Marine Species Survey of Johnston Atoll, Central Pacific Ocean, June 2000

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A report to

U. S. Fish and Wildlife Service
Pacific Islands Area Office
Honolulu, Hawaii

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EXECUTIVE SUMMARY

The marine biota of Johnston atoll was surveyed for nonindigenous species in June, 2000 with observations and collections made by investigators using Scuba. Eleven stations were surveyed, including sites at the Johnston Island pier, the north and south lagoon and the outer reef slope. A total of 668 taxa were determined, with 462 of these identified to species. This compares with 865 taxa reported by the 21 previous studies that have been made at Johnston Atoll. Three hundred twenty five, or 49%, of the taxa of the present study were new reports for the atoll. Most of the previous reports were for macroalgae, corals and fishes, and the present study has the first reports that have been made for organisms in the major groups Porifera, Hydroida, Sipunculida, Bryozoa and Ascidiacea, and of the reef coral *Montipora hoffmeisteri*. Most of the species found in the present study (91%) are known form Hawaii, similar to findings of previous studies.

Little difference was found among the 11 stations in terms of numbers of total taxa, taxa in major taxonomic groups or Shannon's H'_{10} diversity indices. Similarity analysis using the Sorensen's Index of the total taxa among stations showed no clusters grouping above 55% and indicated no unique clusters of stations. The general result indicated by these analyses was of a well mixed system with little variation among sites. However, on-site observations clearly showed that the station on the south side of Johnston Island in the vicinity of the islands sewer outfall was highly eutrophicated, with a heavy bloom of the alga *Byopsis hypnoides* over most of the reef surface and sand channels. However, this infestation appeared to have only a limited impact on other reef organisms, since the site had an intermediate total number of other taxa compared to the other ten stations, including seven species of reef corals, although in relatively low abundance.

Only ten nonindigenous or cryptogenic species were found at Johnston Atoll, and these usually occurred as single specimens at one or two stations. Compared with total reports for this study, nonindigenous or cryptogenic species comprised only 1.5% of the total taxa, or 2% of those identified to species. These introduced or potentially introduced organism were hydroids, polychaete, bryozoans and ascidians, all of which are likely to have come as fouling on vessels arriving in the atoll over the last 60 years. This proportion of introduced species to total biota is in good agreement with values that have been determined for Midway Atoll and Kaho'olawe in the Hawaiian Islands, and for studies that have been made in Guam and Australia. The proportion of introductions is much less than the approximate 20% value that has been determined for Oahu harbors.

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INTRODUCTION

Johnston Atoll lies approximately 1325 km southwest of Honolulu Hawaii in the vicinity of 16° 45' N, 169° 31' W in the north central Pacific Ocean (Figure 1). The nearest other landfalls are French Frigate Shoals, over 800 km to the north-northeast, and the Line Islands, over 1500 km to the southeast. Johnston Atoll is thus one of the most isolated landmasses in the world. It consists of two islands that have been greatly enlarged by dredging and filling and two islands that were totally created by this process. The total land area of the four islands at present is approximately 2.63 km^2, more than 10 times the area of the original natural islands. Most of this was added in dredge and fill operations completed in 1963-64, which created Akau (North) Island and Hikina (East) Island and enlarged Sand Island from about 0.04 to 0.16 km^2 and Johnston Island from about 0.85 to 2.30 km^2. Johnston had previously been enlarged in 1949-50 from its original size of 0.19 km^2 (Amerson 1973). No original shorelines therefore exist at Johnston Atoll and the topography of the lagoon has been highly modified by dredging.

Become of its remote location and restriction from most public access for the last 50 years, relatively little information has been available for most marine taxonomic groups at Johnston Atoll. The most comprehensive sampling of invertebrates was done by the members of the Tanager Expedition in 1923 which concentrated on crustaceans and echinoderms, reported in Edmondson et al. (1925) and Clark (1949). More is known about the reef fish and nearshore pelagic fishes of Johnston Island from expeditions dating back as far as the 1880s (Smith and Swain 1882; Fowler and Ball 1925; Schultz and Collaborators 1953; Halstead and Bunker 1954; Gosline 1955; Brock et al. 1965; Brock et al. 1966; Randall et al. 1985; Kosaki et al. 1991; Chave and Mundy 1994), and reef corals are well known from studies conducted since the late 1940s (Wells 1954; Grigg 1981; Cairns 1984; Maragos and Jokiel 1986; Jokiel and Tyler 1992). Shallow reef macroalgae were comprehensively surveyed in 1964 (Buggeln and Tsuda 1966) and deep algae surveyed using a submersible in 1983 (Agegian 1985). All information for the environment and biota of Johnston Atoll prior to 1973 was assembled and synthesized in two reports (Amerson 1973; Amerson and Shelton 1976) and information for deep-water invertebrates and fishes is summarized in (Chave and Malahoff 1998). Other pertinent marine biota related studies or surveys conducted at Johnston Atoll are (Moul 1964; Baker et al. 1997) for benthic algae; (Bailey-Brock 1976; Ward 1981) for polychaetes; (Kay 1961; Brock 1973; Brock 1979) for mollusks and the spiny lobster; (Jones 1967; Randall 1972; Randall 1977; Lobel 1984; Randall and Ralston 1984; Ralston, et al. 1985; Anderson 1986; Irons 1989; Kosaki 1989; Irons 1990; Winterbottom and Burridge 1993; Dee and Parrish 1994; Lobel and Mann 1995; Mann and Lobel 1995; Kerr and Lobel 1997; Lobel 1997; McCosker and Smith 1997; Sancho et al. 1997; Economakis and Lobel 1998; Randall 1999) for fishes and (Balazs 1986; Balazs 1986; Ackman et al. 1992; Balazs 1994) for sea turtles.

As the agency responsible for stewardship of the atoll, the U.S. Fish and Wildlife Service (USFWS) is concerned with evaluation of the present status of atoll organism populations, including those which inhabit the marine coral reef ecosystem. With the high degree of marine traffic that has frequented the atoll in the last 60 years, there has been ample opportunity for introductions of nonindigenous marine species to the area that may have developed resident populations that could compete or displace native biota. Staff of the Bishop Museum have been conducting studies of nonindigenous marine species over the past five years in harbors on Oahu (Coles et al. 1997; Coles et al, 1999a, 1999b), the island of

Kaho'olawe (Coles et al. 1998) and Midway Atoll (DeFelice et al. 1998) which have shown various levels of nonindigenous species occurrence at these locations in the Hawaiian chain. In order to determine whether such introductions have occurred at Johnston Atoll, and to develop a current baseline of knowledge of the marine biotic community at Johnston, the present study was conducted in June 2000.

HISTORY OF USE

There are no reports of discovery or habitation of Johnston Atoll by Polynesians and, although the atoll may have been sighted by Spanish sailors (Amerson and Shelton 1976), its first recorded discovery was by the American brigg *Sally* on September 2, 1796. First landing was by Captain J. Johnston of the HMS *Cornwallis,* for whom the atoll was later named, on December 14, 1807 (Amerson 1973; Amerson and Shelton 1976). The first habitation and use of the atoll was for mining of bird guano in 1858-60. Following the end of this enterprise, visits were few until the first scientific expedition, that of the *Tanager-Whippoorwill* in 1923. Much of the focus of this expedition was on birds, which led to the atoll being made a federal bird refuge by executive order on July 29, 1926. Responsibility for stewardship of the atoll was originally placed with U. S. Department of Agriculture and passed to the Department of Interior in 1940. However, "ownership" from 1934 to 1973 was designated by executive orders to be with the Department of Navy, while operational control was at various times with the U. S. Navy, the U. S. Air Force, Joint Task Forces (JTC) 7 and 8, the Atomic Energy Commission (AEC) and the Defense Nuclear Agency (DNA) (Amerson and Shelton 1976).

Development at Johnston Atoll began shortly after a contract was awarded in 1939 for construction of a small navy base, initially composed of a lagoon seaplane landing area and headquarters on Sand Island. The naval air station was commissioned in August 1941 and was shelled briefly by the Japanese in December 1941, causing extensive damage to the facilities. These were reconstructed and substantial dredging was conducted during WW II of channel approaches and a seaplane runway, and the atoll was also used as refueling base for Pacific submarines. By the end of the war Johnston was one of the busiest air terminals in the Pacific (Amerson 1973; Amerson and Shelton 1976).

Following WW II, activity decreased and Sand Island was abandoned in 1946. Operational control was transferred to the U. S. Air Force in 1948, and activity resumed in 1951-52 during the Korean War when the Johnston airstrip was enlarged and new buildings were built on Johnston Island. A LORAN transmitting station and a weather station were established on Johnston Island in 1957. The LORAN station and Coast Guard facility were transferred to Sand Island in 1959 and 1961, respectively. A U. S. Air Force tracking station was established on Sand Island in 1964.

In 1958 a new era of operations began with assumption of operational control by the commander of Joint Task Force 7 to conduct stratospheric testing of thermonuclear devices. Two >1 megaton bombs were exploded in 1958, the first on August 1 at an altitude of 76 km and the second on August 12 at approximately 33 km. Two more devices were planned for testing in 1962, and one 1.5 bomb was exploded at 200 km altitude on July 9, while the other planned for July 25 was aborted when the test missile was destroyed. Subsequently Johnston Atoll came under the joint operational control of JTF 8 and the AEC as a headquarters and base of operations in the Pacific in case the Nuclear Test Ban Treaty were nullified, and the island supported personnel of the AIR Defense Command and pacific Missile Range. In 1973 operational control passed to the Defense Nuclear Agency (DNS). In 1976 the USFWS and the DNS completed a Memorandum of Agreement granting USFWS juridiction and responsibillity over the atoll's natural resources, including all waters and coral reefs within three nautical miles of the atoll's land areas.

In 1985 a permit was issued under the Resource Conservation and Recovery Act (RCRA) to build and operate the Johnston Atoll Chemical Disposal System (JACADS) facility to incinerate the U. S. Army's stocks of chemical agents and munitions that were stored on Johnston Island. The JACADS facility is located at the west end of the island, downwind from the prevailing trade winds. It has entered the final stages of agent destruction and is preparing to undergo closure activities in the next two years, and the population on the atoll will decrease dramatically from its present number of over 1000 personnel. The atoll will thereupon revert to its former status of a remote natural wildlife preserve with usage directed toward maintaining undisturbed populations of resident organisms, with a yet to be determined level of human visitors.

This brief history indicates that although remote, Johnston Atoll has been highly utilized for various military and civilian activities over much of the past century, and this usage has provided ample opportunity for introduction of nonindigenous species by supply and transport vessels. At present a supply barge visits Johnston Atoll monthly that moves between Honolulu, Johnston Atoll and Kwajelein Atoll. The two small islands that originally were at the atoll have been greatly enlarged and altered, and the highly modified shorelines of the four islands now present consist primarily of concrete structures that are highly suitable for settlement of fouling organisms that could be transported by ship traffic.

PHYSICAL ENVIRONMENT AND SITE DESCRIPTION

Johnston Atoll consists of a shallow coral reef platform approximately 130 km^2 in area (Figure 1) composed of alternating sand, loose coral and large formations of live coral, especially of the genus *Acropora*. Unlike most coral atolls, the lagoon at Johnston is not enclosed by a ring of reef and islands but only has a protective reef along its northwest margin. This is on a broad shallow ridge that extends from the west end of the marginal reef eastward about 14 km and protects a shallow lagoon about 11 km X 3 km from the predominant waves from the northwest. Depths in the lagoon vary about from about 3 to 10 m. The atoll is not enclosed because the platform on which it sits has subsided and is tilting to the southeast. Most of the reef platform lies outside of the lagoon, extending about 19 km east-southeast and 8 km south of Johnston Island. The platform slopes gently to about 7 to 18 m depth then much more steeply to 180 m (Emery 1956; Amerson and Shelton 1976; Anderson 1986; Jokiel and Tyler 1992).

The oceanographic environment at Johnston is typical of coral reef conditions, with a small and moderate annual temperature range of about 25-27°C, clear oceanic water and surface salinity of 34.6-34.8 $^{o}/oo$ (Wennekens 1969; Amerson 1973). Johnston Atoll lies near the southern edge of the North Pacific gyre and is in the zone of the North Pacific Equatorial Current which moves water past the southern Hawaiian Islands to the atoll (Amerson and Shelton 1976; Maragos and Jokiel 1986). The atoll is also probably affected by the eastwardly flowing North Equatorial Countercurrent, which brings water from more tropical regions (Grigg 1981).

Although the Johnston Atoll reef faces northwest and would therefore normally be on the leeward side of waves generated by the prevailing northeast tradewinds, these waves are influenced by shoaling on shallow areas east of Johnston Island, which refracts them around the platform to break on the northwest side of the reef. The prevailing currents, influenced by both tradewinds and North Pacific equatorial circulation have net flow to the west both inside and outside of the lagoon, stronger during winter months than in summer. Breaking of waves over the reef and entering the lagoon creates a “pumping action” (Jokiel and Tyler 1992) that augments prevailing oceanic currents to generate a westward flowing current. Tides are mixed and semi-diurnal, with strong daily inequalities and maximum amplitudes for highest tides of about 1m. The effect of tides on circulation is to deflect currents to the left on rising tides and to the right on falling tides, and falling tides can reverse the usual westerly flow during weaker circulation in summer months. Ship channels to the southeast and southwest also influence current flow by providing for movement of water out of the lagoon (Wennekens 1969; Amerson and Shelton 1976; Anderson 1986; Jokiel and Tyler 1992).

METHODS

Samples were collected from 11 sites at Johnston Atoll (Figure 1) using methods previously employed on nonindigenous species surveys in Hawaii and Midway (Coles et al. 1997; Coles et al.1998; Coles et al. 1999a; Coles et al. 1999b; DeFelice et al. 1998). Some of the sampling stations were located to be near sites previously sampled by (Brock et al. 1965; Brock et al. 1966) and (Jokiel and Tyler 1992), others were located in important sites such as in the harbor, along dredge channels or near the Johnston Island sewage outfall. Sampling station locations, dates coordinates and depths are summarized in Table 1.

