PIPE	1	786.15			
H	Acanthurus nigrofuscus	16	PIPE	5	71.06			
H	Acanthurus nigrofuscus	16	PIPE	14	759.53			
H	Acanthurus nigrofuscus	16	PIPE	5	119.49	35	5796.09	20.3
O	Stegastes fasciolatus	16	PIPE	3	77.94			
O	Melichthys niger	16	PIPE	12	1195.86			
O	Melichthys vidua	16	PIPE	1	199.03			
O	Cantherhines sandwichiensis	16	PIPE	3	246.15			
O	Canthigaster jactator	16	PIPE	3	10.69	22	1729.67	6.1
P	Chaetodon miliaris	16	PIPE	9	190.51			
P	Abudefduf abdominalis	16	PIPE	12	375.99			
P	Abudefduf vaigensis	16	PIPE	220	6893.17			
P	Chromis ovalis	16	PIPE	120	711.81			
P	Naso brevirostris	16	PIPE	9	350.32			
P	Naso brevirostris	16	PIPE	16	1173.73			
P	Naso brevirostris	16	PIPE	6	1144.46			
P	Naso brevirostris	16	PIPE	5	615.59	397	11455.58	40.1
	TOTAL	16	PIPE	568	28570.45	568	28570.45	100

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	1	EAST1	1	340.44			
C	Plectroglyphidodon imparipennis	1	EAST1	1	0.86			
C	Paracirrhites arcatus	1	EAST1	1	8.12			
C	Thalassoma duperrey	1	EAST1	10	549.49			
C	Thalassoma duperrey	1	EAST1	10	31.51			
C	Thalassoma duperrey	1	EAST1	2	194.10			
C	Thalassoma duperrey	1	EAST1	8	89.31			
C	Thalassoma duperrey	1	EAST1	12	328.69			
C	Stethojulis balteata	1	EAST1	1	4.00			
C	Stethojulis balteata	1	EAST1	2	71.53			
C	Rhinecanthus rectangulus	1	EAST1	1	85.87	49	1703.91	16.2
H	Calotomus carolinus	1	EAST1	1	218.67			
H	Scarus psittacus	1	EAST1	1	144.94			
H	Acanthurus triostegus	1	EAST1	6	277.89			
H	Acanthurus triostegus	1	EAST1	4	400.06			
H	Acanthurus nigrofuscus	1	EAST1	4	56.85			
H	Acanthurus olivaceus	1	EAST1	2	1553.21			
H	Acanthurus olivaceus	1	EAST1	7	1144.61			
H	Acanthurus olivaceus	1	EAST1	5	2815.85			
H	Acanthurus olivaceus	1	EAST1	18	1687.84			
H	Acanthurus dussumieri	1	EAST1	1	326.59			
H	Acanthurus blochii	1	EAST1	1	155.58	50	8782.10	83.7
O	Canthigaster jactator	1	EAST1	2	7.12	2	7.12	0.1
P	Chromis vanderbilti	1	EAST1	4	1.26	4	1.26	0.01
	TOTAL	1	EAST1	105	10494.40	105	10494.40	100
C	Cephalopholis argus	2	EAST2	1	1077.13			
C	Parupeneus multifasciatus	2	EAST2	1	96.08			
C	Parupeneus multifasciatus	2	EAST2	1	155.42			
C	Parupeneus multifasciatus	2	EAST2	2	108.80			
C	Parupeneus multifasciatus	2	EAST2	8	216.93			
C	Plectroglyphidodon johnstonianu	2	EAST2	3	2.59			
C	Plectroglyphidodon johnstonianu	2	EAST2	3	5.17			
C	Paracirrhites arcatus	2	EAST2	1	8.12			
C	Thalassoma duperrey	2	EAST2	13	714.34			
C	Thalassoma duperrey	2	EAST2	10	111.63			
C	Thalassoma duperrey	2	EAST2	3	291.16			
C	Thalassoma duperrey	2	EAST2	24	657.37			
C	Stethojulis balteata	2	EAST2	2	71.53			
C	Halichoeres ornatissimus	2	EAST2	1	16.45			
C	Halichoeres ornatissimus	2	EAST2	1	9.52			
C	Rhinecanthus rectangulus	2	EAST2	1	45.36			
C	Rhinecanthus rectangulus	2	EAST2	3	257.62	78	3845.21	36.0
CF	Chaetodon unimaculatus	2	EAST2	2	50.61			
CF	Chaetodon quadrimaculatus	2	EAST2	4	101.22	6	151.82	1.4
H	Acanthurus nigrofuscus	2	EAST2	30	426.38			
H	Acanthurus nigrofuscus	2	EAST2	13	97.82			
H	Acanthurus nigrofuscus	2	EAST2	48	1147.06			
H	Acanthurus olivaceus	2	EAST2	7	3942.19			
H	Acanthurus olivaceus	2	EAST2	1	261.67			
H	Acanthurus olivaceus	2	EAST2	3	490.55	102	6365.67	59.6
O	Melichthys vidua	2	EAST2	1	296.24			
O	Canthigaster jactator	2	EAST2	4	14.25	5	310.49	2.9
P	Chromis vanderbilti	2	EAST2	3	0.95	3	0.95	0.01
	TOTAL	2	EAST2	194	10674.14	194	10674.14	100
C	Parupeneus multifasciatus	3	EAST3	1	27.12			
C	Parupeneus bifasciatus	3	EAST3	1	59.77			
C	Plectroglyphidodon johnstonianu	3	EAST3	4	6.89			
C	Paracirrhites arcatus	3	EAST3	2	16.24			
C	Bodianus bilunulatus	3	EAST3	1	648.58			
C	Bodianus bilunulatus	3	EAST3	2	266.23			
C	Thalassoma duperrey	3	EAST3	6	582.31			
C	Thalassoma duperrey	3	EAST3	5	55.82			
C	Thalassoma duperrey	3	EAST3	9	246.51			
C	Thalassoma duperrey	3	EAST3	9	494.54			
C	Gomphosus varius	3	EAST3	2	45.20			
C	Gomphosus varius	3	EAST3	1	39.39			
C	Stethojulis balteata	3	EAST3	4	143.05			
C	Stethojulis balteata	3	EAST3	1	72.39			
C	Halichoeres ornatissimus	3	EAST3	2	50.27			
C	Sufflamen bursa	3	EAST3	4	343.49			
C	Sufflamen fraenatus	3	EAST3	1	623.45			
C	Sufflamen fraenatus	3	EAST3	1	144.65	56	3865.92	25.7
CF	Chaetodon unimaculatus	3	EAST3	4	101.22			
CF	Chaetodon quadrimaculatus	3	EAST3	2	50.61			
CF	Chaetodon multicinctus	3	EAST3	2	13.31			
CF	Chaetodon multicinctus	3	EAST3	6	78.18	14	243.32	1.6
H	Scarus rubroviolaceus	3	EAST3	1	85.39			
H	Acanthurus nigrofuscus	3	EAST3	17	127.92			
H	Acanthurus nigrofuscus	3	EAST3	18	255.83			
H	Acanthurus nigrofuscus	3	EAST3	23	549.63			
H	Acanthurus olivaceus	3	EAST3	7	1831.67			
H	Acanthurus olivaceus	3	EAST3	13	7321.21			
H	Ctenochaetus strigosus	3	EAST3	2	30.40			
H	Ctenochaetus strigosus	3	EAST3	1	0.87			
H	Zebrasoma flavescens	3	EAST3	2	106.56	84	10309.49	68.7
O	Stegastes fasciolatus	3	EAST3	5	73.82			
O	Melichthys niger	3	EAST3	3	490.01			
O	Canthigaster jactator	3	EAST3	9	32.06	17	595.88	4.0
P	Chromis vanderbilti	3	EAST3	5	1.58	5	1.58	0.01
	TOTAL	3	EAST3	176	15016.18	176	15016.18	100

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	4	EAST4	2	22.10			
C	Parupeneus multifasciatus	4	EAST4	1	96.08			
C	Parupeneus multifasciatus	4	EAST4	8	435.20			
C	Parupeneus multifasciatus	4	EAST4	9	244.05			
C	Plectroglyphidodon johnstonianu	4	EAST4	3	5.17			
C	Paracirrhites arcatus	4	EAST4	4	32.47			
C	Bodianus bilunulatus	4	EAST4	1	648.58			
C	Labroides phthiophagus	4	EAST4	5	3.14			
C	Thalassoma duperrey	4	EAST4	18	493.03			
C	Thalassoma duperrey	4	EAST4	13	145.12			
C	Thalassoma duperrey	4	EAST4	16	879.18			
C	Thalassoma duperrey	4	EAST4	13	1261.68			
C	Stethojulis balteata	4	EAST4	2	71.53			
C	Halichoeres ornatissimus	4	EAST4	1	16.45			
C	Halichoeres ornatissimus	4	EAST4	1	25.14			
C	Rhinecanthus rectangulus	4	EAST4	1	85.87			
C	Rhinecanthus rectangulus	4	EAST4	1	144.65			
C	Sufflamen fraenatus	4	EAST4	1	623.45			
C	Ostracion meleagris	4	EAST4	1	6.76	101	5239.65	53.1
H	Acanthurus nigrofuscus	4	EAST4	33	469.02			
H	Acanthurus nigrofuscus	4	EAST4	28	669.12			
H	Acanthurus nigrofuscus	4	EAST4	17	127.92			
H	Acanthurus olivaceus	4	EAST4	4	2252.68	82	3518.74	35.7
O	Stegastes fasciolatus	4	EAST4	1	7.39			
O	Melichthys niger	4	EAST4	2	326.67			
O	Melichthys vidua	4	EAST4	1	296.24			
O	Melichthys vidua	4	EAST4	2	398.06			
O	Canthigaster jactator	4	EAST4	8	28.50	14	1056.86	10.7
P	Chromis vanderbilti	4	EAST4	160	50.54	160	50.54	0.5
	TOTAL	4	EAST4	357	9865.79	357	9865.79	100
C	Lutjanus fulvus	5	KO1	1	155.61			
C	Monotaxis grandoculis	5	KO1	1	128.89			
C	Parupeneus multifasciatus	5	KO1	1	27.12			
C	Parupeneus multifasciatus	5	KO1	3	163.20			
C	Plectroglyphidodon johnstonianu	5	KO1	3	5.17			
C	Paracirrhites arcatus	5	KO1	3	24.35			
C	Labroides phthirophagus	5	KO1	2	1.26			
C	Thalassoma duperrey	5	KO1	8	439.59			
C	Thalassoma duperrey	5	KO1	5	55.82			
C	Thalassoma duperrey	5	KO1	5	485.26			
C	Thalassoma duperrey	5	KO1	8	219.12			
C	Gomphosus varius	5	KO1	2	45.20			
C	Gomphosus varius	5	KO1	2	22.08			
C	Gomphosus varius	5	KO1	1	39.39			
C	Coris gaimard	5	KO1	1	83.79			
C	Stethojulis balteata	5	KO1	3	217.17			
C	Zanclus cornutus	5	KO1	1	104.16			
C	Sufflamen bursa	5	KO1	3	257.62	53	2474.79	21.9
CF	Chaetodon multicinctus	5	KO1	6	78.18	6	78.18	0.7
H	Scarus sordidus	5	KO1	2	71.99			
H	Scarus psittacus	5	KO1	3	237.80			
H	Scarus psittacus	5	KO1	2	75.75			
H	Scarus rubroviolaceus	5	KO1	1	147.03			
H	Scarus rubroviolaceus	5	KO1	1	85.39			
H	Cirripectes variolosus	5	KO1	1	3.29			
H	Acanthurus triostegus	5	KO1	1	46.32			
H	Acanthurus leucopareius	5	KO1	1	27.52			
H	Acanthurus leucopareius	5	KO1	6	1396.05			
H	Acanthurus nigrofuscus	5	KO1	3	42.64			
H	Acanthurus nigrofuscus	5	KO1	34	812.50			
H	Acanthurus olivaceus	5	KO1	3	785.00			
H	Ctenochaetus strigosus	5	KO1	21	563.72			
H	Ctenochaetus strigosus	5	KO1	28	1844.22			
H	Ctenochaetus strigosus	5	KO1	15	1982.01			
H	Zebrasoma flavescens	5	KO1	2	106.56			
H	Naso lituratus	5	KO1	1	14.90	125	8242.68	72.9
O	Stegastes fasciolatus	5	KO1	12	177.16			
O	Melichthys niger	5	KO1	2	326.67			
O	Canthigaster jactator	5	KO1	1	3.56	15	507.39	4.5
P	Chromis vanderbilti	5	KO1	12	3.79	12	3.79	0.03
	TOTAL	5	KO1	211	11306.83	211	11306.83	100