Collections and observations were made by three experienced investigators sampling as large a variety of habitats as possible at each station while using Scuba. Two divers sampled organisms growing on hard surfaces and in sediments from the intertidal zone to the base of the reef. The third diver recorded the identities of fishes swimming in the area, noted the presence of abundant invertebrate macrofauna and macroalgae, and photographed and collected corals for identification of both the corals and their commensal organisms. Macro-organisms were collected by hand, hard surfaces were scraped with a chisel, and several liters of coral rubble were placed in an 80 µm mesh bag and transported back to the laboratory for later inspection and removal of cryptic organisms. Where sediments were present at a station, 500 cc of sand was collected in plastic bags and later air-dried prior to hand sorting for micromollusks under a dissecting microscope. A subsample of 20 cc was sorted from each sample. When present at a survey site, whole macroalgae plants were collected and preserved in 70% ethanol, and epiphytic organisms were later rinsed from the algae and preserved in ethanol for future processing. Collected organisms, which range 4-8 liters in total volume for each station were inspected on site, and selected

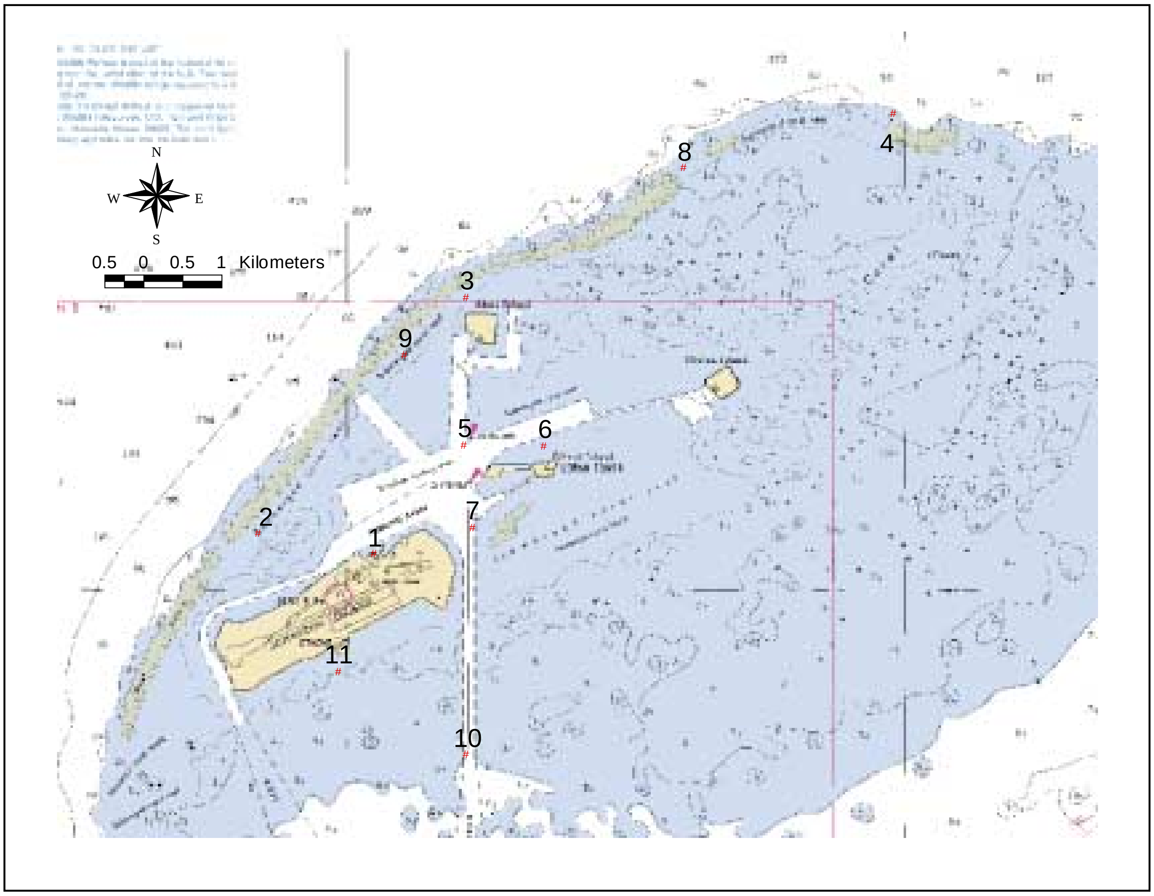

Figure 1. Map of Johnston Atoll showing locations of sampling Stations 1 to 11.

Table 1 Sampling station information

Station	Location	Date	Latitude N	Longitude W	Depth (m)
1	Pier	16-Jun-00	16°44'7.0"	169°31'42.3"	0-12
2	Lagoon (Nr. Brock Sta. 3)	16-Jun-00	16°44'15.5"	169°31'32.5"	3-5.5
3	Lagoon (Nr. Brock Sta. 1)	17-Jun-00	16°45'53.3"	169°31'2.4"	2-3.5
4	Slope, Donovans Reef	17-Jun-00	16°47'10.0"	169°27'58"	8.5-31.5
5	Lagoon (Range Finder)	18-Jun-00	16°44'52.3"	169°31'3.5"	2-9.5
6	NE of Sand Island	18-Jun-00	16°44'51.6"	169°30'28.9"	1.5
7	E of Johnston island	18-Jun-00	16°44'18.0"	169°31'0"	0.5-9
8	Reef Slope	19-Jun-00	16°46'47.2"	169°29'28.7"	3-20
9	Lagoon (Nr.Brock Sta. 2)	19-Jun-00	16°45'29.5"	169°31'29.3"	1-5
10	South Channel	20-Jun-00	16°42'43.7"	169°31'2.4"	2-9.5
11	Sewage Outfall	20-Jun-00	16°43'18.0"	169°31'58"	3-10.0

hydroids, anemones and tunicates were removed and relaxed in a solution of Epsom salts and seawater before preserving in 5% formalin. The remaining organisms were preserved on site in 70% alcohol before returning the samples to the laboratory for sorting and identification of organisms.

Specimens collected were sorted and identified to species or the lowest practicable taxa, using dissecting or compound microscope magnification when necessary. Identifications were made using descriptions available in Reef and Shore Fauna of Hawai'i Sections 1 to 4 (published), 5 and 6 (unpublished), various taxonomic references, and voucher specimens in the Bishop Museum collections. Specimens from various groups were sent to taxonomic experts for final identifications (see Acknowledgments).

All available sources of information for the marine environment of Johnston Atoll were investigated for previous reports of marine organisms collected or sighted at the atoll. Literature consulted included published papers in the open scientific literature, taxonomy-based monographs and reports and unpublished reports for environmental studies. Resources that were consulted in this search were the libraries of Bishop Museum and the University of Hawaii, and literature search engines such as the Zoological Record, Biological and Oceanic Abstracts and the Aquatic Sciences and Fisheries Abstracts (ASFA) available on the University of Hawaii Library web site. The Bishop Museum invertebrate collection database was reviewed for all marine or estuarine organisms indicated to have been collected at Johnston Atoll. The retrieved data were assembled into a combined database containing taxa identity, taxonomic authority, and collection date, when available. Species identified from the present study were compared with listings of known introductions for Hawaii (Carlton and Eldredge in prep.) and the Pacific (Eldredge, 1987) and results of other field studies of nonindigenous species [Coles et al. 1997; Coles et al. 1998; 1999a, 1999b; DeFelice et al. 1998].

The Sorenson's Index of percent similarity, based on presence-absence of species at station pairs, was used to measure the degree of association between stations. By this index, the more species two stations share relative to their total species complements, the greater their ecological similarity. Based on a matrix of Sorensen Index values, cluster analysis was used to arrange stations into groups or clusters. Intercluster distances were calculated using an unweighted pair group average (UPGMA) method. In this analysis, similar stations will form clusters distinct from other stations. These clusters are arranged in a hierarchical, treelike structure called a dendrogram based upon the station pairs similarities. Calculation of the similarity measures and cluster analysis were performed using the Multi Variate Statistical Package (MVSP), Version 3.0 (Kovach 1998).

RESULTS

Station Descriptions

Collections and observations were made at 11 stations, with one of these at the Johnston Island pier, nine on lagoon and outer slope reefs, and one near the sewer outfall on the south side of Johnston Island (Figure 1). Dates of sampling and geographic coordinates for these stations are shown in Table 1. Descriptions of the environment at each station are as follows:

Station 1 (Johnston Island Pier). Near the east end of the north side of Johnston Island, the pier is the docking site for all ships and barges that supply the atoll. The pier is made of interlocked vertical metal sheet piling rising out a depth of about 12 m depth, and the pier surfaces is quite clean of fouling organisms, with few of the barnacles, sponges, bryozoans and tunicates that usually cover pier surfaces in Hawaiian harbors. The substratum outside of the pier is coral rubble and coarse sand, with abundant coral interspersed among the sand patches mostly composed of *Montipora capitata*. Mollusks found at this site include 36 common taxa which inhabit rubble/algae areas. High numbers of cerithids, limpets such as *Diodora granifera*, chitons, and nudibranchs were found, all characteristic of this habitat type. This was one of two sites (the other being site 7) with the vermetid *Dendropoma platypus*, which seems to favor the flat surfaces associated with man-made structures. This site also had two species of littorinid, *Litoraria pintado* and *Littoraria scabra,* due to the site's close proximity to the shore. Fishes were quite abundant, especially in the coral offshore of the pier, with 25 species recorded.

Station 2 (Near Brock et al. 1965 Sta. 3). In the lagoon seaward of Johnston Island near inner reef edge. The substratum is primarily live linear *Montipora capitata* reefs and *Acropora cythera* tables divided by sand channels 3 to 6 m deep. A single *A cythera* table was observed to have an number of aberrant skeletal growths on its surface that may indicate hyperplasia and possible tumor formation (Plate 1). This site contained 69 mollusk species, the highest of any area surveyed, which can probably be attributed to the diversity of habitat types at this location. This diverse community contained common Indo-Pacific reef flat species like *Vasum turbinelles* and *V. ceramicum*, which are among the most common reef flat mollusks in the Pacific, numerous micromollusks and a high diversity of common Pacific reef flat bivalves. These coincided with the extensive patches of coral sand found at this site, a feature uncommon at most of the other survey sites. By contrast with the diverse mollusk community, 32 fish species occurred, one of the lowest values found at the reef stations.

Station 3 (Near Brock et al. 1965 Sta. 1). Another lagoon station, located north of Akau (North) Island in 2-3 m depth. The area had virtually 100% coral cover, almost entirely composed of tabular *Acropora cythera* showing annular growth bands (Plate 2) and growing in a variety of beautiful formations (Plate 3). Almost no sand channels were present. Probably as a result, mollusk diversity was intermediate among the reef stations, with only 35 species found. Of these species, several unusual micro-bivalves were noted, particularly *Crenella* sp. and *Cratis* sp. (*kanekoi*?), two species that have been found in submarine caves off Okinawa. These cave bivalves, among others, are often found in deepwater sediments off Oahu (Swartz et al. 2000, but are not reported from shallow water sediments. These bivalves were collected from a single, small sand patch that was located underneath extensive *Acropora* cover (almost 100% cover). This "cave-like" environment may explain their presence at his site and no other. Fish diversity was also intermediate among the reef stations, with 36 species sighted.

Station 4 (Donovan's Reef). This area, approximately 8 km northeast of Johnston Island, is a popular dive site with residents and the most remote from usual activity on the atoll. The station was located seaward of the isolated reef which is about 1 km east of the main Johnston Atoll reef. The relief of the upper part of the outer reef slope is very gradual from 8.5 to 21 m depth, at which the slope becomes almost vertical to the reef abase at about 32 m. Observations were made throughout the entire depth range. The substratum is consolidated limestone with moderate coral cover and little relief, with coarse sand at the reef base. Coral diversity was among the highest found in the study, with 11 species found. Diversity of mollusks was moderate with 39 species. Cone shells, particularly *Conus lividus*, *C. rattus*, and *C. miles*, were common on the current-swept pavement regions. All three of these species are common cones on Indo-Pacific reef flats, and they tend to favor areas with exposed/bare substrate. Fish diversity was the highest of any site, with 52 species found. These included the only sighting for the study of the Johnston Atoll endemic rainbow angelfish *Centropyge nahackyi* (Plate 4), which was observed and photographed under a ledge near the bottom of the outer reef slope, and of the whaleshark *Rhincodon typus*, which was observed near the surface above the reef edge.

Station 5 (Near Brock et al. 1965 Sta. 7). The station was near a range finder marking the main channel thorough the lagoon. Substratum over 2 to 9.5 m depth consisted of the concrete surface of range finder pilings, high coverage of coral dominated by *Acropora cythera, Montipora capitata* and *M. patula,* and coarse sand in the channel and among the coral formations. This site had the second highest diversity of mollusks, composed of 52 species with a large number of bivalves and several sand dwelling species including two species of tellinid and two species of mesodesmatids. Also present at this site was a cave species, *Barbatia decorata*. This species was described from submarine caves off Okinawa, but may also occur in deep water sediments off Hawaii. Fish diversity was relatively high, with 39 species.

Station 6 (Shallow area NE of Sand island). An area of sparse coral cover on a flat limestone bottom only about 1.5 m deep, with a few concrete structures and interspersed areas of sand. Despite the low coral coverage, diversity was among the highest of any station, with 11 species found. Diversity of mollusks was relatively low (25 species) and composed of common Indo-Pacific species. Sand dwellers such as nassarids were common. Cerithids, especially *Cerithium nesioticum*, were common in the rubble and the on the pavement. Fish diversity was the lowest of any station, with only 20 species observed.