GRP	23-May-12 SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	6	KO2	1	27.12			
C	Parupeneus multifasciatus	6	KO2	1	155.42			
C	Parupeneus bifasciatus	6	KO2	1	992.98			
C	Chaetodon ephippium	6	KO2	1	48.39			
C	Chaetodon lunula	6	KO2	4	143.98			
C	Plectroglyphidodon johnstonianu	6	KO2	5	8.61			
C	Paracirrhites arcatus	6	KO2	1	16.35			
C	Paracirrhites arcatus	6	KO2	2	16.24			
C	Labroides phthirophagus	6	KO2	3	1.88			
C	Thalassoma duperrey	6	KO2	3	291.16			
C	Thalassoma duperrey	6	KO2	3	82.17			
C	Thalassoma duperrey	6	KO2	4	219.80			
C	Gomphosus varius	6	KO2	2	45.20			
C	Halichoeres ornatissimus	6	KO2	3	49.35			
C	Halichoeres ornatissimus	6	KO2	1	25.14			
C	Zanclus cornutus	6	KO2	2	208.32			
C	Sufflamen bursa	6	KO2	3	257.62	40	2589.71	8.0
CF	Chaetodon unimaculatus	6	KO2	2	50.61			
CF	Chaetodon quadrimaculatus	6	KO2	2	50.61			
CF	Chaetodon multicinctus	6	KO2	2	26.06	6	127.28	0.4
H	Scarus psittacus	6	KO2	1	1437.46			
H	Scarus psittacus	6	KO2	1	241.42			
H	Scarus rubroviolaceus	6	KO2	1	1160.01			
H	Acanthurus triostegus	6	KO2	15	694.73			
H	Acanthurus triostegus	6	KO2	7	120.17			
H	Acanthurus triostegus	6	KO2	14	1400.20			
H	Acanthurus leucopareius	6	KO2	3	698.03			
H	Acanthurus nigrofuscus	6	KO2	12	286.76			
H	Acanthurus nigrofuscus	6	KO2	13	705.28			
H	Acanthurus nigrofuscus	6	KO2	4	56.85			
H	Acanthurus nigroris	6	KO2	3	307.42			
H	Acanthurus olivaceus	6	KO2	14	7884.38			
H	Acanthurus olivaceus	6	KO2	9	1471.65			
H	Acanthurus olivaceus	6	KO2	20	5233.34			
H	Acanthurus dussumieri	6	KO2	1	238.09			
H	Acanthurus blochii	6	KO2	3	36.74			
H	Acanthurus blochii	6	KO2	4	622.33			
H	Acanthurus blochii	6	KO2	5	283.50			
H	Acanthurus blochii	6	KO2	2	661.34			
H	Acanthurus blochii	6	KO2	8	232.24			
H	Ctenochaetus strigosus	6	KO2	14	1849.87			
H	Ctenochaetus strigosus	6	KO2	14	375.81			
H	Ctenochaetus strigosus	6	KO2	4	263.46			
H	Zebrasoma flavescens	6	KO2	2	106.56			
H	Zebrasoma flavescens	6	KO2	1	9.48			
H	Naso lituratus	6	KO2	1	72.58			
H	Naso lituratus	6	KO2	1	448.94			
H	Naso lituratus	6	KO2	2	623.23	179	27521.89	84.6
O	Melichthys niger	6	KO2	9	1470.02			
O	Melichthys vidua	6	KO2	1	199.03			
O	Melichthys vidua	6	KO2	1	296.24			
O	Canthigaster jactator	6	KO2	8	28.50	19	1993.78	6.1
P	Abudefduf abdominalis	6	KO2	9	281.99			
P	Chromis hanui	6	KO2	6	4.48	15	286.47	0.9
	TOTAL	6	KO2	259	32519.13	259	32519.13	100
C	Aulostomus chinensis	7	KAHE1D	1	52.00			
C	Parupeneus multifasciatus	7	KAHE1D	1	54.40			
C	Plectroglyphidodon johnstonianu	7	KAHE1D	2	3.44			
C	Labroides phthirophagus	7	KAHE1D	2	1.26			
C	Thalassoma duperrey	7	KAHE1D	10	273.90			
C	Thalassoma duperrey	7	KAHE1D	22	2135.14			
C	Thalassoma duperrey	7	KAHE1D	8	89.31			
C	Thalassoma duperrey	7	KAHE1D	14	769.28			
C	Gomphosus varius	7	KAHE1D	1	39.39			
C	Gomphosus varius	7	KAHE1D	5	113.00			
C	Gomphosus varius	7	KAHE1D	12	132.50			
C	Sufflamen bursa	7	KAHE1D	2	171.75			
C	Ostracion meleagris	7	KAHE1D	1	6.76	81	3842.14	39.7
H	Scarus sordidus	7	KAHE1D	13	467.93			
H	Scarus sordidus	7	KAHE1D	5	68.65			
H	Acanthurus triostegus	7	KAHE1D	3	51.50			
H	Acanthurus leucopareius	7	KAHE1D	4	530.80			
H	Acanthurus nigrofuscus	7	KAHE1D	46	1099.26			
H	Acanthurus nigrofuscus	7	KAHE1D	13	705.28			
H	Ctenochaetus strigosus	7	KAHE1D	2	264.27			
H	Ctenochaetus strigosus	7	KAHE1D	13	348.97			
H	Ctenochaetus strigosus	7	KAHE1D	3	197.59			
H	Zebrasoma flavescens	7	KAHE1D	1	9.48	103	3743.75	38.7
O	Stegastes fasciolatus	7	KAHE1D	2	29.53			
O	Melichthys niger	7	KAHE1D	12	1960.03			
O	Canthigaster jactator	7	KAHE1D	3	10.69	17	2000.24	20.7
P	Chromis vanderbilti	7	KAHE1D	31	9.79			
P	Chromis ovalis	7	KAHE1D	15	88.98	46	98.77	1.0
	TOTAL	7	KAHE1D	247	9684.90	247	9684.90	100

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	8	KAHE5B	2	22.10			
C	Parupeneus multifasciatus	8	KAHE5B	4	108.47			
C	Parupeneus multifasciatus	8	KAHE5B	1	235.75			
C	Parupeneus cyclostomus	8	KAHE5B	2	1561.56			
C	Plectroglyphidodon johnstonianu	8	KAHE5B	3	5.17			
C	Plectroglyphidodon imparipennis	8	KAHE5B	2	1.72			
C	Paracirrhites arcatus	8	KAHE5B	5	40.59			
C	Thalassoma duperrey	8	KAHE5B	12	659.39			
C	Thalassoma duperrey	8	KAHE5B	13	356.08			
C	Thalassoma duperrey	8	KAHE5B	8	776.42			
C	Thalassoma duperrey	8	KAHE5B	14	156.29			
C	Gomphosus varius	8	KAHE5B	1	62.03			
C	Gomphosus varius	8	KAHE5B	1	39.39			
C	Coris venusta	8	KAHE5B	2	47.27			
C	Coris gaimard	8	KAHE5B	1	8.57			
C	Zanclus cornutus	8	KAHE5B	3	312.47			
C	Rhinecanthus rectangulus	8	KAHE5B	1	45.36			
C	Rhinecanthus rectangulus	8	KAHE5B	2	171.75			
C	Sufflamen bursa	8	KAHE5B	3	257.62	80	4867.98	58.1
CF	Chaetodon unimaculatus	8	KAHE5B	1	7.03			
CF	Chaetodon multicinctus	8	KAHE5B	2	13.31	3	20.34	0.2
H	Acanthurus nigrofuscus	8	KAHE5B	23	326.89			
H	Acanthurus nigrofuscus	8	KAHE5B	17	406.25			
H	Acanthurus olivaceus	8	KAHE5B	3	1689.51			
H	Acanthurus olivaceus	8	KAHE5B	1	261.67			
H	Acanthurus olivaceus	8	KAHE5B	5	237.38			
H	Naso lituratus	8	KAHE5B	1	36.34			
H	Naso unicornis	8	KAHE5B	1	5.44			
H	Naso unicornis	8	KAHE5B	1	38.92	52	3002.41	35.8
O	Stegastes fasciolatus	8	KAHE5B	3	44.29			
O	Melichthys vidua	8	KAHE5B	2	398.06			
O	Canthigaster jactator	8	KAHE5B	2	7.12	7	449.47	5.4
P	Chromis vanderbilti	8	KAHE5B	128	40.43	128	40.43	0.5
	TOTAL	8	KAHE5B	270	8380.64	270	8380.64	100
C	Mulloides flavolineatus	9	KAHE7B	3	1095.63			
C	Parupeneus multifasciatus	9	KAHE7B	6	326.40			
C	Parupeneus multifasciatus	9	KAHE7B	2	192.16			
C	Parupeneus multifasciatus	9	KAHE7B	6	162.70			
C	Parupeneus multifasciatus	9	KAHE7B	1	155.42			
C	Thalassoma duperrey	9	KAHE7B	3	164.85			
C	Thalassoma duperrey	9	KAHE7B	2	22.33			
C	Thalassoma duperrey	9	KAHE7B	1	27.39			
C	Coris venusta	9	KAHE7B	1	23.64			
C	Macropharyngodon geoffroy	9	KAHE7B	1	18.63			
C	Sufflamen bursa	9	KAHE7B	3	433.95			
C	Sufflamen bursa	9	KAHE7B	2	171.75	31	2794.83	69.7
CF	Chaetodon multicinctus	9	KAHE7B	1	6.66	1	6.66	0.2
H	Calotomus carolinus	9	KAHE7B	1	131.69			
H	Acanthurus nigrofuscus	9	KAHE7B	4	95.59			
H	Acanthurus olivaceus	9	KAHE7B	1	563.17			
H	Naso lituratus	9	KAHE7B	1	36.34			
H	Naso unicornis	9	KAHE7B	2	34.39			
H	Naso unicornis	9	KAHE7B	1	73.36			
H	Naso unicornis	9	KAHE7B	1	38.92			
H	Naso unicornis	9	KAHE7B	2	10.87	13	984.33	24.6
O	Melichthys vidua	9	KAHE7B	1	199.03			
O	Canthigaster jactator	9	KAHE7B	2	7.12	3	206.15	5.1
P	Dascyllus albisella	9	KAHE7B	4	12.35			
P	Chromis vanderbilti	9	KAHE7B	6	1.90			
P	Chromis ovalis	9	KAHE7B	1	0.75	11	15.00	0.4
	TOTAL	9	KAHE7B	59	4006.97	59	4006.97	100
C	Parupeneus multifasciatus	10	KAHE7C	1	27.12			
C	Paracirrhites arcatus	10	KAHE7C	3	24.35			
C	Zanclus cornutus	10	KAHE7C	1	104.16			
C	Sufflamen bursa	10	KAHE7C	2	171.75			
C	Sufflamen bursa	10	KAHE7C	1	144.65	8	472.02	23.3
CF	Chaetodon multicinctus	10	KAHE7C	2	26.06	2	26.06	1.3
H	Acanthurus triostegus	10	KAHE7C	4	185.26			
H	Acanthurus triostegus	10	KAHE7C	1	100.01			
H	Acanthurus nigrofuscus	10	KAHE7C	4	95.59			
H	Acanthurus olivaceus	10	KAHE7C	4	375.08			
H	Acanthurus olivaceus	10	KAHE7C	2	327.03			
H	Acanthurus blochii	10	KAHE7C	1	56.70			
H	Acanthurus blochii	10	KAHE7C	1	29.03			
H	Naso lituratus	10	KAHE7C	1	36.34			
H	Naso unicornis	10	KAHE7C	2	34.39			
H	Naso unicornis	10	KAHE7C	2	77.85	22	1317.28	65.0
O	Melichthys vidua	10	KAHE7C	1	199.03			
O	Canthigaster jactator	10	KAHE7C	3	10.69	4	209.72	10.4
	TOTAL	10	KAHE7C	36	2025.08	36	2025.08	100

GRP	23-May-12 SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus pleurostigma	11	KAHE7D	4	232.03			
C	Parupeneus pleurostigma	11	KAHE7D	1	98.25			
C	Parupeneus pleurostigma	11	KAHE7D	2	60.88			
C	Parupeneus multifasciatus	11	KAHE7D	1	54.40			
C	Plectroglyphidodon johnstonianu	11	KAHE7D	2	3.44			
C	Paracirrhites arcatus	11	KAHE7D	2	16.24			
C	Sufflamen bursa	11	KAHE7D	1	85.87			
C	Sufflamen bursa	11	KAHE7D	1	144.65	14	695.76	55.6
H	Acanthurus olivaceus	11	KAHE7D	1	163.52			
H	Acanthurus olivaceus	11	KAHE7D	2	187.54			
H	Naso lituratus	11	KAHE7D	2	72.69			
H	Naso lituratus	11	KAHE7D	1	14.90			
H	Naso unicornis	11	KAHE7D	1	38.92			
H	Naso unicornis	11	KAHE7D	1	73.36	8	550.92	44.1
O	Canthigaster jactator	11	KAHE7D	1	3.56	1	3.56	0.3
	TOTAL	11	KAHE7D	23	1250.24	23	1250.24	100
C	Parupeneus multifasciatus	12	KAHE7E	33	894.85			
C	Parupeneus multifasciatus	12	KAHE7E	26	81.10			
C	Parupeneus multifasciatus	12	KAHE7E	21	232.08			
C	Parupeneus multifasciatus	12	KAHE7E	14	761.59			
C	Parupeneus cyclostomus	12	KAHE7E	1	2.81			
C	Paracirrhites arcatus	12	KAHE7E	4	32.47			
C	Thalassoma duperrey	12	KAHE7E	1	27.39			
C	Thalassoma duperrey	12	KAHE7E	1	54.95			
C	Thalassoma duperrey	12	KAHE7E	5	485.26			
C	Pseudojuloides cerasinus	12	KAHE7E	2	22.33			
C	Stethojulis balteata	12	KAHE7E	2	8.00			
C	Zanclus cornutus	12	KAHE7E	1	54.90			
C	Sufflamen bursa	12	KAHE7E	1	144.65			
C	Sufflamen bursa	12	KAHE7E	3	257.62	115	3060.00	57.3
CF	Chaetodon multicinctus	12	KAHE7E	9	59.91	9	59.91	1.1
H	Calotomus carolinus	12	KAHE7E	1	34.69			
H	Acanthurus nigrofuscus	12	KAHE7E	2	28.43			
H	Acanthurus nigrofuscus	12	KAHE7E	5	37.62			
H	Acanthurus olivaceus	12	KAHE7E	6	284.86			
H	Naso lituratus	12	KAHE7E	1	36.34			
H	Naso unicornis	12	KAHE7E	1	5.44			
H	Naso unicornis	12	KAHE7E	2	34.39	18	461.77	8.6
O	Melichthys niger	12	KAHE7E	8	1306.68			
O	Melichthys vidua	12	KAHE7E	2	398.06	10	1704.74	31.9
P	Chaetodon kleini	12	KAHE7E	3	37.49			
P	Chromis vanderbilti	12	KAHE7E	56	17.69	59	55.18	1.0
	TOTAL	12	KAHE7E	211	5341.60	211	5341.60	100
C	Aulostomus chinensis	13	KAHE10	1	52.00			
C	Scorpaenopsis diabolus	13	KAHE10	1	789.07			
C	Cephalopholis argus	13	KAHE10	1	638.29			
C	Mulloides flavolineatus	13	KAHE10	46	5992.84			
C	Parupeneus multifasciatus	13	KAHE10	2	54.23			
C	Parupeneus multifasciatus	13	KAHE10	4	384.33			
C	Parupeneus multifasciatus	13	KAHE10	4	217.60			
C	Parupeneus multifasciatus	13	KAHE10	1	235.75			
C	Parupeneus bifasciatus	13	KAHE10	1	59.77			
C	Forcipiger flavissimus	13	KAHE10	1	9.15			
C	Plectroglyphidodon imparipennis	13	KAHE10	1	0.86			
C	Paracirrhites arcatus	13	KAHE10	2	16.24			
C	Thalassoma duperrey	13	KAHE10	10	273.90			
C	Thalassoma duperrey	13	KAHE10	18	1746.94			
C	Thalassoma duperrey	13	KAHE10	18	989.08			
C	Stethojulis balteata	13	KAHE10	1	72.39			
C	Stethojulis balteata	13	KAHE10	3	107.29			
C	Halichoeres ornatissimus	13	KAHE10	1	25.14			
C	Sufflamen bursa	13	KAHE10	3	257.62	119	11922.47	84.3
H	Acanthurus nigrofuscus	13	KAHE10	5	119.49			
H	Acanthurus nigrofuscus	13	KAHE10	1	54.25			
H	Acanthurus nigrofuscus	13	KAHE10	4	56.85			
H	Acanthurus olivaceus	13	KAHE10	1	93.77			
H	Acanthurus olivaceus	13	KAHE10	1	261.67			
H	Acanthurus blochii	13	KAHE10	1	12.25			
H	Ctenochaetus strigosus	13	KAHE10	1	26.84			
H	Naso lituratus	13	KAHE10	1	72.58	15	697.70	4.9
O	Stegastes fasciolatus	13	KAHE10	8	118.11			
O	Melichthys niger	13	KAHE10	2	326.67			
O	Melichthys vidua	13	KAHE10	1	199.03			
O	Canthigaster jactator	13	KAHE10	3	10.69	14	654.49	4.6
P	Dascyllus albisella	13	KAHE10	14	43.24			
P	Abudefduf abdominalis	13	KAHE10	14	438.66			
P	Abudefduf vaigensis	13	KAHE10	7	219.33			
P	Chromis vanderbilti	13	KAHE10	12	3.79			
P	Chromis ovalis	13	KAHE10	14	161.84			
P	Chromis hanui	13	KAHE10	2	1.49	63	868.34	6.1
	TOTAL	13	KAHE10	211	14143.00	211	14143.00	100

23-May-12

GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	14	NANA1	2	6.24			
C	Plectroglyphidodon imparipennis	14	NANA1	4	3.45			
C	Thalassoma duperrey	14	NANA1	5	55.82			
C	Thalassoma duperrey	14	NANA1	3	82.17			
C	Thalassoma duperrey	14	NANA1	8	25.20			
C	Thalassoma duperrey	14	NANA1	1	54.95			
C	Stethojulis balteata	14	NANA1	3	43.23			
C	Macropharyngodon geoffroy	14	NANA1	1	0.77			
C	Rhinecanthus rectangulus	14	NANA1	1	45.36	28	317.19	45.2
H	Acanthurus triostegus	14	NANA1	1	100.01			
H	Acanthurus triostegus	14	NANA1	1	17.17			
H	Acanthurus triostegus	14	NANA1	3	138.95			
H	Acanthurus olivaceus	14	NANA1	1	93.77			
H	Ctenochaetus strigosus	14	NANA1	2	15.15	8	365.05	52.0
O	Canthigaster jactator	14	NANA1	1	3.56	1	3.56	0.5
P	Chromis vanderbilti	14	NANA1	52	16.43	52	16.43	2.3
	TOTAL	14	NANA1	89	702.22	89	702.22	100
C	Fistularia commersoni	15	NANA2	1	100.51			
C	Parupeneus multifasciatus	15	NANA2	2	108.80			
C	Parupeneus multifasciatus	15	NANA2	2	54.23			
C	Thalassoma duperrey	15	NANA2	5	274.74			
C	Thalassoma duperrey	15	NANA2	5	136.95			
C	Thalassoma duperrey	15	NANA2	1	97.05			
C	Gomphosus varius	15	NANA2	1	22.60			
C	Stethojulis balteata	15	NANA2	1	72.39			
C	Macropharyngodon geoffroy	15	NANA2	1	18.63			
C	Halichoeres ornatissimus	15	NANA2	1	16.45			
C	Sufflamen bursa	15	NANA2	7	1012.55			
C	Sufflamen bursa	15	NANA2	1	85.87	28	2000.78	54.0
CF	Chaetodon multicinctus	15	NANA2	2	13.31	2	13.31	0.4
H	Acanthurus leucopareius	15	NANA2	1	232.68			
H	Acanthurus nigrofuscus	15	NANA2	4	56.85			
H	Acanthurus nigrofuscus	15	NANA2	16	382.35			
H	Ctenochaetus strigosus	15	NANA2	4	30.30			
H	Ctenochaetus strigosus	15	NANA2	5	134.22	30	836.40	22.6
O	Stegastes fasciolatus	15	NANA2	7	103.34			
O	Melichthys niger	15	NANA2	4	653.34			
O	Cantherhines sandwichiensis	15	NANA2	1	82.05			
O	Canthigaster jactator	15	NANA2	1	3.56	13	842.30	22.7
P	Chromis vanderbilti	15	NANA2	45	14.22	45	14.22	0.4
	TOTAL	15	NANA2	118	3707.01	118	3707.01	100
C	Lutjanus kasmira	16	PIPE	5	549.79			
C	Lutjanus kasmira	16	PIPE	30	1720.58			
C	Mulloides vanicolensis	16	PIPE	48	10911.21			
C	Parupeneus multifasciatus	16	PIPE	1	96.08			
C	Thalassoma duperrey	16	PIPE	50	1369.52			
C	Thalassoma duperrey	16	PIPE	41	2252.90			
C	Thalassoma duperrey	16	PIPE	65	6308.38			
C	Gomphosus varius	16	PIPE	14	316.41			
C	Coris flavovittata	16	PIPE	1	45.99			
C	Stethojulis balteata	16	PIPE	3	217.17			
C	Halichoeres ornatissimus	16	PIPE	2	32.90			
C	Zanclus cornutus	16	PIPE	1	104.16			
C	Zanclus cornutus	16	PIPE	1	54.90			
C	Sufflamen bursa	16	PIPE	4	343.49			
C	Sufflamen fraenatus	16	PIPE	1	329.34	267	24652.83	57.5
H	Scarus sordidus	16	PIPE	19	2660.11			
H	Scarus sordidus	16	PIPE	2	1089.14			
H	Scarus sordidus	16	PIPE	3	1101.06			
H	Scarus psittacus	16	PIPE	3	434.82			
H	Acanthurus nigrofuscus	16	PIPE	28	669.12			
H	Ctenochaetus strigosus	16	PIPE	4	107.38	59	6061.63	14.1
O	Stegastes fasciolatus	16	PIPE	8	118.11			
O	Melichthys vidua	16	PIPE	3	597.09			
O	Canthigaster jactator	16	PIPE	5	17.81	16	733.01	1.7
P	Chaetodon miliaris	16	PIPE	9	190.51			
P	Abudefduf abdominalis	16	PIPE	35	1096.64			
P	Abudefduf vaigensis	16	PIPE	265	8303.13			
P	Chromis vanderbilti	16	PIPE	40	12.64			
P	Chromis ovalis	16	PIPE	155	1791.75	504	11394.67	26.6
	TOTAL	16	PIPE	846	42842.13	846	42842.13	100

23 JULY 2012 FIELD DATA

23-Jul-12

GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	1	EAST1	7	2383.10			
C	Parupeneus multifasciatus	1	EAST1	8	3783.53			
C	Parupeneus multifasciatus	1	EAST1	9	2121.73			
C	Plectroglyphidodon johnstonianu	1	EAST1	1	1.72			
C	Plectroglyphidodon imparipennis	1	EAST1	1	0.86			
C	Paracirrhites arcatus	1	EAST1	4	32.47			
C	Paracirrhites forsteri	1	EAST1	1	16.35			
C	Labroides phthirophagus	1	EAST1	7	4.39			
C	Thalassoma duperrey	1	EAST1	12	659.39			
C	Thalassoma duperrey	1	EAST1	8	89.31			
C	Thalassoma duperrey	1	EAST1	12	1164.62			
C	Thalassoma duperrey	1	EAST1	22	602.59			
C	Coris venusta	1	EAST1	1	48.38			
C	Coris venusta	1	EAST1	1	2.55			
C	Coris gaimard	1	EAST1	1	8.57			
C	Stethojulis balteata	1	EAST1	4	143.05			
C	Zanclus cornutus	1	EAST1	3	312.47			
C	Rhinecanthus rectangulus	1	EAST1	1	85.87			
C	Rhinecanthus rectangulus	1	EAST1	1	45.36			
C	Sufflamen fraenatus	1	EAST1	1	623.45			
C	Sufflamen fraenatus	1	EAST1	1	144.65	106	12274.44	32.5
CF	Chaetodon quadrimaculatus	1	EAST1	1	25.30	1	25.30	0.1
H	Acanthurus triostegus	1	EAST1	2	0.78			
H	Acanthurus triostegus	1	EAST1	19	3564.44			
H	Acanthurus nigrofuscus	1	EAST1	31	740.81			
H	Acanthurus nigrofuscus	1	EAST1	19	1030.80			
H	Acanthurus olivaceus	1	EAST1	21	1969.15			
H	Acanthurus olivaceus	1	EAST1	19	902.06			
H	Acanthurus olivaceus	1	EAST1	11	6194.87			
H	Acanthurus olivaceus	1	EAST1	5	3883.02			
H	Acanthurus dussumieri	1	EAST1	3	979.78			
H	Acanthurus dussumieri	1	EAST1	5	2821.77			
H	Acanthurus blochii	1	EAST1	2	464.48			
H	Acanthurus blochii	1	EAST1	6	2721.56			
H	Naso unicornis	1	EAST1	1	190.74	144	25464.27	67.4
O	Canthigaster jactator	1	EAST1	3	10.69	3	10.69	0.03
P	Chaetodon miliaris	1	EAST1	1	12.50			
P	Chromis vanderbilti	1	EAST1	19	6.00	20	18.50	0.05
	TOTAL	1	EAST1	274	37793.19	274	37793.19	100
C	Parupeneus multifasciatus	2	EAST2	1	27.12			
C	Parupeneus multifasciatus	2	EAST2	1	235.75			
C	Parupeneus multifasciatus	2	EAST2	2	108.80			
C	Parupeneus multifasciatus	2	EAST2	2	310.84			
C	Parupeneus multifasciatus	2	EAST2	5	480.41			
C	Parupeneus cyclostomus	2	EAST2	1	10.05			
C	Plectroglyphidodon johnstonianu	2	EAST2	2	3.44			
C	Plectroglyphidodon imparipennis	2	EAST2	1	0.86			
C	Labroides phthirophagus	2	EAST2	1	0.63			
C	Thalassoma duperrey	2	EAST2	5	55.82			
C	Thalassoma duperrey	2	EAST2	9	873.47			
C	Thalassoma duperrey	2	EAST2	6	164.34			
C	Thalassoma duperrey	2	EAST2	11	604.44			
C	Gomphosus varius	2	EAST2	1	22.60			
C	Coris gaimard	2	EAST2	1	83.79			
C	Stethojulis balteata	2	EAST2	1	35.76			
C	Halichoeres ornatissimus	2	EAST2	1	16.45			
C	Rhinecanthus rectangulus	2	EAST2	3	257.62			
C	Sufflamen fraenatus	2	EAST2	1	224.79			
C	Sufflamen fraenatus	2	EAST2	1	329.34	56	3846.31	34.9
CF	Chaetodon quadrimaculatus	2	EAST2	2	50.61	2	50.61	0.5
H	Acanthurus nigrofuscus	2	EAST2	42	596.93			
H	Acanthurus nigrofuscus	2	EAST2	16	120.39			
H	Acanthurus nigrofuscus	2	EAST2	39	931.98			
H	Acanthurus olivaceus	2	EAST2	7	3942.19			
H	Acanthurus olivaceus	2	EAST2	5	468.84			
H	Acanthurus olivaceus	2	EAST2	9	843.92	118	6904.27	62.7
O	Melichthys vidua	2	EAST2	1	199.03			
O	Canthigaster jactator	2	EAST2	3	10.69	4	209.72	1.9
P	Chromis vanderbilti	2	EAST2	7	2.21	7	2.21	0.02
	TOTAL	2	EAST2	187	11013.12	187	11013.12	100

23-Jul-12

GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	3	EAST3	1	96.08			
C	Parupeneus multifasciatus	3	EAST3	1	54.40			
C	Plectroglyphidodon johnstonianu	3	EAST3	6	10.33			
C	Paracirrhites arcatus	3	EAST3	2	16.24			
C	Paracirrhites forsteri	3	EAST3	1	16.35			
C	Thalassoma duperrey	3	EAST3	4	219.80			
C	Thalassoma duperrey	3	EAST3	3	291.16			
C	Thalassoma duperrey	3	EAST3	6	66.98			
C	Thalassoma duperrey	3	EAST3	10	273.90			
C	Gomphosus varius	3	EAST3	5	113.00			
C	Gomphosus varius	3	EAST3	1	62.03			
C	Stethojulis balteata	3	EAST3	1	35.76			
C	Macropharyngodon geoffroy	3	EAST3	1	18.63			
C	Halichoeres ornatissimus	3	EAST3	1	16.45			
C	Sufflamen bursa	3	EAST3	1	85.87			
C	Sufflamen fraenatus	3	EAST3	1	224.79	45	1601.77	20.5
CF	Chaetodon multicinctus	3	EAST3	8	104.24			
CF	Chaetodon multicinctus	3	EAST3	2	13.31	10	117.55	1.5
H	Scarus sordidus	3	EAST3	2	1550.14			
H	Scarus sordidus	3	EAST3	1	1427.57			
H	Scarus sordidus	3	EAST3	1	76.01			
H	Scarus sordidus	3	EAST3	1	234.65			
H	Scarus psittacus	3	EAST3	1	786.15			
H	Acanthurus nigrofuscus	3	EAST3	22	312.68			
H	Acanthurus nigrofuscus	3	EAST3	4	30.10			
H	Acanthurus olivaceus	3	EAST3	1	563.17			
H	Ctenochaetus strigosus	3	EAST3	3	80.53			
H	Ctenochaetus strigosus	3	EAST3	2	30.40	38	5091.40	65.3
O	Stegastes fasciolatus	3	EAST3	7	103.34			
O	Melichthys niger	3	EAST3	4	653.34			
O	Melichthys vidua	3	EAST3	1	199.03			
O	Canthigaster jactator	3	EAST3	9	32.06	21	987.77	12.7
	TOTAL	3	EAST3	114	7798.50	114	7798.50	100
C	Parupeneus pleurostigma	4	EAST4	2	26.51			
C	Parupeneus pleurostigma	4	EAST4	1	30.44			
C	Parupeneus multifasciatus	4	EAST4	1	27.12			
C	Parupeneus multifasciatus	4	EAST4	1	54.40			
C	Plectroglyphidodon johnstonianu	4	EAST4	8	13.77			
C	Plectroglyphidodon imparipennis	4	EAST4	1	0.86			
C	Paracirrhites arcatus	4	EAST4	8	64.94			
C	Bodianus bilunulatus	4	EAST4	1	467.86			
C	Bodianus bilunulatus	4	EAST4	1	133.12			
C	Labroides phthirophagus	4	EAST4	3	1.88			
C	Thalassoma duperrey	4	EAST4	13	1261.68			
C	Thalassoma duperrey	4	EAST4	29	794.32			
C	Thalassoma duperrey	4	EAST4	28	1538.57			
C	Thalassoma duperrey	4	EAST4	24	267.92			
C	Coris gaimard	4	EAST4	2	44.14			
C	Stethojulis balteata	4	EAST4	1	4.00			
C	Halichoeres ornatissimus	4	EAST4	1	16.45			
C	Halichoeres ornatissimus	4	EAST4	4	38.09			
C	Halichoeres ornatissimus	4	EAST4	1	4.41			
C	Sufflamen fraenatus	4	EAST4	1	144.65	131	4935.13	68.4
H	Calotomus carolinus	4	EAST4	1	34.69			
H	Acanthurus nigrofuscus	4	EAST4	16	120.39			
H	Acanthurus nigrofuscus	4	EAST4	30	426.38			
H	Acanthurus nigrofuscus	4	EAST4	14	334.56			
H	Naso lituratus	4	EAST4	1	205.99	62	1122.01	15.6
O	Melichthys niger	4	EAST4	3	490.01			
O	Melichthys vidua	4	EAST4	3	597.09			
O	Canthigaster jactator	4	EAST4	7	24.93	13	1112.03	15.4
P	Chromis vanderbilti	4	EAST4	138	43.59	138	43.59	0.6
	TOTAL	4	EAST4	344	7212.77	344	7212.77	100