Station 7 (Near Brock et al. 1965 Sta. 8). Along the eastern side of the dredged channel east of Johnston Island and adjacent to a shallow reef area with numerous, repeating linear reefs mostly composed of *Montipora and Acropora* species divided by narrow sand channels. Depth ranged 0.5 m on top of the linear reefs to around 10 m at the edge of the dredged channel, with a maximum depth of 12 m. Coral diversity was high with 11 species, but mollusk diversity low with only 19 species, the second lowest station. Thirty eight species of fish were observed, the fourth highest of all the stations.

Station 8 (Outer Reef Slope). The station was located in a break between the main reef and a smaller reef to the northeast, on the outer reef slope. Like Station 4 at Donovan's Reef, the outer slope is gradual from down to about 20 m depth then breaks to a nearly vertical face extending to the reef base. Observations were made from about 3 m depth to the slope break. This area has low relief and mostly dead coral rubble and consolidated limestone until near the slope break where coral becomes more abundant. An exception to this condition occurred in the shallow area near the start of the transect made down the slope, where a prolific growth of *Acropora cythera* provides extensive relief that supports an abundant population of the yellow tang *Zebrasoma flavescens* (Plate 5). This was the area of highest diversity for corals, with 12 species found, but with only 27 species of mollusks. This modest mollusk diversity probably does not typify the area because collection time was restricted and nearly every species collected was a small sand dweller. Large common reef mollusks were present however, including *Cypraea tigris*, and several common thaidids (*Drupella ochrostoma* and *Morula uva*).

Station 9 (Cucumber Flats). Another popular dive site for Johnston Island residents, this site gets its name from the abundant holothurians that occur in the coarse sand among the reefs. Coral is also abundant and diverse (Plate 6), with 11 species found, including *Montipora hoffmeisteri* (Wells, 1956), the first report of this species from Johnston Atoll. Thirty-two species of mollusks were found, including the holothurian parasite *Balcis*, numerous sand dwellers including *Conus pulicaris*, various nassarids, and tellinid bivalves. The large number of bivalve species (7 species) is attributable to the extensive sand patches at this site. With the exception of *Isognomon perna*, all of the bivalves were infaunal species. Fish diversity was second lowest of any reef station, with only 25 species observed.

Station 10 (South Channel). The most southerly located station of the study, this site is at the east edge of the channel dredged in 1963-64 for fill material used in increasing the size of Johnston Island. The substratum is mostly rubble cobbles next to a reef with high coverage of *Acropora cythera* (Plates 7 and 8) and coarse sand in the sand channel. Depths range from 2 m on top of the reef to 9.5 m in the sand channel at the edge of the reef. The *A. cythera* tables can be very large, e.g. one the upper surface of one colony was approximately 6 m in longest diameter. This station had the lowest diversity of both corals (6 species) and mollusks (16 species), but fish diversity was intermediate for the reef stations, with 37 species observed.

Station 11 (Sewage Outfall). The site is along the sewage discharge pipe that extends from the treatment facility on the south jetty of Johnston Island to the point of effluent discharge about 500 m south of the jetty shore. The pipe is approximate 0.5 m in diameter and passes through and over numerous sand patches and reef areas along its route. Unlike all the other stations that had high water clarity and virtually no large macroalgae, algal blooms dominated the benthos at this site. By far the dominant species was the chlorophyte *Bryopsis hypnoides,* which overgrew most hard surfaces on the reefs and collected in mass deposits in sand channels. Another common and obvious species was C*aulerpa racemosa*, large growths of which occurred near the shoreline. The area is therefore under obvious stress from nutrients released from the sewage outfall, which is causing eutrophication in the lagoon south of Johnston Island. The impact of this eutrophication extends as far east and south as Station 10, where *Bryopsis hypnoides* was also observed, although in low abundance.

Despite this eutrophication impact, 7 species of corals occurred at Station 11 in moderate abundance. This site had 36 mollusk species, but these had an unusual composition. Few macro-mollusks were observed at this site; the fauna was almost exclusive micromollusks. The site also had a high number of pyramidellid species, a feature common to high nutrient locations around Hawaii (Swartz et al. 2000), supporting a conclusion of an impact related to the outfall. This conclusion is also sustained by the number of mollusk individuals collected at this site, which had at least four times as many individuals as any other station. Only 30 species of fishes were observed at this station, suggesting that the outfall's impact was reducing the diversity of the fish community, but this effect may also be in part due to the reduced visibility at this station compared the other sites.

Previous Species Reports

A total of 865 taxa were reported by 21 previous surveys and studies at Johnston Atoll or are in the Bishop Museum collections (Appendix Table A), with an additional 24 papers or unpublished reports listing one or two species. The species listed in Appendix A are summarized in Table 2 as follows: 91 macroalgae, 57 cnidarian, 1 aschelminth, 20 polychaetes, 112 crustaceans, 221 molluscs, 56 echinoderms, 306 fishes and 1 reptile. The greatest number of species for each of the previous 21 studies or surveys were 148 for Brock et al. (1965); 149 each for Amerson (1973) and Amerson and Shelton (1976), and 195 by Kay (Unpublished). One hundred sixty-five voucher specimens for these and other studies are in the Bishop Museum collections. As indicated above, the previous reports are highly dominated by fishes, which were the main focus of many of the investigations (Smith and Swain 1982; Fowler and Ball 1925;Schultz and collaborators 1953; Halsted and Bunker; Brock et al. 1965, 1966; Randall et al. 1985; Kosaki et al. 1991). The second most frequently reported group was the Cnidaria, primarily corals (Wells, 1954; Brock et al. 1965, 1966; Amerson 1973; Amerson and Shelton 1976; Grigg 1981; Cairns 1984; Agegian 1985; Maragos and Jokiel 1986; Jokiel 1992; Cohen 1997).

Table 2. Total numbers of taxa of marine organisms reported by 21 previous studies at Johnston Atoll and by present study, numbers of new reports, identified species and proportion of Hawaiian species component.

Taxa	Previous Reports	Present Study	1st J. A. Report	% New Reports	Identified Species	Hawaiian Species	% Hawaiian
Macroalgae	91	100	69	69	73	73	100
Porifera	0	16	16	100	1	1	100
Cnidaria	57	28	5	18	23	16	70
Aschelminthes	1	0	-	-	-	-	-
Polychaeta	20	59	48	81	20	18	90
Sipunculida	0	4	4	100	4	4	100
Crustacea	112	135	96	71	79	69	87
Mollusca	221	178	55	31	126	115	91
Bryozoa	0	12	12	100	11	7	63
Echinodermata	56	30	7	23	26	24	92
Ascidiacea	0	13	13	100	7	4	57
Fish	306	93	0	0	92	90	97
Reptilia	1	0	-	-	-	-	-
Total Taxa	865	668	325	49	462	421	91

<u>Current Study</u>

A total of 668 taxa of macroalgae, invertebrates and fishes were observed or collected at the 11 stations in this survey, (Appendix C), or equal to about 77% of the total number of taxa that had been reported by all previous surveys and studies at Johnston Atoll since 1882 (Table 2). For many taxonomic groups i.e. sponges (16 taxa), sipunculids (4 taxa) bryozoans (30 taxa) and ascidians (13 taxa) the present study provides the first reports and records for the atoll. No new fish taxa were found in the present study, and only five new cnidarians were found. These were the reef coral *Montipora hoffmeisteri,* previously not reported north of Fanning Island (Coles, in press) and four hydroids, one of them the nonindigenous *Pennaria disticha*. For the remaining groups of macroalgae, polychaetes, crustaceans, molluscs, and echinoderms, the number of taxa newly reported taxa range from 13 (echinoderms) to 96 (crustaceans). Alternatively, new reports expressed as a percentage of total taxa range from 23% (echinoderms) to 81% (polychaetes), with nearly half (48%) of the total taxa being previously unreported for the atoll. Within the crustacea, in which new reports were 71 % of the total, some groups such as amphipods, cumaceans and tanaids had no previously reported specimens (Appendix A).

Of the 668 total taxa found in the present study 462 (69%) were identified to species (Appendix B), and 421of these identified species (91%) are known to occur in Hawaii (Table 2), indicating that the majority of the Johnston Atoll marine flora and fauna is composed of Hawaiian species.

This was particularly the case for macroalgae, Porifera, Polychaeta, Sipunculida Mollusca, Echinodermata and fish, where Hawaiian species made up 90% or more of the identified organisms (Table 2). Only bryozoans (Ectoprocta) and ascidian had a substantial proportion of their identified species which were not previous known from Hawaii, suggesting that these two groups, which are susceptible to transport as fouling organisms, include organisms that may have been humanly introduced from areas outside of Hawaii.

Introduced organisms made up only a small fraction of the total Johnston Atoll biota. Only ten of the 668 taxa (1.5%) were species designated as introduced or cryptogenic in Carlton and Eldredge (in prep.) or by taxonomists familiar with the respective groups (Table 3). Alternatively, nonindigenous or cryptogenic species composed only 2% of the 462 taxa identified to species. These introduced or potentially introduced species included the a nonindigenous hydrozoan and polychaete found in Hawaii, a one nonindigenous bryozoan found in Hawaii, three previously unreported cryptogenic bryozoans, and three nonindigenous ascidians. Only one of these, the bryozoan *Didymozoum triseriale* (Philipps, 1899), has a previously known distribution restricted to the Indo-Pacific, while the others were tropical worldwide or undetermined (Table 3).

Table 3. Cryptogenic and nonindigenous species found on June 2000 Johnston Atoll Surveys

Taxa	Species	Status	Origin or Range
Hydrozoa	*Pennaria disticha*	Nonindigenous	Tropical Worldwide
Polychaeta	*Branchiomma nigromaculata*	Cryptogenic	Tropical Worldwide
	Armandia intermedia	Cryptogenic	Undetermined
Bryozoa	*Bugula vectifera?*	Cryptogenic	Undetermined
	Caulibugula dendrograpta	Nonindigenous	Undetermined
	Didymozoum triseriale	Cryptogenic	Indo-Pacific
	Halysis diaphana	Cryptogenic	Tropical Worldwide
Ascidiacea	*Ascidia sydneiensis*	Nonindigenous	Undetermined
	Diplosoma listerianum	Nonindigenous	Tropical Worldwide
	Microcosmus exasperatus	Nonindigenous	Tropical Worldwide

Comparison of numbers of taxa among stations for various taxonomic groups and for all taxa combined (Figure 2, Table 4) showed little variation among stations for any major group nor for total taxa. Maximum numbers of taxa occurred at Station 4 (Donovan's Reef) for combined taxa, crustaceans and fish, but the differences from other stations were not substantial. For example, the 215 total taxa occurring at this site were only 71 more than the 144 taxa occurring at Station 9 (Cucumber Flats), the site of fewest reports. Even lower variation among stations was indicated by Shannon H'_{10} diversity indices, which ranged only 2.16 at Stations 6 and 9 to 2.33 at Station 4. The most species rich taxonomic groups by stations were the macroalgae (9-28 taxa), polychaetes (14-27 taxa), crustaceans (26-49 taxa), mollusks (19-71 taxa) and fishes (20-52 taxa). The only spatial pattern suggested by these data are increased numbers of taxa and diversity at Station 2 on the or at Stations 4 and 8 on the reef slope, which ranked 1 to 3 in total taxa, respectively. However, Station 9 outer back reef flat ranked last of the 11 stations in total taxa, 10^{th} in macroalgae and 9^{th} in fishes.

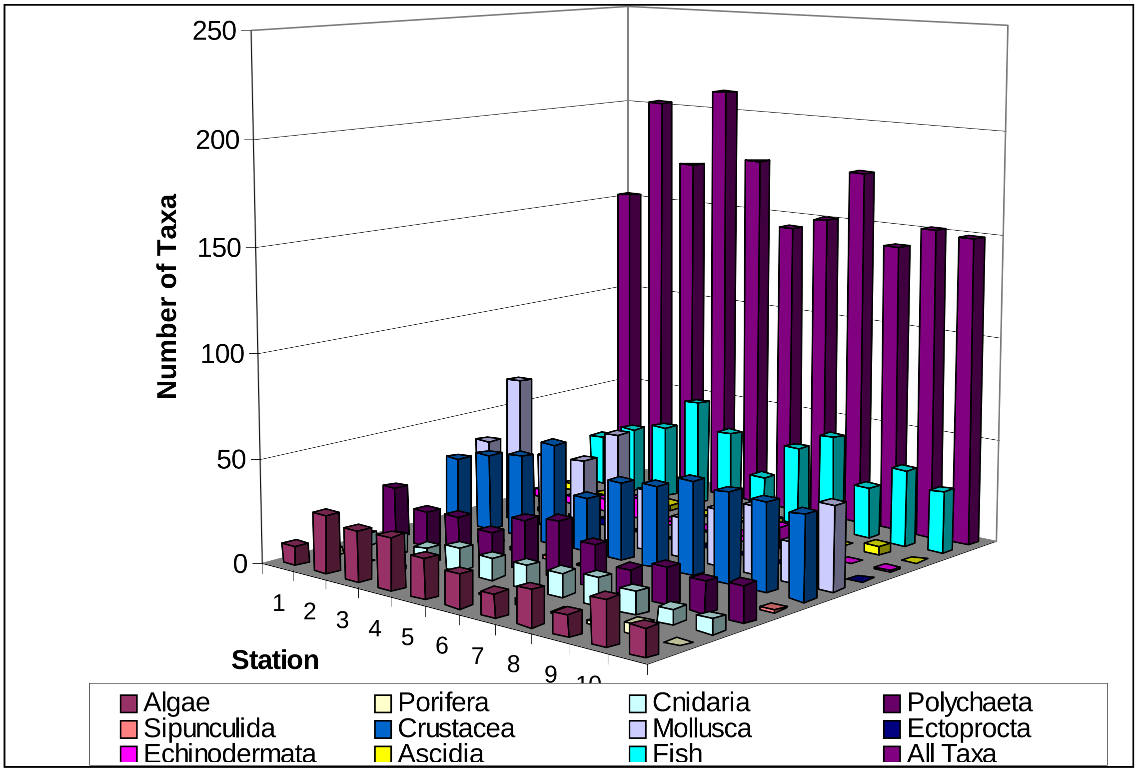

Figure 2 Numbers of taxa in major taxonomic groups at Johnston Atoll stations

Table 4. Data for Figure 2 and Shannon's H'_{10} diversity indices.