23-Jul-12

GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Saurida gracilis	5	KO1	1	6.01			
C	Monotaxis grandoculis	5	KO1	1	128.89			
C	Parupeneus multifasciatus	5	KO1	2	192.16			
C	Chaetodon lunula	5	KO1	1	35.99			
C	Plectroglyphidodon johnstonianu	5	KO1	6	10.33			
C	Paracirrhites arcatus	5	KO1	6	48.71			
C	Cirrhitus pinnulatus	5	KO1	1	90.86			
C	Thalassoma duperrey	5	KO1	13	714.34			
C	Thalassoma duperrey	5	KO1	7	679.36			
C	Thalassoma duperrey	5	KO1	10	273.90			
C	Gomphosus varius	5	KO1	1	11.04			
C	Gomphosus varius	5	KO1	2	45.20			
C	Gomphosus varius	5	KO1	2	78.79			
C	Sufflamen bursa	5	KO1	1	85.87	54	2401.47	26.0
CF	Chaetodon unimaculatus	5	KO1	2	50.61			
CF	Chaetodon ornatissimus	5	KO1	2	138.00			
CF	Chaetodon multicinctus	5	KO1	6	78.18			
CF	Pervagor melanocephalus	5	KO1	1	16.22	11	283.01	3.1
H	Scarus sordidus	5	KO1	1	234.65			
H	Scarus psittacus	5	KO1	1	79.27			
H	Scarus rubroviolaceus	5	KO1	1	147.03			
H	Acanthurus leucopareius	5	KO1	2	265.40			
H	Acanthurus nigrofuscus	5	KO1	8	434.02			
H	Acanthurus nigrofuscus	5	KO1	33	788.60			
H	Acanthurus olivaceus	5	KO1	1	261.67			
H	Acanthurus olivaceus	5	KO1	1	47.48			
H	Acanthurus olivaceus	5	KO1	1	563.17			
H	Acanthurus blochii	5	KO1	1	232.24			
H	Ctenochaetus strigosus	5	KO1	14	375.81			
H	Ctenochaetus strigosus	5	KO1	20	1317.30			
H	Zebrasoma flavescens	5	KO1	4	213.12			
H	Naso lituratus	5	KO1	1	72.58			
H	Naso lituratus	5	KO1	1	127.73			
H	Naso lituratus	5	KO1	2	411.98			
H	Naso unicornis	5	KO1	2	10.87	94	5582.92	60.3
O	Stegastes fasciolatus	5	KO1	6	88.58			
O	Melichthys niger	5	KO1	5	816.68			
O	Canthigaster jactator	5	KO1	3	10.69			
O	Canthigaster jactator	5	KO1	1	2.21	15	918.15	9.9
P	Abudefduf abdominalis	5	KO1	2	62.67			
P	Chromis vanderbilti	5	KO1	9	2.84	11	65.51	0.7
	TOTAL	5	KO1	185	9251.06	185	9251.06	100
C	Cephalopholis argus	6	KO2	1	1676.50			
C	Parupeneus multifasciatus	6	KO2	1	96.08			
C	Parupeneus multifasciatus	6	KO2	1	54.40			
C	Parupeneus bifasciatus	6	KO2	1	394.35			
C	Plectroglyphidodon johnstonianu	6	KO2	1	1.72			
C	Paracirrhites arcatus	6	KO2	4	32.47			
C	Labroides phthirophagus	6	KO2	5	3.14			
C	Thalassoma duperrey	6	KO2	10	273.90			
C	Thalassoma duperrey	6	KO2	5	485.26			
C	Thalassoma duperrey	6	KO2	13	145.12			
C	Thalassoma duperrey	6	KO2	14	769.28			
C	Coris gaimard	6	KO2	1	83.79			
C	Halichoeres ornatissimus	6	KO2	1	9.52			
C	Sufflamen bursa	6	KO2	4	343.49	62	4369.04	16.3
CF	Chaetodon quadrimaculatus	6	KO2	2	50.61			
CF	Cantherhines dumerili	6	KO2	1	65.10	3	115.71	0.4
H	Scarus sordidus	6	KO2	1	775.07			
H	Scarus psittacus	6	KO2	1	786.15			
H	Scarus rubroviolaceus	6	KO2	1	85.39			
H	Scarus rubroviolaceus	6	KO2	1	232.75			
H	Acanthurus triostegus	6	KO2	4	185.26			
H	Acanthurus triostegus	6	KO2	1	100.01			
H	Acanthurus achilles	6	KO2	1	26.95			
H	Acanthurus leucopareius	6	KO2	2	465.35			
H	Acanthurus nigrofuscus	6	KO2	19	454.04			
H	Acanthurus olivaceus	6	KO2	8	2093.34			
H	Acanthurus olivaceus	6	KO2	24	13516.09			
H	Acanthurus olivaceus	6	KO2	1	47.48			
H	Acanthurus blochii	6	KO2	2	58.06			
H	Acanthurus blochii	6	KO2	1	232.24			
H	Ctenochaetus strigosus	6	KO2	3	197.59			
H	Ctenochaetus strigosus	6	KO2	1	15.20			
H	Ctenochaetus strigosus	6	KO2	7	187.91			
H	Ctenochaetus strigosus	6	KO2	5	660.67			
H	Zebrasoma flavescens	6	KO2	7	372.96			
H	Zebrasoma flavescens	6	KO2	4	37.94			
H	Naso lituratus	6	KO2	1	311.61			
H	Naso lituratus	6	KO2	1	448.94	96	21291.01	79.3
O	Melichthys niger	6	KO2	3	490.01			
O	Melichthys vidua	6	KO2	1	199.03			
O	Cantherhines sandwichiensis	6	KO2	1	82.05			
O	Canthigaster jactator	6	KO2	2	4.41			
O	Canthigaster jactator	6	KO2	7	24.93			
O	Canthigaster rivulata	6	KO2	1	7.59	15	808.02	3.0
P	Abudefduf abdominalis	6	KO2	8	250.66	8	250.66	0.9
	TOTAL	6	KO2	184	26834.45	184	26834.45	100

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	7	KAHE1D	3	81.35			
C	Parupeneus multifasciatus	7	KAHE1D	3	163.20			
C	Parupeneus multifasciatus	7	KAHE1D	2	192.16			
C	Chaetodon lunula	7	KAHE1D	1	35.99			
C	Plectroglyphidodon johnstonianu	7	KAHE1D	4	6.89			
C	Labroides phthirophagus	7	KAHE1D	2	1.26			
C	Thalassoma duperrey	7	KAHE1D	17	934.13			
C	Thalassoma duperrey	7	KAHE1D	23	256.75			
C	Gomphosus varius	7	KAHE1D	2	22.08			
C	Gomphosus varius	7	KAHE1D	2	45.20			
C	Gomphosus varius	7	KAHE1D	1	39.39			
C	Stethojulis balteata	7	KAHE1D	1	35.76			
C	Zanclus cornutus	7	KAHE1D	1	104.16			
C	Sufflamen bursa	7	KAHE1D	1	19.92			
C	Sufflamen bursa	7	KAHE1D	1	45.36			
C	Ostracion meleagris	7	KAHE1D	1	6.76	65	1990.38	19.7
CF	Chaetodon multicinctus	7	KAHE1D	2	13.31	2	13.31	0.1
H	Centropyge potteri	7	KAHE1D	1	10.62			
H	Scarus psittacus	7	KAHE1D	17	643.83			
H	Scarus psittacus	7	KAHE1D	12	175.37			
H	Acanthurus triostegus	7	KAHE1D	13	223.17			
H	Acanthurus nigrofuscus	7	KAHE1D	3	42.64			
H	Acanthurus nigrofuscus	7	KAHE1D	18	430.15			
H	Acanthurus olivaceus	7	KAHE1D	20	949.54			
H	Acanthurus blochii	7	KAHE1D	1	29.03			
H	Ctenochaetus strigosus	7	KAHE1D	3	80.53	88	2584.88	25.6
O	Stegastes fasciolatus	7	KAHE1D	2	29.53			
O	Melichthys niger	7	KAHE1D	32	5226.74			
O	Melichthys vidua	7	KAHE1D	1	124.35			
O	Cantherhines sandwichiensis	7	KAHE1D	1	82.05			
O	Canthigaster jactator	7	KAHE1D	4	14.25	40	5476.91	54.3
P	Chromis vanderbilti	7	KAHE1D	54	17.06	54	17.06	0.2
	TOTAL	7	KAHE1D	249	10082.54	249	10082.54	100
C	Myripristis amaenus	8	KAHE5B	5	212.02			
C	Myripristis amaenus	8	KAHE5B	7	574.58			
C	Decapterus macarellus	8	KAHE5B	1	130.28			
C	Parupeneus multifasciatus	8	KAHE5B	3	81.35			
C	Parupeneus multifasciatus	8	KAHE5B	1	11.05			
C	Parupeneus multifasciatus	8	KAHE5B	2	108.80			
C	Parupeneus multifasciatus	8	KAHE5B	2	192.16			
C	Parupeneus multifasciatus	8	KAHE5B	3	466.27			
C	Plectroglyphidodon johnstonianu	8	KAHE5B	1	1.72			
C	Paracirrhites arcatus	8	KAHE5B	3	24.35			
C	Cirrhitops fasciatus	8	KAHE5B	1	8.23			
C	Thalassoma duperrey	8	KAHE5B	3	82.17			
C	Thalassoma duperrey	8	KAHE5B	4	388.21			
C	Thalassoma duperrey	8	KAHE5B	5	274.74			
C	Gomphosus varius	8	KAHE5B	1	22.60			
C	Coris gaimard	8	KAHE5B	1	22.07			
C	Stethojulis balteata	8	KAHE5B	1	35.76			
C	Macropharyngodon geoffroy	8	KAHE5B	2	37.26			
C	Halichoeres ornatissimus	8	KAHE5B	2	19.05			
C	Zanclus cornutus	8	KAHE5B	1	104.16			
C	Rhinecanthus rectangulus	8	KAHE5B	2	171.75			
C	Sufflamen bursa	8	KAHE5B	2	171.75	53	3140.32	38.7
CF	Chaetodon quadrimaculatus	8	KAHE5B	1	25.30			
CF	Chaetodon multicinctus	8	KAHE5B	2	26.06			
CF	Pervagor melanocephalus	8	KAHE5B	1	9.75	4	61.12	0.8
H	Scarus psittacus	8	KAHE5B	1	37.87			
H	Acanthurus nigrofuscus	8	KAHE5B	25	597.43			
H	Acanthurus nigrofuscus	8	KAHE5B	15	213.19			
H	Acanthurus nigrofuscus	8	KAHE5B	5	271.26			
H	Acanthurus olivaceus	8	KAHE5B	1	261.67			
H	Acanthurus olivaceus	8	KAHE5B	14	664.68			
H	Acanthurus olivaceus	8	KAHE5B	3	490.55			
H	Acanthurus olivaceus	8	KAHE5B	5	468.84			
H	Acanthurus blochii	8	KAHE5B	1	12.25			
H	Naso unicornis	8	KAHE5B	1	17.19			
H	Naso unicornis	8	KAHE5B	2	557.41			
H	Naso unicornis	8	KAHE5B	2	1050.52	75	4642.86	57.3
O	Stegastes fasciolatus	8	KAHE5B	2	29.53			
O	Melichthys vidua	8	KAHE5B	1	124.35			
O	Cantherhines sandwichiensis	8	KAHE5B	1	82.05			
O	Canthigaster jactator	8	KAHE5B	1	3.56	5	239.49	3.0
P	Chromis vanderbilti	8	KAHE5B	74	23.38			
P	Chromis hanui	8	KAHE5B	1	0.75	75	24.12	0.3
	TOTAL	8	KAHE5B	212	8107.91	212	8107.91	100

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus pleurostigma	9	KAHE7B	4	232.03			
C	Parupeneus multifasciatus	9	KAHE7B	1	96.08			
C	Parupeneus multifasciatus	9	KAHE7B	3	466.27			
C	Parupeneus multifasciatus	9	KAHE7B	2	108.80			
C	Parupeneus multifasciatus	9	KAHE7B	2	54.23			
C	Parupeneus multifasciatus	9	KAHE7B	1	235.75			
C	Parupeneus cyclostomus	9	KAHE7B	1	49.96			
C	Forcipiger flavissimus	9	KAHE7B	1	9.15			
C	Paracirrhites arcatus	9	KAHE7B	1	8.12			
C	Bodianus bilunulatus	9	KAHE7B	1	0.52			
C	Thalassoma duperrey	9	KAHE7B	3	82.17			
C	Thalassoma duperrey	9	KAHE7B	5	274.74			
C	Thalassoma duperrey	9	KAHE7B	4	388.21			
C	Gomphosus varius	9	KAHE7B	1	39.39			
C	Gomphosus varius	9	KAHE7B	1	91.05			
C	Coris venusta	9	KAHE7B	1	86.86			
C	Stethojulis balteata	9	KAHE7B	1	72.39			
C	Macropharyngodon geoffroy	9	KAHE7B	1	0.77			
C	Halichoeres ornatissimus	9	KAHE7B	1	9.52			
C	Sufflamen bursa	9	KAHE7B	4	343.49	39	2649.52	51.2
CF	Chaetodon multicinctus	9	KAHE7B	2	26.06			
CF	Pervagor melanocephalus	9	KAHE7B	1	0.76	3	26.82	0.5
H	Acanthurus nigrofuscus	9	KAHE7B	2	28.43			
H	Acanthurus nigrofuscus	9	KAHE7B	6	325.51			
H	Acanthurus olivaceus	9	KAHE7B	6	284.86			
H	Acanthurus olivaceus	9	KAHE7B	2	1126.34			
H	Acanthurus olivaceus	9	KAHE7B	1	261.67			
H	Acanthurus blochii	9	KAHE7B	1	12.25			
H	Naso lituratus	9	KAHE7B	3	109.03			
H	Naso unicornis	9	KAHE7B	1	38.92			
H	Naso unicornis	9	KAHE7B	1	17.19	23	2204.21	42.6
O	Melichthys vidua	9	KAHE7B	1	199.03			
O	Cantherhines sandwichiensis	9	KAHE7B	1	82.05			
O	Canthigaster jactator	9	KAHE7B	1	3.56	3	284.64	5.5
P	Dascyllus albisella	9	KAHE7B	1	3.09			
P	Chromis vanderbilti	9	KAHE7B	12	3.79	13	6.88	0.1
	TOTAL	9	KAHE7B	81	5172.07	81	5172.07	100
C	Parupeneus pleurostigma	10	KAHE7C	1	98.25			
C	Parupeneus pleurostigma	10	KAHE7C	1	30.44			
C	Parupeneus pleurostigma	10	KAHE7C	2	116.02			
C	Parupeneus multifasciatus	10	KAHE7C	1	235.75			
C	Parupeneus multifasciatus	10	KAHE7C	1	96.08			
C	Parupeneus multifasciatus	10	KAHE7C	2	310.84			
C	Paracirrhites arcatus	10	KAHE7C	1	8.12			
C	Coris venusta	10	KAHE7C	1	9.39			
C	Coris venusta	10	KAHE7C	1	48.38			
C	Halichoeres ornatissimus	10	KAHE7C	1	1.18			
C	Sufflamen bursa	10	KAHE7C	4	343.49	16	1297.94	70.7
CF	Chaetodon multicinctus	10	KAHE7C	2	26.06	2	26.06	1.4
H	Acanthurus triostegus	10	KAHE7C	1	46.32			
H	Acanthurus olivaceus	10	KAHE7C	4	189.91			
H	Naso unicornis	10	KAHE7C	1	38.92			
H	Naso unicornis	10	KAHE7C	1	17.19	7	292.34	15.9
O	Melichthys vidua	10	KAHE7C	1	199.03			
O	Canthigaster jactator	10	KAHE7C	3	10.69	4	209.72	11.4
P	Chromis vanderbilti	10	KAHE7C	35	11.06	35	11.06	0.6
	TOTAL	10	KAHE7C	64	1837.11	64	1837.11	100
C	Decapterus macarellus	11	KAHE7D	12	2299.60			
C	Aprion virescens	11	KAHE7D	1	347.35			
C	Mulloides flavolineatus	11	KAHE7D	1	365.21			
C	Parupeneus multifasciatus	11	KAHE7D	1	235.75			
C	Plectroglyphidodon johnstonianu	11	KAHE7D	1	1.72			
C	Paracirrhites arcatus	11	KAHE7D	1	8.12			
C	Sufflamen bursa	11	KAHE7D	1	85.87	18	3343.62	96.5
H	Acanthurus olivaceus	11	KAHE7D	1	47.48	1	47.48	1.4
P	Naso brevirostris	11	KAHE7D	1	73.36	1	73.36	2.1
	TOTAL	11	KAHE7D	20	3464.46	20	3464.46	100

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus pleurostigma	12	KAHE7E	1	98.25			
C	Parupeneus pleurostigma	12	KAHE7E	1	58.01			
C	Parupeneus multifasciatus	12	KAHE7E	21	569.45			
C	Parupeneus multifasciatus	12	KAHE7E	19	1033.59			
C	Parupeneus multifasciatus	12	KAHE7E	10	110.52			
C	Parupeneus cyclostomus	12	KAHE7E	1	10.05			
C	Chaetodon auriga	12	KAHE7E	1	48.39			
C	Plectroglyphidodon johnstonianu	12	KAHE7E	3	2.59			
C	Thalassoma duperrey	12	KAHE7E	7	191.73			
C	Thalassoma duperrey	12	KAHE7E	4	388.21			
C	Thalassoma duperrey	12	KAHE7E	8	439.59			
C	Coris venusta	12	KAHE7E	4	94.55			
C	Pseudojuloides cerasinus	12	KAHE7E	1	11.16			
C	Pseudojuloides cerasinus	12	KAHE7E	3	9.45			
C	Macropharyngodon geoffroy	12	KAHE7E	1	18.63			
C	Sufflamen bursa	12	KAHE7E	3	257.62			
C	Sufflamen fraenatus	12	KAHE7E	1	224.79	89	3566.57	55.0
CF	Chaetodon multicinctus	12	KAHE7E	8	6.61			
CF	Chaetodon multicinctus	12	KAHE7E	2	13.31			
CF	Cantherhines dumerili	12	KAHE7E	1	3.28			
CF	Cantherhines dumerili	12	KAHE7E	2	235.92	13	259.13	4.0
H	Calotomus carolinus	12	KAHE7E	1	13.46			
H	Acanthurus nigrofuscus	12	KAHE7E	3	3.13			
H	Acanthurus olivaceus	12	KAHE7E	2	94.95			
H	Ctenochaetus strigosus	12	KAHE7E	2	1.74			
H	Zebrasoma flavescens	12	KAHE7E	3	5.06			
H	Naso lituratus	12	KAHE7E	1	36.34			
H	Naso lituratus	12	KAHE7E	1	72.58			
H	Naso unicornis	12	KAHE7E	6	103.17	19	330.45	5.1
O	Melichthys niger	12	KAHE7E	9	1470.02			
O	Melichthys vidua	12	KAHE7E	4	796.12	13	2266.14	34.9
P	Chaetodon kleini	12	KAHE7E	3	19.67			
P	Chromis vanderbilti	12	KAHE7E	133	42.01			
P	Chromis hanui	12	KAHE7E	4	2.99	140	64.67	1.0
	TOTAL	12	KAHE7E	274	6486.96	274	6486.96	100
C	Aulostomus chinensis	13	KAHE10	1	210.62			
C	Aprion virescens	13	KAHE10	1	202.48			
C	Lutjanus kasmira	13	KAHE10	175	10036.69			
C	Lutjanus kasmira	13	KAHE10	4	439.83			
C	Parupeneus pleurostigma	13	KAHE10	1	58.01			
C	Parupeneus multifasciatus	13	KAHE10	1	235.75			
C	Parupeneus multifasciatus	13	KAHE10	1	27.12			
C	Parupeneus multifasciatus	13	KAHE10	2	192.16			
C	Parupeneus cyclostomus	13	KAHE10	3	74.39			
C	Chaetodon lunula	13	KAHE10	1	35.99			
C	Plectroglyphidodon johnstonianu	13	KAHE10	2	3.44			
C	Paracirrhites arcatus	13	KAHE10	3	24.35			
C	Cirrhitops fasciatus	13	KAHE10	1	8.23			
C	Thalassoma duperrey	13	KAHE10	10	273.90			
C	Thalassoma duperrey	13	KAHE10	18	989.08			
C	Thalassoma duperrey	13	KAHE10	10	970.52			
C	Thalassoma ballieui	13	KAHE10	1	102.61			
C	Gomphosus varius	13	KAHE10	4	90.40			
C	Coris venusta	13	KAHE10	1	48.38			
C	Coris venusta	13	KAHE10	1	9.39			
C	Stethojulis balteata	13	KAHE10	3	217.17			
C	Stethojulis balteata	13	KAHE10	1	35.76			
C	Sufflamen bursa	13	KAHE10	1	85.87	246	14372.16	77.9
CF	Chaetodon ornatissimus	13	KAHE10	2	138.00			
CF	Chaetodon multicinctus	13	KAHE10	4	52.12	6	190.12	1.0
H	Acanthurus triostegus	13	KAHE10	1	17.17			
H	Acanthurus nigrofuscus	13	KAHE10	4	95.59			
H	Acanthurus olivaceus	13	KAHE10	2	94.95			
H	Acanthurus blochii	13	KAHE10	1	12.25			
H	Ctenochaetus strigosus	13	KAHE10	5	134.22			
H	Ctenochaetus strigosus	13	KAHE10	1	65.86			
H	Naso lituratus	13	KAHE10	1	36.34	15	456.38	2.5
O	Stegastes fasciolatus	13	KAHE10	17	250.97			
O	Melichthys niger	13	KAHE10	2	326.67			
O	Melichthys vidua	13	KAHE10	1	199.03			
O	Cantherhines sandwichiensis	13	KAHE10	1	82.05			
O	Canthigaster jactator	13	KAHE10	1	3.56	22	862.29	4.7
P	Dascyllus albisella	13	KAHE10	13	40.15			
P	Abudefduf vaigensis	13	KAHE10	15	469.99			
P	Abudefduf abdominalis	13	KAHE10	45	1409.97			
P	Chromis vanderbilti	13	KAHE10	21	6.63			
P	Chromis ovalis	13	KAHE10	56	647.34	150	2574.08	13.9
	TOTAL	13	KAHE10	439	18455.03	439	18455.03	100

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	14	NANA1	2	22.10			
C	Plectroglyphidodon imparipennis	14	NANA1	4	3.45			
C	Bodianus bilunulatus	14	NANA1	1	467.86			
C	Bodianus bilunulatus	14	NANA1	2	429.34			
C	Cheilinus bimaculatus	14	NANA1	1	19.37			
C	Thalassoma duperrey	14	NANA1	4	44.65			
C	Thalassoma duperrey	14	NANA1	3	82.17			
C	Thalassoma duperrey	14	NANA1	5	15.75			
C	Stethojulis balteata	14	NANA1	3	12.00			
C	Stethojulis balteata	14	NANA1	2	28.82			
C	Halichoeres ornatissimus	14	NANA1	1	4.41			
C	Plagiotremus ewaensis	14	NANA1	2	1.90			
C	Rhinecanthus rectangulus	14	NANA1	1	85.87	31	1217.70	97.5
H	Calotomus carolinus	14	NANA1	1	13.46			
H	Acanthurus triostegus	14	NANA1	1	0.39			
H	Acanthurus nigrofuscus	14	NANA1	1	1.04	3	14.89	1.2
O	Canthigaster jactator	14	NANA1	1	3.56			
O	Canthigaster rivulata	14	NANA1	1	7.59	2	11.15	0.9
P	Chromis vanderbilti	14	NANA1	18	5.69	18	5.69	0.5
	TOTAL	14	NANA1	54	1249.44	54	1249.44	100
C	Myripristis amaenus	15	NANA2	1	140.81			
C	Parupeneus multifasciatus	15	NANA2	1	54.40			
C	Parupeneus multifasciatus	15	NANA2	1	27.12			
C	Chaetodon lunula	15	NANA2	2	71.99			
C	Thalassoma duperrey	15	NANA2	4	219.80			
C	Rhinecanthus rectangulus	15	NANA2	1	85.87			
C	Sufflamen bursa	15	NANA2	3	257.62			
C	Ostracion meleagris	15	NANA2	1	6.76	14	864.36	4.9
CF	Chaetodon ornatissimus	15	NANA2	2	138.00	2	138.00	0.8
H	Acanthurus leucopareius	15	NANA2	17	3955.48			
H	Acanthurus nigrofuscus	15	NANA2	20	477.94			
H	Acanthurus nigrofuscus	15	NANA2	2	15.05			
H	Acanthurus olivaceus	15	NANA2	4	1046.67			
H	Acanthurus olivaceus	15	NANA2	14	7884.38			
H	Acanthurus blochii	15	NANA2	1	330.67			
H	Acanthurus blochii	15	NANA2	1	155.58			
H	Ctenochaetus strigosus	15	NANA2	3	80.53			
H	Zebrasoma flavescens	15	NANA2	2	106.56			
H	Naso lituratus	15	NANA2	1	72.58	65	14125.45	80.3
O	Stegastes fasciolatus	15	NANA2	4	59.05			
O	Melichthys niger	15	NANA2	3	490.01			
O	Canthigaster jactator	15	NANA2	4	14.25	11	563.31	3.2
P	Naso hexacanthus	15	NANA2	4	155.70			
P	Naso hexacanthus	15	NANA2	3	1168.27			
P	Naso hexacanthus	15	NANA2	3	572.23	10	1896.20	10.8
	TOTAL	15	NANA2	102	17587.32	102	17587.32	100
C	Adioryx spinifer	16	PIPE	1	369.30			
C	Parupeneus multifasciatus	16	PIPE	3	288.24			
C	Parupeneus multifasciatus	16	PIPE	1	235.75			
C	Chaetodon fremblii	16	PIPE	2	41.82			
C	Plectroglyphidodon johnstonianu	16	PIPE	8	13.77			
C	Paracirrhites arcatus	16	PIPE	9	73.06			
C	Cirrhitops fasciatus	16	PIPE	1	15.63			
C	Labroides phthirophagus	16	PIPE	5	3.14			
C	Pseudocheilinus octotaenia	16	PIPE	4	57.64			
C	Thalassoma duperrey	16	PIPE	28	1538.57			
C	Thalassoma duperrey	16	PIPE	35	3396.82			
C	Thalassoma purpureum	16	PIPE	1	525.30			
C	Gomphosus varius	16	PIPE	7	434.20			
C	Gomphosus varius	16	PIPE	5	113.00			
C	Macropharyngodon geoffroy	16	PIPE	2	37.26			
C	Halichoeres ornatissimus	16	PIPE	2	50.27			
C	Zanclus cornutus	16	PIPE	1	54.90			
C	Sufflamen bursa	16	PIPE	3	257.62	118	7506.28	24.5
CF	Chaetodon multicinctus	16	PIPE	2	26.06			
CF	Chaetodon multicinctus	16	PIPE	4	26.63	6	52.69	0.2
H	Scarus sordidus	16	PIPE	29	2204.39			
H	Scarus sordidus	16	PIPE	1	1427.57			
H	Scarus sordidus	16	PIPE	1	35.99			
H	Scarus sordidus	16	PIPE	2	734.04			
H	Scarus sordidus	16	PIPE	3	2325.21			
H	Scarus psittacus	16	PIPE	1	241.42			
H	Acanthurus nigrofuscus	16	PIPE	19	1030.80			
H	Acanthurus blochii	16	PIPE	1	29.03			
H	Ctenochaetus strigosus	16	PIPE	8	214.75			
H	Ctenochaetus strigosus	16	PIPE	3	197.59			
H	Naso lituratus	16	PIPE	1	127.73	69	8568.53	28.0
O	Stegastes fasciolatus	16	PIPE	24	354.32			
O	Melichthys vidua	16	PIPE	4	796.12			
O	Canthigaster rivulata	16	PIPE	1	13.65	29	1164.09	3.8
P	Chaetodon miliaris	16	PIPE	5	105.84			
P	Abudefduf abdominalis	16	PIPE	23	720.65			
P	Abudefduf vaigensis	16	PIPE	340	10653.08			
P	Chromis ovalis	16	PIPE	43	497.07			
P	Chromis ovalis	16	PIPE	49	977.00			
P	Naso brevirostris	16	PIPE	3	369.35	463	13322.98	43.5
	TOTAL	16	PIPE	685	30614.57	685	30614.57	100