	Station										
Taxa	1	2	3	4	5	6	7	8	9	10	11
Algae	9	28	24	25	19	16	11	17	10	21	13
Porifera	3	0	2	4	0	1	3	1	1	5	0
Cnidaria	7	9	7	12	11	11	13	13	11	7	7
Polychaeta	25	17	18	14	24	27	20	12	17	15	17
Sipunculida	3	2	1	2	1	1	0	0	0	0	1
Crustacea	32	37	40	49	26	37	39	45	43	42	40
Mollusca	37	71	36	37	53	29	19	27	32	19	40
Ectoprocta	5	1	1	3	1	0	1	0	0	1	0
Echinodermata	4	10	10	13	2	2	2	15	5	1	1
Ascidia	3	1	0	3	1	1	6	3	0	4	0
Fish	25	32	36	52	39	20	38	47	25	37	30
All Taxa	153	208	175	214	177	145	152	180	144	152	149
H'_{10} Diversity	2.18	2.32	2.24	2.33	2.25	2.16	2.17	2.26	2.16	2.17	2.18

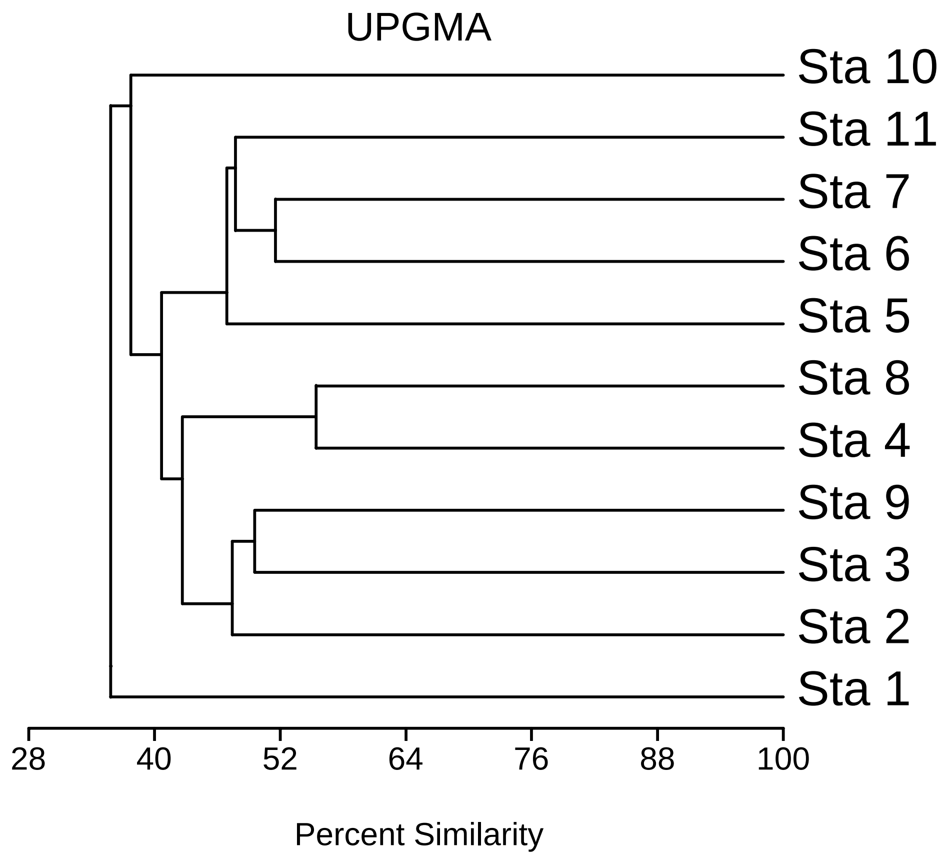

Figure 3. Dendrograph of Sorenson similarities among station for all taxa using UPGMA method for calculating intercluster distances

Calculation of Sorensen similarity indices species presence-absence (Figure 3) for all taxa indicates that similarities within clusters were not high in any case, with the highest similarity about 55% occurring between stations 4 and 8. Nonetheless, the dendrograph suggests patterns among station clusters that correspond to reef location and environment, despite the relatively small differences among stations for species numbers and diversity. Stations 1 and 10 did not group with any other, and these were in unique locations, Station 1 being on and near the Johnston Island pier, and Station 10 along the channel in the south lagoon. The Station 4 and 8 cluster contains the two stations which were on the outer reef slope where overall taxa numbers and diversity were high (Table 3), especially for crustaceans and fishes.

The cluster containing Stations 2, 3 and 9 corresponds to locations in the north lagoon that were on the outer back reef flat. Running similar analysis for the individual taxonomic groups indicates that this cluster results primarily from taxa within the polycheats, crustaceans, echinoderms and fishes. Stations 2 and 3 grouped at about 60% similarity for the crustaceans and echinoderms.

Stations 2 and 9 grouped at about 77% similarity for the fishes, and Stations 3 and 9 at about 70% similarity for the polychaetes.

The largest cluster of four stations for total taxa is formed by Stations 5, 6 and 7, all along dredged areas in the north lagoon, with Station 11, near the sewage outfall south of Johnston Island. This cluster appears to result from a number of associations within the individual taxonomic groups. Station 5 groups at about 75% similarity with Station 6 for the polychaetes, at about 65% similarity with Station 7 for the fishes and at about 55% similarity with Station 11 for the crustaceans. Station 6 clusters with Station 11 at about 72% similarity for the fishes, at 92% similarity with Station 7 for the cnidarians; and with Station 7 at about 40% similarity for mollusks. Station clusters at about 63% similarity with both Stations 5 and 6 for the polychaetes.

Station 11 was the most unusual of the reef sites surveyed, with the alga *Bryopsis hypnoides* growing over the reef in high densities, apparently dominating the benthos in competition with reef corals and other sessile forms. Despite this apparent dominance by a species indicating eutrophication by the sewage outfall and discharge, the similarity analysis based on species presence-absence did not separate this station from any other for total taxa or any major taxonomic group. Nor were species diversity or numbers of taxa particularly low at this station except for echinoderms, where it tied with Station 7 for least number of species. This indicates, that despite the apparent dominance of *Bryopsis hypnoides* in this area, the site still supports a large variety of biota typical for the Johnston Atoll lagoon.

Stations 1 and 10 did not group with any sites for total taxa (Figure 3) or in similarity dendrographs for all invertebrates excluding algae and fishes, and for mollusks alone. Station 1 was unique in its location on and near the concrete Johnston Island Pier where most benthic organisms had little three dimensional relief for settlement and growth, and many molluscs which are usually found on flat manmade structures occurred only at this site. Also the fewest numbers of algal found on the study were at this site, and fish species tied with second from last. Station 10, at the end of the south lagoon channel, had next to the lowest number of total taxa and the fewest taxa of molluscs and coral species found on the study.

DISCUSSION

Compared with harbors which have been surveyed on Oahu, Hawaii (Coles et al. 1997, 1999a, 1999b) and found to have a introduced component of around 100 species or about 20% of their total biota, cryptogenic or nonindigenous are only a minor portion of the Johnston Atoll marine community. With only ten potentially introduced species comprising only 1-2% of the total species or taxa, the nonindigenous component approximates that which has been found for previous surveys of non harbor areas in the Hawaiian Islands such as Midway Atoll and Kaho'olawe (Coles et al. 1998, DeFelice et al. 1998). Similarly, studies in Guam (Paulay et al. in prep.) and Australia (Hewitt et al, 1998; Hoedt et al. 2000) which have found a nonindigenous component of around 1-2% of the total biota identified (Table 5). Nonindigenous species conspicuously absent from Johnston Atoll are the Caribbean intertidal barnacle *Cthamalus* *proteus* , which is extremely abundant in the intertidal zone in harbors and bays in Hawaii and has spread as far westward as Guam (Southward et al. 1998), and invasive nonindigenous red algae (Russell 1992) which cover reef flats in many areas of the main Hawaiian Islands. With monthly visits by a supply barge from Honolulu plus previous military vessel movement during the atoll's occupation in the last 50 years, there has been ample opportunity for species introductions. The relative lack of introduced species on the atoll is probably in large part due to the inability for nonindigenous forms adapted to harbor conditions to establish themselves in the oligotrophic reef environment where they must also compete with a diverse biota adapted to tropical conditions. Higher diversity of the Australian native fauna has been proposed to account for the relatively low nonindigenous component found in North Queensland ports and harbors (Hutchings et al. ms submitted) although such areas are still susceptible to invasion by an foreign organism that is adapted to tropical reef conditions (Pyne 1999; Willan et al. 2000).

Table 5. Numbers of marine nonindigenous, cryptogenic and total species determined on Hawaii, Guam and Australian surveys. (Modified from Coles and Eldredge, ms submitted).

Location	Nonindigenous (N)	Cryptogenic (C)	Total N + C	Total Species	% N + C
Hawaii					
Oahu, Pearl Harbor	69	26	95	419	23.0
Oahu, S. & W. Shores	73	27	100	585	17.0
Midway	4	0	4	444	1.5
Kaho'olawe	3	0	3	298	1.0
Guam					
Apra Harbor	27*	29*	46*	682	6.7
Island-wide			104	4635	2.2
Australia					
Hay Point Port	8	2	10	506	2.0
Mourilyan Harbour	2	2	4	401	1.0
Abbot Point Port	0	5	5	593	0.8

As previously reported for the algal fish and reef coral assemblages at Johnston Atoll, the invertebrates found in this study are highly dominated by organisms that occur in the Hawaiian Islands. This would be expected given Johnston Atoll's location in the North pacific gyre where it receives water that has passed the Hawaiian Islands. However, under the influence of the North Equatorial Countercurrent, the Johnston Atoll biota also has a number of tropical species not found in the main Hawaiian Islands which probably originate from the central equatorial Pacific. Some taxonomic groups such as reef corals, are highly dominated by tropical species which are not found in most of the main Hawaiian Islands, and Johnston Atoll may be responsible for the reintroduction of these organisms into the Northwest Hawaiian Islands (Grigg 1981).

The data and similarity analyses indicate that there are no large differences among the sites in terms of their species presence-absence, although there is an overall pattern in the similarities that corresponds to location and environmental conditions. Small differences among the biota of the eleven sites would be expected in a well-mixed atoll lagoon where no outstanding differences occur among sites in depth, water quality or sedimentation. The only area that was dramatically different from the other areas observed on the survey was at Station 11 in the vicinity of the Johnston Island sewer outfall. The bloom of *Byopsis hypnoides* and, to lesser extent, *Caulerpa racemosa* in this area was conspicuous and unique for the atoll, and clearly indicated eutrophication of the waters of the south lagoon by the sewage discharge. This is somewhat surprising, given the openness of the receiving water to unrestricted flow of open ocean water, depth of the discharge which should encourage mixing as effluent rises to the surface, and assumed low volume of discharge.

The occurrence of a colony of *Acropora cythera* with aberrant growth on its surface at Station 2 (Plate 1) is interesting and may warrant further surveys for corals with such growths in the Johnston Atoll lagoon, given the use of the atoll for aerial nuclear bomb testing 40-50 years ago. These growths are reminiscent, but not the same as spherical calicoblastic tumors that have been observed on *Acropora* corals in Oman (Coles and Seapy 1998) and elsewhere (Peters et al. 1986). The factor or factors that causes such aberrant coral growth is unknown, and the growth form found on the Johnston Atoll coral has not previously been observed.

CONCLUSIONS

The Johnston Atoll marine community is a representative of a typical coral reef environment that is composed primarily of organisms found in the Hawaiian Islands. However, its megafauna is highly dominated by live reef corals of the genus *Acropora*, which is not found in any of the main Hawaiian Islands except Kauai, where it occurs only rarely. The present study has substantially increased the knowledge of taxonomic groups other than macroalgae, reef corals and fishes with 325 taxa newly reported, with about 90% of these composed of Hawaiian species ort higher taxa.

A very small component of the Johnston Atoll marine community is composed of introduced species, with only ten cryptogenic or recognized nonindigenous species found among the 668 taxa or 452 identified species. None of these introduced organisms were abundant, and they usually occurred as single specimens at one or two stations. Johnston Atoll is therefore consistent with other coral reef areas in Hawaii, Guam and Australia that have been found to have few nonindigenous species occurring in low abundance.

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PLATES

Plate 1. Colony of the table coral *Acropora cythera* at Station 2 showing aberrant growths on upper surface.

Plate 2. *Acropora cythera* at Station 3 showing annular growth bands.

Plate 3. Mixed growth of *Acropora* and *Montipora* coral species at Station 3.

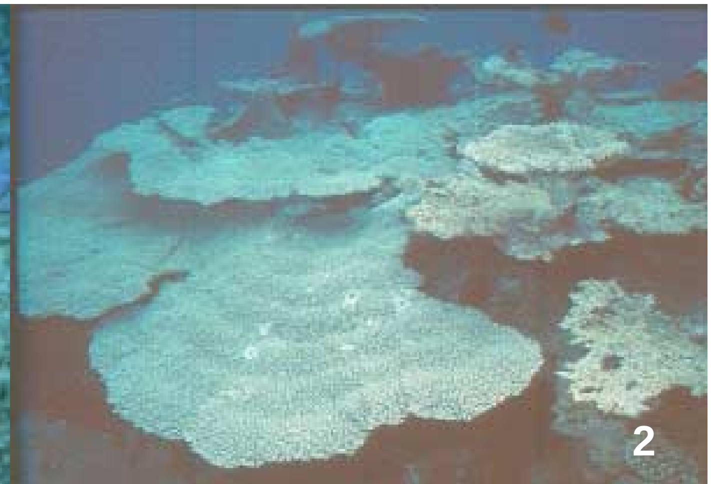
Plate 4. The damselfish *Centropyge nahackyi* Kosaki, 1989 at the base of the reef slope in 20 depth at Station 4.