2 NOVEMBER 2012 FIELD DATA

02-Nov-12

GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Scomberoides laysan	1	EAST1	1	149.61			
C	Parupeneus multifasciatus	1	EAST1	1	235.75			
C	Parupeneus multifasciatus	1	EAST1	1	96.08			
C	Plectroglyphidodon imparipennis	1	EAST1	5	4.31			
C	Paracirrhites arcatus	1	EAST1	2	16.24			
C	Labroides phthirophagus	1	EAST1	2	1.26			
C	Thalassoma duperrey	1	EAST1	8	776.42			
C	Thalassoma duperrey	1	EAST1	6	66.98			
C	Thalassoma duperrey	1	EAST1	17	465.64			
C	Thalassoma duperrey	1	EAST1	12	659.39			
C	Coris venusta	1	EAST1	2	5.11			
C	Coris gaimard	1	EAST1	2	278.26			
C	Coris gaimard	1	EAST1	1	8.57			
C	Stethojulis balteata	1	EAST1	1	14.41			
C	Rhinecanthus rectangulus	1	EAST1	3	257.62			
C	Rhinecanthus rectangulus	1	EAST1	2	289.30			
C	Sufflamen fraenatus	1	EAST1	1	461.25	67	3786.18	21.9
H	Acanthurus triostegus	1	EAST1	19	1900.27			
H	Acanthurus triostegus	1	EAST1	2	0.78			
H	Acanthurus nigrofuscus	1	EAST1	2	47.79			
H	Acanthurus nigrofuscus	1	EAST1	9	67.72			
H	Acanthurus nigrofuscus	1	EAST1	10	542.52			
H	Acanthurus olivaceus	1	EAST1	20	949.54			
H	Acanthurus olivaceus	1	EAST1	4	3106.42			
H	Acanthurus olivaceus	1	EAST1	21	3433.84			
H	Acanthurus olivaceus	1	EAST1	6	2359.26			
H	Acanthurus blochii	1	EAST1	1	783.81	94	13191.96	76.3
O	Melichthys vidua	1	EAST1	1	296.24			
O	Canthigaster jactator	1	EAST1	1	3.56	2	299.80	1.7
P	Chromis vanderbilti	1	EAST1	38	12.00	38	12.00	0.1
	TOTAL	1	EAST1	201	17289.95	201	17289.95	100
C	Fistularia commersoni	2	EAST2	1	165.95			
C	Parupeneus pleurostigma	2	EAST2	1	58.01			
C	Parupeneus multifasciatus	2	EAST2	2	192.16			
C	Plectroglyphidodon johnstonianu	2	EAST2	4	6.89			
C	Thalassoma duperrey	2	EAST2	21	575.20			
C	Thalassoma duperrey	2	EAST2	26	1428.67			
C	Thalassoma duperrey	2	EAST2	4	388.21			
C	Thalassoma duperrey	2	EAST2	4	44.65			
C	Coris gaimard	2	EAST2	1	139.13			
C	Stethojulis balteata	2	EAST2	1	35.76			
C	Stethojulis balteata	2	EAST2	1	72.39			
C	Halichoeres ornatissimus	2	EAST2	1	9.52			
C	Rhinecanthus rectangulus	2	EAST2	2	171.75			
C	Sufflamen fraenatus	2	EAST2	1	623.45			
C	Sufflamen fraenatus	2	EAST2	1	224.79	71	4136.54	40.1
CF	Chaetodon quadrimaculatus	2	EAST2	2	50.61	2	50.61	0.5
H	Calotomus carolinus	2	EAST2	1	131.69			
H	Acanthurus nigrofuscus	2	EAST2	42	596.93			
H	Acanthurus nigrofuscus	2	EAST2	2	108.50			
H	Acanthurus nigrofuscus	2	EAST2	9	67.72			
H	Acanthurus nigrofuscus	2	EAST2	62	1481.62			
H	Acanthurus olivaceus	2	EAST2	9	3538.89	125	5925.35	57.4
O	Melichthys vidua	2	EAST2	1	199.03			
O	Canthigaster jactator	2	EAST2	2	7.12	3	206.15	2.0
P	Chromis vanderbilti	2	EAST2	23	7.27	23	7.27	0.1
	TOTAL	2	EAST2	224	10325.92	224	10325.92	100
C	Parupeneus multifasciatus	3	EAST3	1	235.75			
C	Parupeneus bifasciatus	3	EAST3	1	59.77			
C	Plectroglyphidodon johnstonianu	3	EAST3	9	15.50			
C	Paracirrhites arcatus	3	EAST3	1	8.12			
C	Labroides phthirophagus	3	EAST3	2	1.26			
C	Pseudocheilinus octotaenia	3	EAST3	1	35.76			
C	Thalassoma duperrey	3	EAST3	1	97.05			
C	Thalassoma duperrey	3	EAST3	8	439.59			
C	Thalassoma duperrey	3	EAST3	5	136.95			
C	Gomphosus varius	3	EAST3	1	11.04			
C	Macropharyngodon geoffroy	3	EAST3	1	18.63			
C	Halichoeres ornatissimus	3	EAST3	1	25.14			
C	Sufflamen bursa	3	EAST3	2	171.75			
C	Sufflamen fraenatus	3	EAST3	1	623.45			
C	Sufflamen fraenatus	3	EAST3	1	461.25	36	2341.00	10.8
CF	Chaetodon ornatissimus	3	EAST3	2	138.00			
CF	Chaetodon quadrimaculatus	3	EAST3	2	50.61			
CF	Chaetodon multicinctus	3	EAST3	1	13.03	5	201.64	0.9
H	Scarus psittacus	3	EAST3	1	786.15			
H	Scarus rubroviolaceus	3	EAST3	3	5509.14			
H	Scarus rubroviolaceus	3	EAST3	3	1039.51			
H	Scarus rubroviolaceus	3	EAST3	5	5800.04			
H	Scarus rubroviolaceus	3	EAST3	5	3368.77			
H	Acanthurus nigrofuscus	3	EAST3	32	764.71			
H	Acanthurus nigrofuscus	3	EAST3	31	440.59			
H	Acanthurus olivaceus	3	EAST3	1	776.60			
H	Ctenochaetus strigosus	3	EAST3	3	80.53			
H	Ctenochaetus strigosus	3	EAST3	6	91.19	90	18657.24	85.9
O	Stegastes fasciolatus	3	EAST3	9	132.87			
O	Melichthys vidua	3	EAST3	1	296.24			
O	Cantherhines sandwichiensis	3	EAST3	1	82.05			
O	Canthigaster jactator	3	EAST3	5	17.81	16	528.97	2.4
	TOTAL	3	EAST3	147	21728.86	147	21728.86	100

02-Nov-12

GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	4	EAST4	1	96.08			
C	Parupeneus multifasciatus	4	EAST4	4	217.60			
C	Plectroglyphidodon johnstonianu	4	EAST4	2	3.44			
C	Paracirrhites arcatus	4	EAST4	2	16.24			
C	Labroides phthirophagus	4	EAST4	1	0.63			
C	Thalassoma duperrey	4	EAST4	14	383.47			
C	Thalassoma duperrey	4	EAST4	1	97.05			
C	Thalassoma duperrey	4	EAST4	18	989.08			
C	Coris venusta	4	EAST4	1	2.55			
C	Coris gaimard	4	EAST4	3	25.70			
C	Coris gaimard	4	EAST4	1	45.99			
C	Stethojulis balteata	4	EAST4	4	143.05			
C	Stethojulis balteata	4	EAST4	2	144.78			
C	Plagiotremus ewaensis	4	EAST4	1	0.95			
C	Zanclus cornutus	4	EAST4	1	104.16			
C	Zanclus cornutus	4	EAST4	1	54.90			
C	Rhinecanthus rectangulus	4	EAST4	1	85.87			
C	Rhinecanthus rectangulus	4	EAST4	1	45.36			
C	Ostracion meleagris	4	EAST4	1	6.76	60	2463.67	24.1
CF	Chaetodon quadrimaculatus	4	EAST4	2	50.61			
CF	Chaetodon multicinctus	4	EAST4	1	0.83	3	51.43	0.5
H	Acanthurus nigrofuscus	4	EAST4	45	639.57			
H	Acanthurus nigrofuscus	4	EAST4	9	67.72			
H	Acanthurus nigrofuscus	4	EAST4	15	358.46			
H	Acanthurus olivaceus	4	EAST4	8	4505.36			
H	Ctenochaetus strigosus	4	EAST4	1	7.58	78	5578.69	54.5
O	Melichthys niger	4	EAST4	6	1488.19			
O	Melichthys vidua	4	EAST4	3	597.09			
O	Canthigaster coronata	4	EAST4	1	7.59			
O	Canthigaster jactator	4	EAST4	3	10.69	13	2103.55	20.5
P	Chromis vanderbilti	4	EAST4	131	41.38	131	41.38	0.4
	TOTAL	4	EAST4	285	10238.73	285	10238.73	100
C	Parupeneus multifasciatus	5	KO1	1	27.12			
C	Parupeneus multifasciatus	5	KO1	3	288.24			
C	Parupeneus multifasciatus	5	KO1	1	235.75			
C	Parupeneus bifasciatus	5	KO1	1	59.77			
C	Parupeneus cyclostomus	5	KO1	2	99.93			
C	Plectroglyphidodon johnstonianu	5	KO1	6	18.18			
C	Labroides phthirophagus	5	KO1	4	2.51			
C	Thalassoma duperrey	5	KO1	9	246.51			
C	Thalassoma duperrey	5	KO1	14	769.28			
C	Thalassoma duperrey	5	KO1	7	679.36			
C	Thalassoma ballieui	5	KO1	1	520.80			
C	Gomphosus varius	5	KO1	1	11.04			
C	Gomphosus varius	5	KO1	2	45.20			
C	Coris gaimard	5	KO1	1	139.13			
C	Stethojulis balteata	5	KO1	1	72.39			
C	Halichoeres ornatissimus	5	KO1	1	25.14			
C	Sufflamen bursa	5	KO1	2	171.75			
C	Sufflamen bursa	5	KO1	2	289.30			
C	Sufflamen fraenatus	5	KO1	1	1050.18	60	4751.58	17.3
CF	Chaetodon unimaculatus	5	KO1	4	101.22			
CF	Chaetodon multicinctus	5	KO1	2	26.06			
CF	Chaetodon multicinctus	5	KO1	2	45.11	8	172.39	0.6
H	Calotomus carolinus	5	KO1	2	2576.07			
H	Scarus sordidus	5	KO1	3	1101.06			
H	Scarus sordidus	5	KO1	3	420.02			
H	Scarus sordidus	5	KO1	1	1427.57			
H	Scarus psittacus	5	KO1	1	37.87			
H	Scarus rubroviolaceus	5	KO1	1	1160.01			
H	Cirripectes variolosus	5	KO1	1	7.25			
H	Acanthurus triostegus	5	KO1	1	100.01			
H	Acanthurus nigrofuscus	5	KO1	15	813.79			
H	Acanthurus nigrofuscus	5	KO1	67	1601.10			
H	Acanthurus olivaceus	5	KO1	7	1144.61			
H	Acanthurus olivaceus	5	KO1	9	5068.53			
H	Acanthurus olivaceus	5	KO1	7	656.38			
H	Acanthurus dussumieri	5	KO1		0.00			
H	Ctenochaetus strigosus	5	KO1	14	922.11			
H	Ctenochaetus strigosus	5	KO1	17	456.35			
H	Ctenochaetus strigosus	5	KO1	18	2378.41			
H	Naso lituratus	5	KO1	1	205.99			
H	Naso lituratus	5	KO1	2	897.88			
H	Naso lituratus	5	KO1	1	311.61	171	21286.63	77.6
O	Stegastes fasciolatus	5	KO1	8	207.84			
O	Stegastes fasciolatus	5	KO1	3	44.29			
O	Melichthys niger	5	KO1	4	653.34			
O	Melichthys vidua	5	KO1	1	296.24			
O	Canthigaster jactator	5	KO1	4	14.25	20	1215.96	4.4
	TOTAL	5	KO1	259	27426.57	259	27426.57	100

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Scorpaenopsis diabolus	6	KO2	1	3436.33			
C	Parupeneus multifasciatus	6	KO2	5	272.00			
C	Plectroglyphidodon johnstonianu	6	KO2	2	3.44			
C	Paracirrhites arcatus	6	KO2	2	16.24			
C	Labroides phthirophagus	6	KO2	4	2.51			
C	Thalassoma duperrey	6	KO2	7	384.64			
C	Thalassoma duperrey	6	KO2	5	485.26			
C	Thalassoma duperrey	6	KO2	6	164.34			
C	Gomphosus varius	6	KO2	1	11.04			
C	Stethojulis balteata	6	KO2	1	72.39			
C	Stethojulis balteata	6	KO2	3	107.29			
C	Macropharyngodon geoffroy	6	KO2	1	18.63			
C	Zanclus cornutus	6	KO2	1	104.16			
C	Sufflamen bursa	6	KO2	2	171.75	41	5250.02	18.9
CF	Chaetodon unimaculatus	6	KO2	2	50.61			
CF	Chaetodon ornatissimus	6	KO2	2	138.00			
CF	Chaetodon quadrimaculatus	6	KO2	2	50.61			
CF	Chaetodon multicinctus	6	KO2	6	78.18	12	317.40	1.1
H	Centropyge potteri	6	KO2	1	10.62			
H	Scarus sordidus	6	KO2	1	544.57			
H	Scarus psittacus	6	KO2	1	79.27			
H	Scarus psittacus	6	KO2	1	241.42			
H	Scarus rubroviolaceus	6	KO2	1	673.75			
H	Scarus rubroviolaceus	6	KO2	1	85.39			
H	Acanthurus triostegus	6	KO2	4	68.67			
H	Acanthurus triostegus	6	KO2	51	5100.73			
H	Acanthurus leucopareius	6	KO2	1	132.70			
H	Acanthurus nigrofuscus	6	KO2	18	255.83			
H	Acanthurus nigrofuscus	6	KO2	7	379.77			
H	Acanthurus nigrofuscus	6	KO2	24	573.53			
H	Acanthurus olivaceus	6	KO2	8	4505.36			
H	Acanthurus olivaceus	6	KO2	9	3538.89			
H	Acanthurus olivaceus	6	KO2	7	332.34			
H	Acanthurus olivaceus	6	KO2	2	1553.21			
H	Acanthurus blochii	6	KO2	3	87.09			
H	Acanthurus blochii	6	KO2	1	155.58			
H	Ctenochaetus strigosus	6	KO2	3	700.13			
H	Ctenochaetus strigosus	6	KO2	4	107.38			
H	Ctenochaetus strigosus	6	KO2	5	660.67			
H	Zebrasoma flavescens	6	KO2	4	66.13			
H	Zebrasoma flavescens	6	KO2	2	3.38			
H	Zebrasoma flavescens	6	KO2	2	106.56			
H	Naso lituratus	6	KO2	1	622.36	162	20585.32	74.1
O	Melichthys niger	6	KO2	6	1488.19			
O	Canthigaster jactator	6	KO2	3	10.69	9	1498.87	5.4
P	Abudefduf abdominalis	6	KO2	4	125.33			
P	Chromis vanderbilti	6	KO2	21	6.63	25	131.96	0.5
	TOTAL	6	KO2	249	27783.57	249	27783.57	100
C	Cephalopholis argus	7	KAHE1D	1	1077.13			
C	Parupeneus multifasciatus	7	KAHE1D	2	310.84			
C	Parupeneus multifasciatus	7	KAHE1D	1	27.12			
C	Forcipiger flavissimus	7	KAHE1D	1	5.13			
C	Forcipiger flavissimus	7	KAHE1D	1	9.15			
C	Plectroglyphidodon imparipennis	7	KAHE1D	3	2.59			
C	Cirrhitus pinnulatus	7	KAHE1D	1	90.86			
C	Thalassoma duperrey	7	KAHE1D	139	13490.22			
C	Thalassoma duperrey	7	KAHE1D	19	520.42			
C	Thalassoma duperrey	7	KAHE1D	32	1758.36			
C	Gomphosus varius	7	KAHE1D	2	22.08			
C	Gomphosus varius	7	KAHE1D	2	45.20			
C	Halichoeres ornatissimus	7	KAHE1D	2	50.27			
C	Zanclus cornutus	7	KAHE1D	1	104.16			
C	Zanclus cornutus	7	KAHE1D	1	54.90			
C	Rhinecanthus rectangulus	7	KAHE1D	1	45.36			
C	Sufflamen bursa	7	KAHE1D	4	343.49	213	17957.30	49.2
CF	Chaetodon quadrimaculatus	7	KAHE1D	2	50.61	2	50.61	0.1
H	Scarus sordidus	7	KAHE1D	38	1367.81			
H	Scarus psittacus	7	KAHE1D	121	4582.59			
H	Scarus psittacus	7	KAHE1D	31	453.04			
H	Scarus rubroviolaceus	7	KAHE1D	1	147.03			
H	Acanthurus triostegus	7	KAHE1D	14	648.41			
H	Acanthurus triostegus	7	KAHE1D	5	85.83			
H	Acanthurus leucopareius	7	KAHE1D	1	27.52			
H	Acanthurus nigrofuscus	7	KAHE1D	7	99.49			
H	Acanthurus nigrofuscus	7	KAHE1D	6	325.51			
H	Acanthurus nigrofuscus	7	KAHE1D	19	454.04			
H	Acanthurus olivaceus	7	KAHE1D	5	237.38			
H	Acanthurus blochii	7	KAHE1D	8	232.24			
H	Acanthurus blochii	7	KAHE1D	1	56.70			
H	Acanthurus blochii	7	KAHE1D	4	48.99			
H	Ctenochaetus strigosus	7	KAHE1D	5	134.22			
H	Zebrasoma flavescens	7	KAHE1D	2	52.06	268	8952.86	24.5
O	Melichthys niger	7	KAHE1D	55	8983.45			
O	Melichthys vidua	7	KAHE1D	1	199.03			
O	Cantherhines sandwichiensis	7	KAHE1D	1	82.05			
O	Canthigaster jactator	7	KAHE1D	2	7.12			
O	Canthigaster rivulata	7	KAHE1D	1	22.05	60	9293.71	25.5
P	Chaetodon miliaris	7	KAHE1D	1	21.17			
P	Dascyllus albisella	7	KAHE1D	2	6.18			
P	Chromis vanderbilti	7	KAHE1D	35	11.06			
P	Chromis ovalis	7	KAHE1D	81	203.28	119	241.68	0.7
	TOTAL	7	KAHE1D	662	36496.16	662	36496.16	100

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Parupeneus multifasciatus	8	KAHE5B	4	108.47			
C	Parupeneus multifasciatus	8	KAHE5B	2	108.80			
C	Parupeneus multifasciatus	8	KAHE5B	2	310.84			
C	Parupeneus multifasciatus	8	KAHE5B	1	340.44			
C	Plectroglyphidodon johnstonianu	8	KAHE5B	5	8.61			
C	Cirrhitops fasciatus	8	KAHE5B	1	8.23			
C	Labroides phthirophagus	8	KAHE5B	1	0.63			
C	Thalassoma duperrey	8	KAHE5B	5	485.26			
C	Thalassoma duperrey	8	KAHE5B	9	494.54			
C	Thalassoma duperrey	8	KAHE5B	3	82.17			
C	Halichoeres ornatissimus	8	KAHE5B	1	25.14			
C	Halichoeres ornatissimus	8	KAHE5B	2	19.05			
C	Rhinecanthus rectangulus	8	KAHE5B	1	45.36			
C	Sufflamen bursa	8	KAHE5B	3	257.62	40	2295.15	12.3
CF	Chaetodon unimaculatus	8	KAHE5B	3	75.91			
CF	Chaetodon unimaculatus	8	KAHE5B	2	5.66			
CF	Chaetodon multicinctus	8	KAHE5B	4	52.12			
CF	Pervagor melanocephalus	8	KAHE5B	1	9.75	10	143.45	0.8
H	Scarus psittacus	8	KAHE5B	1	79.27			
H	Acanthurus triostegus	8	KAHE5B	4	400.06			
H	Acanthurus triostegus	8	KAHE5B	3	51.50			
H	Acanthurus achilles	8	KAHE5B	1	26.95			
H	Acanthurus nigrofuscus	8	KAHE5B	13	705.28			
H	Acanthurus nigrofuscus	8	KAHE5B	24	573.53			
H	Acanthurus nigrofuscus	8	KAHE5B	7	99.49			
H	Acanthurus olivaceus	8	KAHE5B	9	2355.00			
H	Acanthurus olivaceus	8	KAHE5B	6	284.86			
H	Acanthurus olivaceus	8	KAHE5B	16	9010.72			
H	Naso lituratus	8	KAHE5B	3	383.20			
H	Naso lituratus	8	KAHE5B	1	622.36			
H	Naso lituratus	8	KAHE5B	1	205.99	89	14798.21	79.3
O	Stegastes fasciolatus	8	KAHE5B	3	22.18			
O	Stegastes fasciolatus	8	KAHE5B	4	59.05			
O	Melichthys vidua	8	KAHE5B	2	398.06			
O	Cantherhines sandwichiensis	8	KAHE5B	1	82.05			
O	Canthigaster jactator	8	KAHE5B	5	17.81			
O	Canthigaster rivulata	8	KAHE5B	1	7.59	16	586.74	3.1
P	Chromis vanderbilti	8	KAHE5B	180	56.86			
P	Naso brevirostris	8	KAHE5B	5	194.62			
P	Naso brevirostris	8	KAHE5B	8	586.86	193	838.35	4.5
	TOTAL	8	KAHE5B	348	18661.89	348	18661.89	100
C	Taenianotus triacanthus	9	KAHE7B	1	6.59			
C	Mulloides flavolineatus	9	KAHE7B	65	23738.58			
C	Mulloides vanicolensis	9	KAHE7B	3	994.13			
C	Parupeneus pleurostigma	9	KAHE7B	10	580.08			
C	Parupeneus multifasciatus	9	KAHE7B	5	135.58			
C	Parupeneus multifasciatus	9	KAHE7B	3	466.27			
C	Parupeneus multifasciatus	9	KAHE7B	1	54.40			
C	Parupeneus cyclostomus	9	KAHE7B	1	49.96			
C	Plectroglyphidodon imparipennis	9	KAHE7B	1	0.86			
C	Paracirrhites arcatus	9	KAHE7B	4	32.47			
C	Cirrhitops fasciatus	9	KAHE7B	1	8.23			
C	Bodianus bilunulatus	9	KAHE7B	1	648.58			
C	Cheilinus bimaculatus	9	KAHE7B	1	19.37			
C	Thalassoma duperrey	9	KAHE7B	2	194.10			
C	Thalassoma duperrey	9	KAHE7B	4	109.56			
C	Thalassoma duperrey	9	KAHE7B	1	54.95			
C	Coris venusta	9	KAHE7B	1	48.38			
C	Coris gaimard	9	KAHE7B	1	83.79			
C	Macropharyngodon geoffroy	9	KAHE7B	1	18.63			
C	Anampses cuvier	9	KAHE7B	1	64.38			
C	Halichoeres ornatissimus	9	KAHE7B	1	25.14			
C	Zanclus cornutus	9	KAHE7B	1	104.16			
C	Sufflamen bursa	9	KAHE7B	6	515.24			
C	Sufflamen bursa	9	KAHE7B	2	289.30	118	28242.72	91.3
CF	Chaetodon multicinctus	9	KAHE7B	4	26.63	4	26.63	0.1
H	Acanthurus triostegus	9	KAHE7B	1	100.01			
H	Acanthurus nigrofuscus	9	KAHE7B	5	37.62			
H	Acanthurus nigrofuscus	9	KAHE7B	1	54.25			
H	Acanthurus nigroris	9	KAHE7B	1	102.47			
H	Acanthurus olivaceus	9	KAHE7B	2	523.33			
H	Acanthurus olivaceus	9	KAHE7B	10	937.69			
H	Acanthurus olivaceus	9	KAHE7B	9	427.29			
H	Acanthurus blochii	9	KAHE7B	1	56.70			
H	Naso lituratus	9	KAHE7B	1	4.24			
H	Naso lituratus	9	KAHE7B	1	8.47			
H	Naso unicornis	9	KAHE7B	1	123.12	33	2375.20	7.7
O	Cantherhines sandwichiensis	9	KAHE7B	3	246.15			
O	Canthigaster jactator	9	KAHE7B	2	7.12	5	253.28	0.8
P	Dascyllus albisella	9	KAHE7B	3	9.26			
P	Chromis vanderbilti	9	KAHE7B	49	15.48			
P	Chromis hanui	9	KAHE7B	7	5.23	59	29.97	0.1
	TOTAL	9	KAHE7B	219	30927.80	219	30927.80	100