Plate 5. School of surgeonfish *Zebrasoma flavescens* (Bennett, 1828) near top of reef slope in about 5 m depth at Station 8.

Plate 6. Mixed growth of *Acropora* and *Montipora* coral species at Station 9.

Plate 7. Close-up of *Acropora cythera* at Station 10 showing annular growth bands.

Plate 8. Medium distance view of *Acropora cythera* at Station 10 showing annular growth bands.


1

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APPENDIX A

Previous Reports of Marine Organisms Observed or Collected at Johnston Atoll

Marine organisms reported from previous studies and surveys at Johnston Island. References 1: Smith and Swain 1882; 2: Edmondson, et al. 1925; 3: Fowler and Ball 1925; 4: Schultz and Collaborators 1953; 5: Halstead and Bunker 1954; 6: Wells 1954; 7: Gosline 1955; 8: Brock, et al. 1965; 9: Brock, et al. 1966; 10: Buggeln and Tsuda 1966; 11: Amerson 1973; 12: Bailey-Brock 1976; 13: Amerson and Shelton 1976; 14: Agegian 1985; 15: Randall, et al. 1985; 16: Maragos and Jokiel 1986; 17: Kosaki, et al. 1991; 18: Jokiel and Tyler 1992; 19: Chave and Mundy 1994; 20:Chave and Malahoff 1998; 21: Kay Unpublished; 22: BPBM Collections.

				Reference Number																					
Taxa1	Taxa 2	Genus/Species	Authority	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Planta	Chlorophyta	*Acetabularia clavata*	Yamada										x												
		Acetabularia mobii											x												
		Acetabularia sp.											x												
		Acetabularia tsengiana											x												
		Borzia elongata																							
		Broodlea composita	(Harv.) Brand										x												
		Bryopsis pennata	Lamour										x												
		Caulerpa ambigua	(Okamura) Prudhomme & Lokhorst										x				x								
		Caulerpa bikinensis	Taylor														x								
		Caulerpa racemosa	(Forsskal) J. Agardh										x												
		Caulerpa urvilliana	Mont.										x												
		Cladophora crystalline	(Roth.) Kütz.										x												
		Cladophoropsis sp.											x												
		Codium arabicum	Kütz.										x												
		Codium sp.											x												
		Derbesia sp.											x												
		Dervesia marina	(Lyngbye) Solier										x												
		Dictyosphaeria versluysii	Weber Bosse										x				x								
		Enteromorpha kylinii	Bliding										x												
		Halimeda discoidea	Decaisne										x												
		Halimeda fragilis	Taylor														x								
		Halimeda tuna	Moul										x												
		Microdictyon setchellianum	M. Howe										x												
		Palmogloea protuberans	(Sm. & Sow.) Kütz.										x												
		Pseudochlorodesmis parv											x												
		Valonia ventricosa	J. Agardh										x												
	Chrysophyta	*Ostreobium reineckei*											x												
	Cyanophyta	*Anacystis dimidiata*	(Kütz.) Drouet & Daily										x												
		Calothrix crustacea	Drouet										x												
		Calothrix scopulorum											x												
		Entophysalis deusta	(Menegh.) Drouet & Daily										x												
		Hormothamnion enteromorphoides	Bornet & Flahault										x												
		Hydrocoleum lyngbyaceum	(Kütz.) Gomont										x												
		Lyngbya aestuarii	Gomont										x												
		Lyngbya confervoides	Gomont										x												
		Lyngbya lutea	(Agardh) Gomont										x												
		Lyngbya majuscula	Harv. ex Gomont									x													
		Microcoleus chthonoplastes	Gomont										x												

				Reference Number																					
Taxa1	Taxa 2	Genus/Species	Authority	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
		Microcoleus tenerrimus	Gomont										x												
		Oscillatoria nigroviridis											x												
		Phormidium submembranaceum	Gomont										x												
		Schizothrix calcicola	(C.Agardh) Gomont										x												
		Spirulina tenerrima	Gomont										x												
		Symploca atlantica	Gomont										x												
	Phaeophyta	*Dictyopteris bartayresii*	J. V. Lamour														x								
		Dictyota sp.											x												
		Ectocarpus breviarticulatus											x												
		Ectocarpus indicus											x												
		Ectocarpus irregularis											x												
		Ectocarpus sp.											x												
		Lobophora variegata	(J. V. Lamour.) Womersley														x								
		Pocockiella variegata											x												
		Sphacelaria furcigera											x												
		Sphacelaria novaehollandiae											x												
		Sphacelaria tribuloides	Menegh										x												
	Rhodophyta	*Amphiroa Sp.*											x												
		Antithamnion antillarum											x												
		Asterocystis ornata											x												
		Callithamnion marshallensis	Dawson										x												
		Callithamnion sp.											x												
		Caloglossa leprieurii	(Mont.) J. Agardh										x												
		Centroceras apiculatum	Yamada										x												
		Centroceras clavulatum	C.Agardh) Mont.										x												
		Ceramium affine	(Harv.) Kylin										x												
		Ceramium fimbriatum	Setch. & N. L. Gardner										x												
		Ceramium gracillimum byssoideum	Arnott										x												
		Ceramium huysmansii	Weber Bosse										x												
		Ceramium maryae	Weber Bosse										x												
		Ceramium sp.											x												
		Ceramium vagabunde											x												
		Ceramium zacae											x												
		Champia parvula	(C. Agardh) Harv.										x												
		Chrondria repens	Borgesen										x												
		Crouania minutissima	Yamada										x												
		Dasya adherens	Yamada										x												
		Dasya sinicola	(Setch. & N. L.Gardner) Dawson 1959										x												
		Dasya sp.											x												
		Erythrotrichia sp.											x												
		Gelidium crinale	(Turner) J .V. Lamour										x												
		Gelidium pusillum	(Stackh.) Le Jolis										x												

				Reference Number																					
Taxa1	Taxa 2	Genus/Species	Authority	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
		Goniotrichum alsidii	(Zanardini) M. Howe										x												
		Griffithsia metcalfii	Tseng										x												
		Griffithsia ovalis	Harv.										x												
		Griffithsia sp.											x												
		Griffithsia tenuis	C. Agardh										x												
		Hypnea esperi	Bory										x												
		Jania capillacea	Harv.										x												
		Jania decussato-dichotoma	(Yendo) Yendo										x												
		Lomentaria hakodatensis	Yendo										x												
		Taenioma macrourum											x												
		Wurdemania sp.											x												
Hydrozoa	Milleporidae	*Millepora tenera*	Boschma, 1949						x										x		x		x		
		Millepora tenera?	Boschma, 1949								x														
	Stylasterinidae	*Distichopora violacea*	(Pallas, 1766)																x		x		x		x
		Stylaster sp												x		x			x				x		
Anthozoa	Acroporidae	*Acropora cerialis*	(Dana, 1846)																x						
		Acropora cythera	(Dana, 1846)						x										x						x
		Acropora elseyi	(Brook, 1892)																x						
		Acropora humilis	(Dana, 1846)						x										x		x				x
		Acropora nasuta	(Dana, 1846)																						x
		Acropora paniculata	(Verrill, 1902)																x						
		Acropora selago	(Studer, 1878)																x						
		Acropora valida	(Dana, 1846)						2										x		x				x
		Acropora yongei	Veron & Wallace 1984																x						
		Montipora capitata?	(Lamarck, 1816)						x										x		x				
		Montipora studeri	(Vaughan, 1907)																x		x				
		Montipora tuberculosa	(Lamarck, 1816)																x						
		Montipora verrilli	Vaughan, 1907																		x				x
		Montipora verrucosa	(Lamarck, 1816)								x														x
	Agariciidae	*Leptastrea purpurea*	(Dana, 1846)																x						
		Leptastrea sp.							x																
		Leptoseris hawiiensis	Vaughan, 1907																x						x
		Leptoseris incrustans	(Quelch 1886																x						
		Leptoseris papyracea	(Dana, 1846)																						x
		Leptoseris scabra	(Vaughan, 1907)																x						
		Pavona duerdeni	(Vaughan, 1907)																x		x				2
		Pavona maldivensis	(Gardiner, 1905)																x		x				
		Pavona varians	Verrill, 1864								x								x		x				x
	Alcyonacea	*Bebryce brunnea*	(Nutting)																						x
		Corallium tortuosum	Bayer																						2
		Sinularia abrupta	Tixier-Durivault, 1970																				x		
	Antipatharia	*Antipathes dichotoma*	Pallas																				x		
		Antipathes intermedia	(Brook)																				x		
		Antipathes punctata	(Roule)																				x		

				Reference Number																					
Taxa1	Taxa 2	Genus/Species	Authority	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
		Antipathes subpinnata	Ellis & Solander																						x
		Antipathes ulex	Ellis & Solander																						x
		Bathypathers conferta	(Brook)																				x		
		Cirrhipathes spiralis	L.inn., 1758																				x		x
		Leopathes glaberrima	(Esper)																				x		
	Balanophyllidae	*Balanophyllia hawaiiensis*	Vaughan, 1907																						x
	Dendrophyllidae	*Cladopsammia echinata*	Cairns, 1984																						2
		Dendrophyllia oahuensis	Vaughan, 1907																				x		x
		Enallopsammia rostrata	Pourtales, 1878																						2
	Faviidae	*Cyphastrea ocellina*	(Dana, 1846)																x						
		Plesiastrea versipora	(Lamarck, 1816)																						x
	Flabellidae	*Javania lamprotichum*	Mosley, 1880																				x		x
	Fungiidae	*Cycloseris vaughani*	Lamarck, 1801																x						
		Fungia scutaria	Lamarck, 1801						x										x						x
	Isopheliidae	*Telmatactis decora*	(Hemprich and Ehrenberg, 1834)											x		x									x
	Pocilloporidae	*Madracis kauaiensis*	Vaughan, 1907																				x		x
		Pocillopora damicornis	(Linnaeus, 1758)								x								x						
		Pocillopora eydouxi	(Milne Edwards and Haime 1860)						x										x		x				x
		Pocillopora meandrina	(Dana, 1846)								x								x		x				
	Poritidae	*Portites lobata*	(Dana, 1846)						x										x						x
		Portites lutea	(Milne Edwards and Haime 1860)						x										x						
	Siderastreidae	*Psammocora nierstrazi*	Van der Horst, 1922																x						
		Psammocora stellata	Verrill, 1864																x						
		Oulangia bradleyi	(Boschma, 1923)																x						
Aschelminthes	Nemertea	*Baseodiscus cingulatum*	(Coe, 1906)																						x
Polychaeta	Amphinomidae	*Eurythoe complanata*	(Pallas, 1766)											x		x									x
		Eurythoe pacifica	Kinberg		x																				
		Hermodice pinnata	Treadwell		x																				
		Notopygos albiseta	Holly, 1939																						x
		Pherecardia striata	(Kinberg, 1857																						x
	Cirratulidae	*Cirratulus sp.*			x																				x
	Eunicidae	*Eunice sp.*												x		x									x
	Leodicidae	*Lysidice fusca*	Treadwell		x																				
		Lysidice sp.									x														x
	Leodocidae	*Leodice sp.*									x														
	Nereidae	*Perinereis helleri*	(Grube, 1878)		x																				x
		Perinereis sp.																							x
		Platynereis pulchella	Gravier, 1901								x														
	Phyllodocidae	*Phyllodoce stigmata*	Treadwell		x									x		x									2
	Polynoidae	*Hololepidella nigropunctata*	(Horst, 1915)											x		x									x
	Spirobidae	*Neodexiospira foraminosa*	(Morre & Bush, 1904)												x										
		Neodexiospira pseudocorrugata	(Bush, 1904)												x										
		Pileolaria pseudomilitaris	(Thirot-Quievreux, 1965)												x										
		Vinearia koehleri	(Caullery & Mesnil, 1897)												x										

Taxa1	Taxa 2	Genus/Species	Authority	Reference Number 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
		Oenone fulgida																							x
Crustacea	Alpheidae	*Alpheus brevipes*	Stimpson, 1860								x														
		Alpheus bucephalus	Coutiere, 1905		x									x		x									x
		Alpheus clypeatus	Coutiere, 1905		x						x			x		x									x
		Alpheus collumianus	Stimpson, 1860		x									x		x									
		Alpheus crassimanus	Heller		x									x		x									
		Alpheus diadema	Dana, 1852		x									x		x									
		Alpheus gracilis simplex	(Banner, 1953)		x									x		x									
		Alpheus paracrinitus	Miers, 1881		x									x		x									
		Alpheus paragracilis	Coutiere, 1905		x									x		x									
		Alpheus edmondsoni	(Banner, 1953)																						x
		Alpheus leviusculus	Dana, 1852		x									x		x									
		Alpheus lottini	Guerin, 1830								x			x		x									x
		Synalpheus paraneomeris	Coutiere, 1905		x									x		x									x
	Axiidae	*Axiopsis johnstoni*	Edmondson		x									x		x									x
	Calappidae	*Calappa hepatica*	(Linnaeus, 1758)		x																				x
	Chirostylidae	*Eumunida smithii*	Henderson, 1885																						x
	Cirripedia	*Lepas anatifera*	L., 1758											x		x									x
	Cryptochiridae	*Hapalocarcinus marsupialis*	Stimpson, 1859		x									x		x									x
		Pseudocryptochirus crescentus	(Edmondson, 1925		x									x		x									2
	Diogenidae	*Aniculus aniculus*	(Fabricius, 1787)		x									x		x									x
		Calcinus elegans	(N. Milne-Edwards, 1836)		x									x		x									x
		Calcinus herbstii	deMan		x									x		x									x
		Calcinus latens	(Randall, 1840))		x									x		x									x
		Dardanus haanii	Rathbun											x		x									
		Dardanus megistos	(Herbst)											x		x									
		Dardanus punctulatus			x																				
		Trizopagurus tenebrarum	(Alcock, 1905)																						x
	Dynomenidae	*Dynomene devaneyi*	Takeda																				x		2
		Dynomene hispida	Desmarest, 1825																						x
		Dynomene hispida	Desmarest, 1825		x									x		x									
	Galatheidae	*Galathea spinosorostris*	Dana								x														
		Munida brucei	Baba																				x		
		Munida heteracantha	Ortmann, 1892																						x
	Gnathophyllidae	*Gnathophyllum americanum*	Guerin, 1856		x									x		x									
		Gnathophyllum fasciolatum																							x
	Grapsidae	*Grapsus strigosus*	(Herbst)		x									x		x									x
		Grapsus tenuicrustatus	(Herbst, 1783)		x									x		x									2
		Pachygrapsus minutus	A. Milne-Edwards		x									x		x									x
		Pachygrapsus plicatus	A. Milne-Edwards											x		x									
		Pachygrapsus plicatus	A. Milne-Edwards																						x
	Hippolytidae	*Lysmata paucidens*	(Rathbun)		x									x		x									x
		Saron marmoratus	(Olivier, 1811)		x																				x
	Isopoda	*Limnoria tripunctata*	Menzies, 1951																						x

Taxa1	Taxa 2	Genus/Species	Authority	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
				Reference Number																					
	Latrellidae	*Latreillia metanesa*	(Williams)																				x		
	Leucosidae	*Nucia speciosa*	Dana											x		x									x
		Randallia distincta	Rathbun, 1906																						x
	Leucosiidae	*Nucia speciosa*	Dana		x																				
		Randallia distincta	Rathbun																				x		
	Majidae	*Perinea tumida*	Dana, 1852																						x
		Schizophrys hilensis	Rathbun, 1906								x														
	Ocypodidae	*Ocypode pallidula*	Jacquinot											x		x									
			Jaguinot, 1852																						x
	Paguridae	*Pagurus haani*																							x
		Pagurus megistos																							x
	Palaemonidae	*Coralliocaris graminea*	(Dana, 1852)		x									x		x									x
		Harpiliopsis depressus	(Stimpson, 1860)		x						x			x		x									x
		Jocaste lucina	(Nobili, 1901)		x									x		x									x
		Palaemonella tenuipes	Dana, 1852		x																				x
		Periclimenaeus tridentatus	(Miers, 1884)		x									x		x									x
	Panuliridae	*Panulirus marginatus*	(Quoy & Gaimard)											x		x							x		x
		Panulirus pencillatus	(Olivier, 1888)		x									x		x									x
	Parapaguridae	*Parapagurus dofleini*	Balss																				x		
	Parthenopidae	*Parthenope stellata*	Rathbun, 1906																				x		
	Plandonidae	*Plesionika alcocki*	(Anderson)																						2
		Plesionika pacificus	Edmondson, 1952																						2
	Portunidae	*Catoptrus inaequalis*	(Rathbun, 1906)		x									x		x									x
		Libystes edwardsi	Alcock, 1900																						x
		Portunus lonqispinosus	(Dana)		x									x		x									
		Thalamita admete	(Herbst)		x									x		x									
		Thalamitoides quadridens	(A. Milne-Edwards, 1869)																						x
		Thalamitoides quidridens	(A. Milne-Edwards, 1869)		x									x		x									
	Processidae	*Heterocarpus ensifer*	A. Milne Edwards, 1881																						x
	Scyllaridae	*Parribacus antarcticus*	(Lund)		x									x		x									2
	Squillidae	*Pseudosquilla oculata*	(Brulle)		x									x		x									x
	Stenopididae	*Stenopus hispidus*	Rathbun, 1907																						x
		Stenopus pyrsonotus	Goy & Devaney																				x		x
	Xanthidae	*Actaea speciosa*	(Dana, 1852)		x						x			x		x									2
		Carpilius convexus	(Forsskal, 1775)		x																				2
		Carpilodes bellus	(Dana, 1852)																						x
		Chlorodiella asper	Edmondson		x									x		x									
		Chlorodiella laevissima	A. Milne-Edwards, 1873																						x
		Chlorodiella nigra	(Forskal, 1775)																						x
		Chlorodopsis aberrans	Rathbun, 1906																						x
		Chlorodopsis areolata	A. Milne-Edwards, 1873																						x
		Domecia hispida	Eydoux & Souleyet, 1842		x						x			x		x									x
		Etisus electra	(Herbst, 1801)		x									x		x									x
		Leptodius sanguineus	(H. Milne-Edwards, 1834)		x									x		x									2

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Taxa1	Taxa 2	Genus/Species	Authority	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
		Leptodius waialuanus	(Rathbun, 1906)		x																				
		Liocarpilodes biunguis	(Rathbun, 1906)																						x
		Liocarpilodes integerrimus	Dana, 1852																						x
		Liomera belia	(Dana, 1852)		x									x											
		Lophozozymus dodone	(Herbst, 1801)											x		x									x
		Phymodius laysani	(Herbst, 1801)		x									x		x									x
		Phymodius nitidus	(Dana, 1852)		x									x		x									x
		Pilodius aberrans	(Rathbun, 1906)		x									x		x									
		Pilodius areolata	(H. Milne-Edwards)											x		x									
		Platypodia eydouxi	(A. Milne-Edwards, 1865)		x									x		x									x
		Portunus longispinosus	(Dana, 1852)								x														x
		Pseudoliomera speciosa	(Dana, 1852)		x									x		x									
		Tetralia glaberrima	(Herbst)		x																				x
		Tetralia spp.	spp.								x														
		Trapezia cymodoce	(Herbst, 1801)								x														
		Trapezia digitalis	(Dana, 1852)		x						x			x		x									x
		Trapezia ferruginea	Latreille, 1823		x									x		x									x
		Trapezia intermedia	Miers, 1886		x									x		x									x
		Trapezia rufopunctuta	(Herbst)		x																				
		Trapezia tigrina	Eydoux & Souleyet, 1842								x			x		x									x
Gastropoda	Actaeonidae	*Pupa tessellata*	Reeve, 1842																					x	
	Aplustridae	*Hydratina amplustre*	Linn., 1758																					x	
	Architectonidae	*Heliacus implexus*	Mighels, 1845																					x	
	Assumineidae	*Assumiea nitida*	Pease, 1865																					x	
	Buccinidae	*Cantharis farinosus*	Gould, 1850																					x	
		Pisania ignea	Gmelin, 1791											x		x									
		Prodotia iostomus	Gray, 1834																					x	
	Bullidae	*Bulla vernicosa*	Gould, 1859																					x	
	Bursidae	*Bursa cruentata*	Sowerby, 1841																					x	
		Bursa rosa	Perry, 1811																					x	
	Caecidae	*Caecum arcuatum*	de Folin, 1867																					x	
		Caecum sepimentum	de Folin, 1867																					x	
	Cassidae	*Casmaria erinaceus kalosmodix*	Melvill, 1883																					x	
		Cassus cornuta	Linnaeus, 1758																					x	
	Cerithiidae	*Bittium impendens*	Hedley, 1899																					x	
		Bittium zebrum	(Kiener, 1841)																					x	
		Cerithium atromarginatum	Dautzenberg and Bouge, 1933																					x	
		Cerithium columna	Sowerby, 1834																					x	
		Cerithium interstatum	Sowerby, 1841																					x	
		Cerithium mutatum	Sowerby, 1834											x		x								x	

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Taxa1	Taxa 2	Genus/Species	Authority	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
		Cerithium nesioticum	Pilsbry & Vanatta, 1905											x		x								x	
		Cerithium placidum	Gould, 1861																					x	
		Plesiotrochus luteus	Gould, 1861																					x	
		Rhinoclavis articulatus	Adams & Reeve											x		x									
		Rhinoclavis sinensis	(Gmelin)											x		x									
		Rhinoclavus articulata	Adams and Reeve, 1850																					x	
		Rhinoclavus fasciata	Bruguière, 1792																					x	
		Rhinoclavus sinensis	Gmelin, 1791																					x	
	Columbellidae	*Mitolumna metula*	Hinds, 1843																					x	
		Seminella virginea	Gould, 1860																					x	
	Conidae	*Conus abbreviatus*	Reeve, 1843																					x	
		Conus bandanus																						x	
		Conus ebraeus	Linn., 1758																					x	
		Conus flavidus	Lamarck											x		x									
		Conus imperialis	Linn., 1758																					x	
		Conus lividus	Hwass, 1792																					x	
		Conus miles	Linn., 1758											x		x								x	
		Conus millepunctatus																						x	
		Conus nanus	Sowerby											x		x									
		Conus obscurus	Sowerby, 1833																					x	
		Conus pulicarius	Hwass, 1792											x		x								x	
		Conus rattus	Hwass, 1792											x		x								x	
		Conus retifer	Menke, 1829																					x	
		Conus sponsalis	Hwass, 1792																					x	
		Conus textile	Linn., 1758																					x	
		Conus vitulinus	Hwass, 1792											x		x								x	
	Coralliophilidae	*Coralliophila erosa*	(Roding, 1798)																					x	
		Coralliophila violacea	(Kiener, 1836)																					x	
		Coralliphilia erosa	Röding, 1798																					x	
		Coralliphilia vilacea	(Kiener, 1836)											x		x									
		Quoyula madroporarum	Sowerby, 1834											x		x									
	Cyclostrematidae	*Cyclostremicus emeryi*	(Ladd, 1966)																					x	
	Cymatidae	*Cymatium aquatile*	Reeve, 1844											x		x									
		Cymatium gemmatum	Reeve, 1844											x		x									
		Cymatium muricinum	Röding, 1798											x		x									
		Cymatium nicobaricum	Röding, 1798											x		x									
		Distorsio anus	Linn., 1758											x		x									
		Charonia tritonis	Linnaeus, 1767																					x	
		Cymatium aquatile	Reeve, 1844																					x	
		Cymatium gemmatum	Reeve, 1844																					x	
		Cymatium intermedius	Pease, 1869																					x	
		Cymatium muricinum	(Roding, 1798)																					x	
		Cymatium nicobaricum	(Roding, 1798)																					x	
		Cymatium rubeculum	Linnaeus, 1758																					x	

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Taxa1	Taxa 2	Genus/Species	Authority	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
		Distorsio anus	Linn., 1758																					x	
	Cypraeidae	*Cymatium aquatile*	Reeve, 1844																					x	
		Cypraea caputserpentis	Linn., 1758											x		x								x	
		Cypraea carneola	Linn., 1758											x		x								x	
		Cypraea chinensis	Gmelin, 1791																					x	
		Cypraea granulata	Pease, 1863											x		x								x	
		Cypraea helvola	Linn., 1758											x		x								x	
		Cypraea isabella	Linn., 1758											x		x								x	
		Cypraea lynx	Linn., 1758																					x	
		Cypraea maculifera	Schilder, 1932											x		x								x	
		Cypraea mauritiana	Linn., 1758																					x	
		Cypraea moneta	Linn., 1758											x		x								x	
		Cypraea nucleus	Linn., 1758																					x	
		Cypraea poraria	Linn., 1758											x		x								x	
		Cypraea schilderorum	Iredale, 1939											x		x								x	
		Cypraea scurra	Gmelin, 1791																					x	
		Cypraea talpa	Linnaeus, 1758																					x	
		Cypraea teres	Gmelin, 1791																					x	
		Cypraea tigris	Linn., 1758																					x	
		Cypraea ventriculus																						x	
	Dialidae	*Cerithidum diplax*	Watson, 1886																					x	
		Dendrodoris nigra	Stimpson, 1856																					x	
	Fasciolaridae	*Peristernia crocea*	(Gray)											x		x									
		Peristernia chlorostoma	Sowerby, 1825																					x	
		Peristernia crocea																						x	
	Fissurellidae	*Diodora foveolata*																						x	
		Diodora granifera	Pease, 1861																					x	
		Emarginula cf. dilecta	A. Adams, 1852																					x	
	Harpidae	*Harpa amouretta*	Röding, 1798																					x	
	Hipponicidae	*Antisabia foliaceus*	Quoy and Gaimard, 1835																					x	
		Sabia conica	(Schumacher, 1817)											x		x								x	
	Juliidae	*Julia exquisita*	Gould, 1862																					x	
	Littorinidae	*Littoraria coccinea*	Gmelin, 1791																					x	
		Littoraria pintado	(Wood, 1828)											x		x								x	
		Littoraria scabra	(Linnaeus, 1758)																					x	
		Littoraria undulata	Gray, 1839											x		x								x	
		Littorina coccinea	(Gmelin)											x		x									
		Peasiella tantilla	Gould, 1849																					x	
	Marginellidae	*Volvarina fusiformis*	Hinds, 1844																					x	
	Mitridae	*Imbricaria olivaeformis*	Swainson, 1821																					x	
		Mitra acuminata	Swainson, 1824																					x	
		Mitra columbelliformis	Kiener											x		x									
		Mitra cucumerina	Lamarck, 1811																					x	