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Decapterus macarellus	10	KAHE7C	7	1885.39			
C	Parupeneus pleurostigma	10	KAHE7C	1	58.01			
C	Parupeneus multifasciatus	10	KAHE7C	1	27.12			
C	Plectroglyphidodon johnstonianu	10	KAHE7C	2	1.72			
C	Thalassoma duperrey	10	KAHE7C	2	194.10			
C	Thalassoma duperrey	10	KAHE7C	2	109.90			
C	Thalassoma duperrey	10	KAHE7C	1	27.39			
C	Gomphosus varius	10	KAHE7C	1	62.03			
C	Stethojulis balteata	10	KAHE7C	1	35.76			
C	Zanclus cornutus	10	KAHE7C	2	109.80			
C	Zanclus cornutus	10	KAHE7C	3	72.13			
C	Sufflamen bursa	10	KAHE7C	7	601.11	30	3184.46	74.4
CF	Chaetodon multicinctus	10	KAHE7C	6	78.18	6	78.18	1.8
H	Acanthurus nigrofuscus	10	KAHE7C	4	30.10			
H	Acanthurus olivaceus	10	KAHE7C	1	47.48			
H	Acanthurus olivaceus	10	KAHE7C	2	187.54			
H	Acanthurus blochii	10	KAHE7C	1	56.70			
H	Naso unicornis	10	KAHE7C	1	123.12			
H	Naso unicornis	10	KAHE7C	2	77.85	11	522.78	12.2
O	Melichthys vidua	10	KAHE7C	2	398.06			
O	Canthigaster coronata	10	KAHE7C	1	7.59			
O	Canthigaster jactator	10	KAHE7C	4	14.25	7	419.90	9.8
P	Chromis vanderbilti	10	KAHE7C	5	1.58			
P	Naso brevirostris	10	KAHE7C	1	73.36	6	74.94	1.8
	TOTAL	10	KAHE7C	60	4280.26	60	4280.26	100
C	Parupeneus pleurostigma	11	KAHE7D	1	98.25			
C	Parupeneus pleurostigma	11	KAHE7D	1	225.63			
C	Plectroglyphidodon johnstonianu	11	KAHE7D	1	0.86			
C	Paracirrhites arcatus	11	KAHE7D	1	3.45			
C	Coris venusta	11	KAHE7D	2	10.46			
C	Halichoeres ornatissimus	11	KAHE7D	1	4.41			
C	Sufflamen bursa	11	KAHE7D	1	85.87			
C	Sufflamen fraenatus	11	KAHE7D	1	329.34	9	758.26	90.1
O	Cantherhines sandwichiensis	11	KAHE7D	1	82.05	1	82.05	9.7
P	Chromis vanderbilti	11	KAHE7D	4	1.26	4	1.26	0.2
	TOTAL	11	KAHE7D	14	841.58	14	841.58	100
C	Fistularia commersoni	12	KAHE7E	2	150.46			
C	Apogon kallopterus	12	KAHE7E	11	157.19			
C	Parupeneus pleurostigma	12	KAHE7E	5	66.27			
C	Parupeneus pleurostigma	12	KAHE7E	4	232.03			
C	Parupeneus multifasciatus	12	KAHE7E	5	135.58			
C	Parupeneus multifasciatus	12	KAHE7E	2	310.84			
C	Parupeneus multifasciatus	12	KAHE7E	5	272.00			
C	Parupeneus multifasciatus	12	KAHE7E	5	55.26			
C	Forcipiger flavissimus	12	KAHE7E	1	2.53			
C	Plectroglyphidodon johnstonianu	12	KAHE7E	1	0.86			
C	Cirrhitops fasciatus	12	KAHE7E	1	3.75			
C	Labroides phthirophagus	12	KAHE7E	2	1.26			
C	Thalassoma duperrey	12	KAHE7E	4	219.80			
C	Thalassoma duperrey	12	KAHE7E	1	97.05			
C	Coris venusta	12	KAHE7E	2	47.27			
C	Coris gaimard	12	KAHE7E	1	45.99			
C	Coris gaimard	12	KAHE7E	1	8.57			
C	Pseudojuloides cerasinus	12	KAHE7E	9	100.47			
C	Pseudojuloides cerasinus	12	KAHE7E	5	136.95			
C	Stethojulis balteata	12	KAHE7E	1	35.76			
C	Macropharyngodon geoffroy	12	KAHE7E	1	18.63			
C	Macropharyngodon geoffroy	12	KAHE7E	3	17.24			
C	Anampses chrysocephalus	12	KAHE7E	13	34.16			
C	Sufflamen bursa	12	KAHE7E	4	343.49	89	2493.43	43.5
CF	Chaetodon multicinctus	12	KAHE7E	2	1.65			
CF	Chaetodon multicinctus	12	KAHE7E	6	39.94	8	41.59	0.7
H	Calotomus carolinus	12	KAHE7E	1	34.69			
H	Scarus psittacus	12	KAHE7E	1	14.61			
H	Acanthurus nigrofuscus	12	KAHE7E	43	323.56			
H	Acanthurus nigrofuscus	12	KAHE7E	13	184.77			
H	Acanthurus olivaceus	12	KAHE7E	4	78.97			
H	Acanthurus olivaceus	12	KAHE7E	6	562.61			
H	Ctenochaetus strigosus	12	KAHE7E	6	5.23			
H	Zebrasoma flavescens	12	KAHE7E	5	8.44			
H	Naso lituratus	12	KAHE7E	1	36.34			
H	Naso lituratus	12	KAHE7E	1	72.58			
H	Naso lituratus	12	KAHE7E	5	21.19			
H	Naso unicornis	12	KAHE7E	1	5.44			
H	Naso unicornis	12	KAHE7E	1	123.12	88	1471.56	25.7
O	Melichthys niger	12	KAHE7E	2	326.67			
O	Melichthys vidua	12	KAHE7E	1	296.24			
O	Melichthys vidua	12	KAHE7E	1	199.03			
O	Canthigaster jactator	12	KAHE7E	4	14.25	8	836.19	14.6
P	Chaetodon kleini	12	KAHE7E	2	13.12			
P	Chaetodon miliaris	12	KAHE7E	1	0.88			
P	Chromis vanderbilti	12	KAHE7E	291	91.92			
P	Chromis hanui	12	KAHE7E	39	29.12			
P	Naso hexacanthus	12	KAHE7E	3	369.35			
P	Naso hexacanthus	12	KAHE7E	1	389.42	337	893.82	15.6
	TOTAL	12	KAHE7E	530	5736.59	530	5736.59	100

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GRP	SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Aulostomus chinensis	13	KAHE10	1	12.84			
C	Decapterus macarellus	13	KAHE10	30	5749.01			
C	Lutjanus kasmira	13	KAHE10	57	17503.94			
C	Lutjanus kasmira	13	KAHE10	23	2529.05			
C	Monotaxis grandoculis	13	KAHE10	2	27.47			
C	Parupeneus pleurostigma	13	KAHE10	1	98.25			
C	Parupeneus pleurostigma	13	KAHE10	1	58.01			
C	Parupeneus multifasciatus	13	KAHE10	3	466.27			
C	Parupeneus bifasciatus	13	KAHE10	1	59.77			
C	Plectroglyphidodon johnstonianu	13	KAHE10	2	1.72			
C	Paracirrhites arcatus	13	KAHE10	3	24.35			
C	Thalassoma duperrey	13	KAHE10	27	2620.40			
C	Thalassoma duperrey	13	KAHE10	30	1648.47			
C	Thalassoma duperrey	13	KAHE10	18	493.03			
C	Gomphosus varius	13	KAHE10	1	62.03			
C	Coris venusta	13	KAHE10	1	48.38			
C	Stethojulis balteata	13	KAHE10	3	107.29			
C	Halichoeres ornatissimus	13	KAHE10	1	25.14			
C	Zanclus cornutus	13	KAHE10	2	48.09			
C	Sufflamen bursa	13	KAHE10	7	601.11	214	32184.61	86.5
CF	Chaetodon multicinctus	13	KAHE10	2	26.06			
CF	Pervagor melanocephalus	13	KAHE10	1	9.75	3	35.81	0.1
H	Acanthurus leucopareius	13	KAHE10	2	265.40			
H	Acanthurus nigrofuscus	13	KAHE10	8	191.18			
H	Acanthurus olivaceus	13	KAHE10	1	261.67			
H	Acanthurus olivaceus	13	KAHE10	4	375.08			
H	Acanthurus olivaceus	13	KAHE10	4	189.91			
H	Acanthurus blochii	13	KAHE10	1	29.03			
H	Ctenochaetus strigosus	13	KAHE10	2	131.73	22	1443.99	3.9
O	Stegastes fasciolatus	13	KAHE10	19	280.50			
O	Melichthys niger	13	KAHE10	3	490.01			
O	Melichthys vidua	13	KAHE10	1	199.03			
O	Canthigaster jactator	13	KAHE10	1	3.56	24	973.10	2.6
P	Chaetodon miliaris	13	KAHE10	1	21.17			
P	Dascyllus albisella	13	KAHE10	33	101.91			
P	Abudefduf abdominalis	13	KAHE10	55	1723.29			
P	Chromis vanderbilti	13	KAHE10	55	17.37			
P	Chromis ovalis	13	KAHE10	60	693.58	204	2557.33	6.9
	TOTAL	13	KAHE10	467	37194.83	467	37194.83	100
C	Fistularia commersoni	14	NANA1	1	3.67			
C	Parupeneus pleurostigma	14	NANA1	1	30.44			
C	Parupeneus multifasciatus	14	NANA1	4	108.47			
C	Parupeneus cyclostomus	14	NANA1	1	24.80			
C	Plectroglyphidodon imparipennis	14	NANA1	7	6.03			
C	Thalassoma duperrey	14	NANA1	8	219.12			
C	Thalassoma duperrey	14	NANA1	6	66.98			
C	Thalassoma duperrey	14	NANA1	2	109.90			
C	Thalassoma lutescens	14	NANA1	2	127.11			
C	Stethojulis balteata	14	NANA1	1	35.76			
C	Stethojulis balteata	14	NANA1	3	43.23			
C	Macropharyngodon geoffroy	14	NANA1	1	18.63			
C	Rhinecanthus rectangulus	14	NANA1	1	85.87	38	880.00	72.4
H	Acanthurus triostegus	14	NANA1	7	11.00			
H	Acanthurus nigrofuscus	14	NANA1	7	52.67			
H	Acanthurus olivaceus	14	NANA1	11	217.18			
H	Acanthurus blochii	14	NANA1	1	3.63	26	284.47	23.4
O	Canthigaster jactator	14	NANA1	2	7.12			
O	Canthigaster rivulata	14	NANA1	2	44.10	4	51.22	4.2
	TOTAL	14	NANA1	68	1215.70	68	1215.70	100
C	Scorpaenopsis diabolus	15	NANA2	1	533.06			
C	Parupeneus multifasciatus	15	NANA2	1	54.40			
C	Bodianus bilunulatus	15	NANA2	1	324.75			
C	Thalassoma duperrey	15	NANA2	1	97.05			
C	Thalassoma duperrey	15	NANA2	9	494.54			
C	Thalassoma duperrey	15	NANA2	2	54.78			
C	Gomphosus varius	15	NANA2	1	39.39			
C	Coris venusta	15	NANA2	1	23.64			
C	Stethojulis balteata	15	NANA2	7	250.34			
C	Halichoeres ornatissimus	15	NANA2	2	50.27			
C	Rhinecanthus rectangulus	15	NANA2	1	85.87			
C	Sufflamen bursa	15	NANA2	1	85.87	28	2093.98	9.7
CF	Chaetodon ornatissimus	15	NANA2	2	138.00			
CF	Chaetodon multicinctus	15	NANA2	4	26.63	6	164.63	0.8
H	Scarus sordidus	15	NANA2	1	775.07			
H	Scarus psittacus	15	NANA2	1	375.61			
H	Acanthurus triostegus	15	NANA2	12	555.78			
H	Acanthurus triostegus	15	NANA2	8	1500.82			
H	Acanthurus triostegus	15	NANA2	3	138.95			
H	Acanthurus leucopareius	15	NANA2	16	3722.80			
H	Acanthurus leucopareius	15	NANA2	27	3582.91			
H	Acanthurus leucopareius	15	NANA2	3	200.22			
H	Acanthurus nigrofuscus	15	NANA2	25	597.43			
H	Acanthurus nigrofuscus	15	NANA2	27	383.74			
H	Acanthurus nigrofuscus	15	NANA2	5	2735.96			
H	Acanthurus olivaceus	15	NANA2	3	785.00			
H	Acanthurus olivaceus	15	NANA2	5	2815.85			
H	Acanthurus olivaceus	15	NANA2	1	93.77			
H	Ctenochaetus strigosus	15	NANA2	10	75.76			
H	Ctenochaetus strigosus	15	NANA2	2	53.69	149	18393.35	85.5
O	Stegastes fasciolatus	15	NANA2	2	29.53			
O	Melichthys niger	15	NANA2	5	816.68			
O	Canthigaster jactator	15	NANA2	1	3.56	8	849.77	4.0
P	Chromis vanderbilti	15	NANA2	9	2.84	9	2.84	0.01
	TOTAL	15	NANA2	200	21504.57	200	21504.57	100

GRP	02-Nov-12 SPECIES	RB	STATION	NO.	BIOMASS	NO. INDIV.	GROUP BIOMASS	GROUP PERCENT
C	Aulostomus chinensis	16	PIPE	2	103.99			
C	Aulostomus chinensis	16	PIPE	2	421.24			
C	Decapterus macarellus	16	PIPE	30	3908.37			
C	Decapterus macarellus	16	PIPE	350	29205.63			
C	Lutjanus kasmira	16	PIPE	10	258.57			
C	Lutjanus kasmira	16	PIPE	3	571.94			
C	Mulloides flavolineatus	16	PIPE	9	751.00			
C	Mulloides vanicolensis	16	PIPE	17	420.52			
C	Parupeneus pleurostigma	16	PIPE	2	116.02			
C	Parupeneus multifasciatus	16	PIPE	6	1414.49			
C	Parupeneus multifasciatus	16	PIPE	5	480.41			
C	Forcipiger flavissimus	16	PIPE	2	18.30			
C	Plectroglyphidodon johnstonianu	16	PIPE	2	3.44			
C	Paracirrhites arcatus	16	PIPE	3	24.35			
C	Labroides phthirophagus	16	PIPE	1	0.63			
C	Thalassoma duperrey	16	PIPE	47	2582.60			
C	Thalassoma duperrey	16	PIPE	38	1040.84			
C	Thalassoma duperrey	16	PIPE	56	5434.91			
C	Gomphosus varius	16	PIPE	6	372.17			
C	Gomphosus varius	16	PIPE	9	354.55			
C	Coris gaimard	16	PIPE	1	83.79			
C	Stethojulis balteata	16	PIPE	6	434.34			
C	Halichoeres ornatissimus	16	PIPE	2	32.90			
C	Zanclus cornutus	16	PIPE	4	219.59			
C	Sufflamen bursa	16	PIPE	2	171.75	615	48426.33	72.6
CF	Chaetodon multicinctus	16	PIPE	2	26.06	2	26.06	0.0
H	Scarus psittacus	16	PIPE	12	454.47			
H	Acanthurus nigrofuscus	16	PIPE	27	1464.82			
H	Acanthurus nigrofuscus	16	PIPE	5	119.49			
H	Acanthurus nigrofuscus	16	PIPE	14	198.98			
H	Acanthurus blochii	16	PIPE	1	12.25			
H	Naso lituratus	16	PIPE	4	145.37			
H	Naso unicornis	16	PIPE	3	116.77	66	2512.15	3.8
O	Stegastes fasciolatus	16	PIPE	9	233.82			
O	Melichthys vidua	16	PIPE	1	199.03			
O	Canthigaster jactator	16	PIPE	6	21.37	16	454.22	0.7
P	Chaetodon miliaris	16	PIPE	6	127.01			
P	Dascyllus albisella	16	PIPE	5	15.44			
P	Abudefduf abdominalis	16	PIPE	25	783.31			
P	Abudefduf vaigiensis	16	PIPE	190	5953.19			
P	Chromis ovalis	16	PIPE	355	7078.25			
P	Chromis ovalis	16	PIPE	9	53.39			
P	Naso brevirostris	16	PIPE	20	778.49			
P	Naso brevirostris	16	PIPE	7	513.51	617	15302.58	22.9
	TOTAL	16	PIPE	1316	66721.35	1316	66721.35	100