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Taxa1	Taxa 2	Genus/Species	Authority	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
		Mitra papalis	Linn., 1758																					x	
		Scabricola casta																						x	
	Modulidae	*Modulus tectum*	Gmelin, 1791											x		x								x	
	Muricidae	*Aspella cf. producta*	Pease, 1861																					x	
	Nassariidae	*Nassarius crematus*	Hinds, 1844																					x	
		Nassarius dermstina	(Gould)											x		x									
		Nassarius papliiosus	Linnaeus, 1758																					x	
		Nassarius pauperus	Gould, 1850																					x	
	Naticidae	*Natica bougei*	Sowerby, 1908																					x	
		Natica gaulteriana	Récluz, 1844																					x	
		Polinices melanostomus	Gmelin, 1791											x		x									
		Polynices melanostomus	Gmelin, 1791																					x	
	Neritidae	*Nerita albicilla*	Linn., 1758											x		x								x	
		Nerita picea	(Recluz, 1841)											x		x								x	
		Nerita plicata	Linn., 1758											x		x									
		Nerita polita	Linn., 1758											x		x								x	
	Olividae	*Oliva paxillus*	Pease, 1860																					x	
	Omalogyridae	*Omalogyra japonica*	Habe, 1972																					x	
	Orbitestellidae	*Orbitestella regina*	Kay, 1979																					x	
	Phasianellidae	*Tricolia variablis*	Pease, 1861																					x	
	Planaxidae	*Planaxis zonatus*	A. Adams											x		x								x	
	Pyramidellidae	*Odostomia gulicki*	Pilsbry, 1918																					x	
		Odostomia stearnsiella	Pilsbry, 1918																					x	
		Pyramidella sulcata	A. Adams, 1854																					x	
	Rissoidae	*Merelina wanawana*	Kay, 1979																					x	
		Powellsetia fallax	Kay, 1979																					x	
		Pyramidelloides miranda	A. Adams, 1861																					x	
		Rissoina abigua	Gould, 1849																					x	
		Rissoina costata	A. Adams, 1851																					x	
		Rissoina ephamilla	Watson, 1886																					x	
		Schwartziella horrida																						x	
	Scaphandridae	*Acteocina hawaiiensis*	Pilsbry, 1921																					x	
	Scissurellidae	*Scissurela coronata*																						x	
	Siphonariidae	*Siphonaria normalis*	Gould, 1846																					x	
		Williamia radiata	Pease, 1861																					x	
	Strombidae	*Strombus dentatus*	Linn., 1759																					x	
		Strombus maculatus	Sowerby, 1842											x		x								x	
	Terebridae	*Hastula lanceata*	Linn., 1758																					x	
		Terebra achates	Weaver, 1960																					x	
		Terebra affinis	Gray, 1834																					x	
		Terebra babylonia	Lamarck, 1822																					x	
		Terebra cf. argus	Pilsbry, 1921																					x	
		Terebra crenulata	(Linn., 1758)											x		x								x	
		Terebra felina	Dillwyn, 1817																					x	

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Taxa1	Taxa 2	Genus/Species	Authority	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
		Terebra guttata	Röding, 1798																					x	
		Terebra maculata	(Linn. , 1758)																					x	
	Thaididae	*Drupa morum*	Roding											x		x								x	
		Drupa ricina	Linnaeus, 1758											x		x								x	
		Drupa rubusidaeus	Röding, 1798																					x	
		Drupella ochrostoma	(Blainville, 1832)											x		x									
		Maculotriton bracteatus	(Hinds, 1844)																					x	
		Morula granulata	(Duclos, 1832)											x		x								x	
		Morula uva	(Roding, 1798)											x		x								x	
		Nassa serta	Bruguière, 1789											x		x								x	
		Thais armigera	Link, 1807																					x	
	Tonnidae	*Malea pomom*																						x	
		Tonna perdix	(Linn., 1758)																					x	
		Tonna romum	(Linn., 1758)											x		x									
	Triphoridae	*Triphora pelea*	Baker and Spicer, 1935																					x	
	Trochidae	*Euchelus angulatus*																						x	
		Gibbula marmorea	Pease, 1861																					x	
		Synaptocochlea concinna	Gould, 1845																					x	
		Trochus intertextus	Kiener, 1850											x		x								x	
	Turbinellidae	*Vasum turbinellus*	(Linn., 1758)											x		x									
	Turbinidae	*Leptothyra rubricincta*	Mighels, 1845																					x	
		Turbo articulatus	Reeve											x		x								x	
	Turridae	*Carinapex minutissimus*	(Garrett, 1873)																					x	
		Carinapex papilosa	Garret, 1873																					x	
		Kermia aniani	Kay, 1979																					x	
		Kermia daedalea	Garrett, 1873																					x	
		Kermia white																						x	
		Lovellona peasei																						x	
		Macteola segesta	Chenu, 1850																					x	
		Xenoturris cerithiformis	Powell, 1964																					x	
		Xenoturris kingae	Powell, 1964																					x	
	Vasidae	*Vasum turbinellum*																						x	
	Vermetidae	*Dendropoma platypus*	Morch 1861																					x	
		Vexillum pacificum	Reeve, 1845																					x	
	Vexillidae	*Vexillum rubrum*	Broderip, 1836																					x	
		Vexillum unifascialis	Lamarck, 1811																					x	
	Vitrinellidae	*Haplochlias minutum*																						x	
		Loitina loculosa																						x	
Opisthobranchia	Aplysiidae	*Dolabrifera dolabrifera*	Rang, 1828																					x	
	Atyidae	*Atys debilis*	Pease, 1860																					x	
		Atys semistrata	Pease, 1860																					x	
		Diniatys dentifer	A. Adams, 1850																					x	
Bivalvia	Arcidae	*Arca ventricosa*	Lamarck, 1819																					x	

Taxa1	Taxa 2	Genus/Species	Authority	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
																								Reference Number	
	Cardidae	*Fragum fragum*																						x	
		Fragummundum	Reeve, 1845																					x	
	Chamidae	*Chama iostoma*	Conrad, 1837																					x	
	Isognomonidae	*Isognomon perna*	(Linn. 1767)											x		x								X	
		Parviperna dentifera	(Krauss)																					x	
	Lucinidae	*Ctena bella*	(Conrad, 1837)																					x	
		Lucina edentula	Linn., 1758																					x	
	Malleidae	*Malleus regula*	Forskål, 1775																					x	
	Mesodesmatidae	*Ervilia sanwicensis*	(Smith, 1855)																					x	
	Mytilidae	*Septifer bryanae*	Pilsbry, 1921																					x	
	Ostreidae	*Ostrea thaanumi*	Dall, Bartsch & Rehder, 1939																					x	
	Pectinidae	*Mirapecten mirificus*	Reeve, 1853																					x	
	Pinnidae	*Pinna muricata*	Linn. 1758																					x	
		Streptopinna saccata	Linn., 1758																					x	
	Pteridae	*Pinctada margaritifera*	(Linn., 1758)																					x	
	Tellinidae	*Arcopagia scobinata*	Linn. 1758											x		x									
		Macoma obliquelineata	(Conrad, 1837)																					x	
		Tellina crucigera	Lamarck, 1818																					x	
		Tellina elizabethae	Pilsbry, 1918																					x	
		Tellina robusta	Hanley, 1844																					x	
	Trapezidae	*Trapezium oblongum*	(Linn., 1758)											x		x								x	
	Veneridae	*Periglypta reticulata*	Linn., 1758																					x	
Cephalopoda	Octopodidae	*Berrya hoylei*	(Berry)																				x		
		Octopus ornatus	Gould, 1852																				x	x	
Ophiuroidea	Ophiactidae	*Macrophiothrix lepidus*	(Clark)																				x		
		Ophiactis savignyi	Muller & Troschel, 1842		x									x		x									x
	Ophiocomidae	*Ophiocoma erinaceus*	Muller and Troschel, 1842		x									x		x									x
		Ophiocoma pica	Muller and Troschel, 1842		x									x		x									x
		Ophiocoma sp.									x														
		Ophiocomella clippertoni									x														
		Ophiocomella sexradia	(Duncan, 1887)											x		x									x
	Ophiodermatidae	*Distichophis clarki*									x														
		Ophiopeza spinosa	(Ljungman)											x		x									x
	Ophiomyxidae	*Ophiomyxa fisheri*	Clark, 1949																				x		2
Asteroidea	Acanthasteridae	*Acanthaster planci*	(Linnaeus, 1758)		x									x		x									x
	Echinasteridae	*Coronaster eclipes*	Fisher																				x		
		Henricia pauperrima	Fisher																				x		x
		Henricia robusta	Fisher																				x		
	Mithrodiidae	*Mithrodia bradleyi*	Verrill		x																				x
		Mithrodia fisheri	Holly, 1932		x									x		x									
	Ophidiasteridae	*Linckia multifora*	(Lamarck, 1816)		x									x		x							x		x
		Ophidiaster rhabdotus	Fisher, 1906																						x

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Taxa1	Taxa 2	Genus/Species	Authority	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
		Tamaria triseriata	(Fisher)																				x		
	Oreaster idae	*Culcita arenosa*	Perrier		x																				
		Culcita novaeguineae	Muller & Troschel		x									x		x									x
	Oreastreidae	*Pentaceraster cumingi*	(Gray)																				x		
Echinoidea	Asterostomatidae	*Eurypatagus ovalis*	Mortensen																				x		
	Brissidae	*Brissus latecarinatus*	(Leske)		x									x		x									2
	Cidaridae	*Actinocidaris thomasii*	Agassiz & Clark, 1907																				x		
		Chondrocidaris gigantea	A. Agassiz, 1863																				x		x
		Stylocidaris rufa	Mortensen																				x		
	Diadematidae	*Diadema savignyi*	Michelin																				x		
		Echinothrix calamaris	(Pallas, 1774)								x	x													
		Echinothrix diadema	(L., 1758)		x						x	x													
	Echinometridae	*Echinometra mathaei*	(de Blainville, 1826)		x						x	x		x		x									2
		Echinometra obionga	(de Blainville, 1826)		x						x	x		x		x									2
		Echinostrephus aciculatus	A. Agassiz, 1863		x									x		x									2
		Echinostrephus molaris	(de Blainville)		x																				
		Echinothrix diadema	(L., 1758)																						x
		Heterocentrotus mammillatus	(L., 1758)		x						x	x		x		x									2
		Heterocentrotus trigonarius	(Lamarck)		x									x		x									x
	Lissodiadematidae	*Lissodiadema lorioli*																							x
		Lissodiadema purpureum	(Agassiz & Clark)																				x		
	Pedinidae	*Caenopedina pulchella*	(Agassiz & Clark)																				x		
	Toxopneustidae	*Tripneustes gratilla*	(Linnaeus, 1758)		x						x	x		x		x									x
Holothuroidea	Holothuriidae	*Actinopyga mauritiana*	(Quoy & Gaimard, 1833)		x									x		x							x		x
		Actinopyga obesa	(Selenka)		2																				
		Actinopyga echinites																							x
		Actinopyga parvula																							x
		Holothuria atra	Jaeger, 1833		x						x	x		x		x							x		2
		Holothuria difficilis	Semper											x		x									
		Holothuria hilla	Lesson, 1830		x									x		x									x
		Holothuria impatiens	(Forsskal, 1775)		x									x		x									x
		Holothuria pardalis	Selenka, 1867		x									x		x									2
		Holothuria parvula	(Selenka)		x									x		x									
	Synallactidae	*Paelopatides retifer*	Fisher																				x		
	Synaptidae	*Chiridota rigida*	Semper		x									x		x									x
		Opheodesoma spectabilis	Fisher, 1907								x	x													
		Polyplectana kefersteinii	(Selenka, 1867)											x		x									x
		Polyplectana kefersteinii	(Selenka, 1867)		x																				
Elasmobranchii	Carcharhinidae	*Alopias vulpinus*	(Bonnatere)																			x	x		
		Carcharhinus amblyrhynchos	(Bleeker, 1856)															x				x	x		
		Triaenodon obesus	(Ruppel, 1837)								x							x							
	Myliobatidae	*Aetobatus narinari*	(Euphasen, 1790)			x					x	x													

				Reference Number																					
Taxa1	Taxa 2	Genus/Species	Authority	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Osteichthyes	Acanthuridae	*Acanthurus achilles*	Shaw, 1803			x				x	x	x													
		Acanthurus blochii	Valenciennes, 1835									x						x							
		Acanthurus dussimeri	Valenciennes, 1835															x				x	x		
		Acanthurus glaucopareius	Cuvier, 1829							x		x						x							
		Acanthurus guttatus	Schneider, 1801								x														
		Acanthurus nigricauda	Duncker & Mohr, 1929			x																			
		Acanthurus nigroris	Valenciennes, 1835			x				x	x	x													
		Acanthurus olivaceus	Forster & Schneider, 1801			x				x	x	x													
		Acanthurus thompsoni	(Fowler, 1923)															x				x	x		
		Acanthurus triostegus	(Linnaeus, 1758)	x						x	x	x													
		Ctenochaetus hawaiiensis	Randall 1955								x	x													
		Ctenochaetus marginatus	(Valenciennes, 1835)									x													
		Ctenochaetus strigosus	(Bennett, 1828)			x				x	x	x													
		Naso brevirostris	(Valenciennes, 1839)																	x		x	x		
		Naso hexacanthus	(Bleeker, 1855)															x							
		Naso lituratus	Forster & Schneider, 1801			x				x	x	x													
		Naso unicornis	(Forsskal, 1775)			x				x	x							x							
		Zebrasoma flavescens	(Bennett, 1828)			x				x	x	x						x							
		Zebrasoma veliferum	(Bloch, 1797)								x														
	Albulidae	*Albula glossodonta*	(Forsskal, 1775)															x							
	Antennariidae	*Antennarius coccineus*	(Cuvier, 1831)																	x					
	Apogonidae	*Apogon coccineus*	Ruppell, 1838								x														
		Apogon erythrinus	Snyder, 1904							x															
		Apogon kallopterus	Bleeker, 1856			x				x	x														
		Apogon perdix	Bleeker, 1854							x															
		Apogon taeniopterus	Bennett, 1835							x	x	x													
		Epigonus atherinoides	(Gilbert)																			x	x		
		Pseudamiops gracilicauda	Lachner, 1953								x														
	Aulostomidae	*Aulostomus chinensis*	(Linnaeus, 1766)	x						x	x	x										x	x		
	Balistidae	*Melichthys niger*	(Bloch, 1786)	x						x	x	x													
		Melichthys vidua	(Solander, 1844)			x				x	x	x													
		Rhinecanthus aculeatus	(L., 1758)	x						x	x	x													
		Sufflamen bursa	(Bloch & Schneider, 1801)								x														
		Sufflamen fraenatus	(Bloch & Schneider, 1801)																			x	x		
		Xanthichthys auromarginatus	(Bennett, 1831)					x										x				x	x		
	Belonidae	*Platybelone argalus*	(Lesueur, 1821)			x				x															
	Blenniidae	*Cirripectes vanderbilti*	(Fowler, 19380			x																			
		Cirripectes variolosus	(Valenciennes, 1836)							x	x							x							
		Exallias brevis	(Kner,1868)							x	x														
		Istiblennius gibbifrons	(Quoy & Gaimard, 1824)			x				x	x														
	Bothidae	*Bothus mancus*	(Broussonet, 1782)	x						x		x													
	Bromidae	*Eumegistus illusris*	Jordan & Jordan, 1922															x							
	Brotulidae	*Brotula multibarbata*	Temminck & Schlegel, 1846																	x					
		Brotula townsendi	Fowler, 1900							x															

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	Callanthiidae	*Grammatonatus laysanus*	Gilbert, 1905															x				x	x		
	Callionymidae	*Synchiropus rosulentus*	Randall, 1999																						
	Carangidae	*Carangoides ferdau*	Forsskal, 1775			x				x	x							x							
		Carangoides orthogrammus	Jordan & Gilbert, 1881	x														x				x	x		
		Caranx equula	Schlegel, 1844			x																			
		Caranx ignobilis	(Forsskal, 1775)															x							
		Caranx lugubris	Poey, 1860			x												x				x	x		
		Caranx melampygus	Cuvier and Valenciennes, 1833					x										x							
		Caranx sexfasciatus	Quoy & Gaimard, 1824																	x					
		Decapterus marcarellus	Cuvier, 1833															x							
		Elegatis bipinnulatus	(Quoy & Gaimard, 1825)															x				x	x		
		Gnathanodon speciosus	Forsskal, 1775									x													
		Scomberoides lysan	(Forsskal, 1775)	x																					
		Selar crumenophthalmus	(Bloch, 1793)							x															
		Seriola dumerili	(Risso, 1810)															x				x	x		
	Carapodidae	*Carapus mourlani*	(Petit, 1934)															x							
	Chaetodontidae	*Chaetodon auriga*	Forsskal, 1775	x						x	x	x										x	x		
		Chaetodon citrinellus	Cuvier 1831					x		x	x	x													
		Chaetodon ephippium	Cuvier 1831			x				x	x	x													
		Chaetodon lineolatus	Cuvier 1831															2							
		Chaetodon lunula	(Lacepede, 1803)																	x					
		Chaetodon lunulatus	Quoy & Gaimard, 1825			x					x	x													
		Chaetodon miliaris	(Quoy & Gaimard, 1835)															x				x	x		
		Chaetodon modestus	Temminck & Schlegel, 1842															x				x	x		
		Chaetodon multicinctus	Garrett, 1863			x				x	x	x													
		Chaetodon ornatissimus	Cuvier 1831			x				x	x	x													
		Chaetodon quadrimaculatus	Gray, 1831			x				x	x	x										x	x		
		Chaetodon reticulatus	Cuvier 1831								x														
		Chaetodon tinkeri	Schultz, 1951															x				x	x		
		Chaetodon trifascialis	(Quoy & Gaimard, 1825)			x					x	x													
		Chaetodon unimaculatus	Bloch, 1788			x				x	x	x													
		Forciper flavissimus	Jorfan & McGregor, 1898								x							x				x	x		
		Hemitaurichthys thompsoni	Fowler, 1923								x	x						x							
		Heniochus diphreutes	Jordan, 1903															x				x	x		
	Cirrhitidae	*Amblycirrhites bimacula*	(Jenkins, 1903)							x	x														
		Cirrhitus alternatus	Gill, 1862								x														
		Cirrhitus pinnulatus	Bloch & Schneider, 1801			x				x	x														
		Paracirrhites arcatus	(Cuvier 1831)								x														
		Paracirrhites forsteri	(Bloch & Schneider, 1801)								x														
	Congridae	*Ariosoma marginatum*	(Vaillant & Sauvage)																			x	x		
		Conger cinereus	Ruppell, 1830							x								x							
		Conger oligoporus	Kanazawa																			x	x		
	Coryphaenidae	*Coryphaena hippurus*	L., 1758															x							
	Diodontidae	*Diodon hystrix*	Linnaeus, 1758	x														x							

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Taxa1	Taxa 2	Genus/Species	Authority	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	Echeneidae	*Remora remora*	(L., 1758)							x															
	Emmelicthyidae	*Erythrocles scintillans*	(Jordan & Thompson, 1905)															x				x	x		
	Epigonidae	*Pseudamiops gracilicauda*	Lachner, 1953							x															
	Exocoetidae	*Cypeselurus simus*	(Cuvier and Valenciennes, 1846)			x																			
		Cypselurus peocilopterus	(Cuvier and Valenciennes, 1846)			x																			
		Exocoetus volitans	L., 1758				x																		
	Fistulariidae	*Fistularia commersonii*	Ruppell, 1838			x				x	x														
	Gobiidae	*Bathygobius cocosensis*	(Bleeker, 1854)			x																			
		Eviota epiphanes	Jenkins, 1903			x																			
		Gnatholepis anjerensis	(Bleeker, 1850)							x	x														
		Nemateleotris magnifica	Fowler, 1938															x							
		Priolepsis aureoviridis	(Gosline, 1959)															x							
		Priolepsis farcimen	(Jordan & Evermann, 1903)							x															
		Ptereleotris heteroptera	(Bleeker, 1855)															x							
		Trimma unisquamis	(Gosline, 1959)								x														
	Grammistidae	*Pseudogramma polyacantha*	Bleeker, 1856							x	x														
	Hemiramphidae	*Hyporhamphus acutus*	(Gunther, 1871)							x	x														
	Holocentridae	*Myripristis amaena*	(Castelnau, 1873)			2				x	x														
		Myripristis berndti	Jordan and Everman, 1903					x			x														
		Myripristis chryseres	Jordan and Everman, 1903															x				x	x		
		Myripristis kuntee	Cuvier and Valenciennes, 1831															x							
		Neoniphon aurolineatus	(Lienard, 1839)															x				x	x		
		Neoniphon sammara	(Forsskal, 1775)					x		x	x	x													
		Plectrypos lima	(Valenciennes, 1831)							x	x														
		Pristilepis oligolepis	(Whitley, 1941)															x							
		Sargocentron microstoma	(Gunther, 1859)			x																x	x		
		Sargocentron punctatissimum	(Cuvier, 1829)			x				x	x														
		Sargocentron spiniferum	(Forssal, 1775)			x				x	x											x	x		
		Sargocentron tiere	(Cuvier and Valenciennes, 1829)			x				x	x	x													
		Sargocentron xantherythrum	(Jordan and Everman, 1903)							x												x	x		
	Kuhliidae	*Kuhlia marginata*	(Cuvier and Valenciennes, 1829)	x						x															
	Kyphosidae	*Kyphosus bigibbus*	Lacepede, 1802					x																	
		Kyphosus vaigiensis	(Quoy & Gaimard, 1825)							x	x														
	Labridae	*Anampses cuvier*	Quoy & Gaimard, 1824															x							
		Bodianus bilunulatus	(Valenciennes, 1839)	x														x				x	x		
		Cheilio inermis	(Forsskal, 1775)								x														
		Cirrhilabrus luteovittatus	Randall, 1988																	x					
		Coris ballieui	Vaulant & Sauvage, 1875															x							
		Coris flavovittata	(Bennett, 1829)									x													
		Coris gaimard	(Quoy & Gaimard, 1824)								x	x													
		Epibulus insidiator	(Pallas, 1770)			x				x	x	x													
		Gomphosus varius	Lacepede, 1801			x				x	x	x						x							
		Halichoeres ornatissimus	(Garrett, 1863)			x				x															
		Labroides phthirophagus	Randall 1958								x	x										x	x		

Taxa1	Taxa 2	Genus/Species	Authority	Reference Number																					
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
		Macropharyngodon geoffroy	(Quoy & Gaimard, 1824)															x							
		Novaculichthys taeniourus	(Lacepede, 1801)							x															
		Oxycheilinus unifasciatus	Streets, 1877	x						x		x													
		Polylepion russelli	(Gomion & Randall, 1975)															x				x	x		
		Pseudocheilinus evanidus	Jordan & Evermann, 1903																	x					
		Pseudocheilinus octotaenia	Jenkins, 1900							x		x													
		Pseudocheilinus tetrataenia	Schultz, 1960			x				x	x														
		Pseudojuloides cerasinus	(Snyder, 19040															x							
		Stethojulis albovittata	(Bonnaterre, 1788)								x	x													
		Stethojulis axillaris	(Quoy & Gaimard, 1824)							x	x														
		Stethojulis balteata	(Quoy & Gaimard, 1824)								x														
		Thalassoma ballieui	(Vaillant and Sauvage, 1875	x							x	x													
		Thalassoma duperreyi	(Quoy and Gaimard, 1824)	x						x	x	x													
		Thalassoma lutescens	(Lay and Bennett, 1839)			x				x	x	x													
		Thalassoma purpureum	(Forsskal, 1775)			x						x													
		Thalassoma quinguevittatum	(Lay and Bennett, 1839)							x	x	x													
		Thalassoma trilobatum	(Lacepede, 1801)								x														
		Thalassoma umbrostigma	(Ruppell, 1838)									x													
		Wetmorella albofasciata	Schultz & Marshall, 1954																	x					
		Xyrichtys ameitensis	(Gunther, 1862)															x							
		Xyrichtys pavo	Valenciennes, 1839																	x					
	Lutjanidae	*Aphareus furca*	(Lecepede, 1802)			x					x											x	x		
		Aphareus rutilans	Valenciennes, 1830															x				x	x		
		Aprion virescens	Valenciennes, 1830																	x					
		Etelis carbuncalus	Cuvier, 1828															x				x	x		
		Etelis coruscans	Valenciennes, 1862															x				x	x		
		Pristipomoides auricilla	Jordan, Evermann & Tanaka, 1927															x				x	x		
		Pristipomoides filamentosus	Valenciennes, 1830															x				x	x		
		Pristipomoides zonatus	(Valenciennes, 1830)															x				x	x		
		Symphysanodon maunaloa	Anderson, 1970															x				x	x		
	Malacanthidae	*Malacanthus brevirostris*	Guichenot, 1858															x							
	Monocanthidae	*Aluterus scriptus*	(Osbeck, 1775)								x														
		Cantherhines dumerilii	(Hollard, 1854)			x		x																	
		Cantherhines sandwichiensis	(Quoy and Gaimard, 1824)								x	x													
		Pervagor aspricaudus	(Hollard, 1854)			x					x	x													
		Pervagor spilosoma	(Lay and Bennett, 1839)									x													
	Moridae	*Physiculus grinnelli*	Jordan & Jordan, 1922															x							
	Moringuidae	*Moringua ferruginea*	Bleeker, 1855							x	x														
	Mugilidae	*Chaenomugil leuciscus*	(Gunther, 1871)			x				x															
	Mugiloididae	*Parapercis roseoviridis*	(Gilbert, 1905)															x				x	x		
		Parapercis schauinslandi	(Steindachner, 1900)															x							
	Mullidae	*Mulloidichthys flavolineatus*	(Lacepede, 1801)	x						x	x	x													
		Mulloidichthys vanicolensis	(Valenciennes, 1831)			x					x	x													
		Parupeneus barberinus	(Lacepede, 1801)			x																			

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		Parupeneus bifasciatus	(Lacepede, 1801)	x						x		x													
		Parupeneus chrysonemus	Jordan & Evermann																			x	x		
		Parupeneus cyclostomus	(Lecepede, 1801)					x				x						x				x	x		
		Parupeneus multifasciatus	Quoy & Gaimard, 1824	x						x		x						x				x	x		
		Parupeneus pleurostigma	(Bennett, 1830)															x							
	Muraenidae	*Anarchias allardicei*	Jordan & Starks, 1906							x	x														
		Anarchias cantonensis	(Schultz, 1943)							x															
		Anarchias leucurus	Jordan and Starcks, 1906							x	x														
		Echidna leucotaenia	Schultz, 1943							x															
		Echidna polyzona	(Richardson,1844)							x															
		Echidna unicolor	Schultz, 1953								x														
		Enchelycore pardalis	(Temminck & Schlegel, 1846)																	x					
		Gymnomuraena zebra	(Shaw, 1797)							x															
		Gymnothorax berndti	Snyder, 1904															x				2	2		
		Gymnothorax buroensis	(Bleeker, 1857)			x												x							
		Gymnothorax eurostus	(Abbott, 1860)							x	x														
		Gymnothorax flavimarginatus	(Ruppell, 1828)															x							
		Gymnothorax fuscomaculatus	(Schultz, 1953							x	x														
		Gymnothorax gracilicaudus	Jenkins, 1903							x	x														
		Gymnothorax javanicus	(Bleeker, 1859)			x				x	x														
		Gymnothorax margaritophorous	(Bleeker, 1865)																	x					
		Gymnothorax meleagris	(Shaw and Nodder, 1795)			x				x	x														
		Gymnothorax pindae	(Smith, 1962)							x	x														
		Gymnothorax undulatus	(Lacepede,1803)							x	x														
		Gymnothorax nudivomer	(Bleeker, 1864)															x							
		Gymnothorax nuttingi	Snyder, 1904															x				x	x		
		Gymnothorax zonipectis	Seale, 19717																	x					
		Siderea picta	(Ahl, 1789)			x																			
		Uropterygius fuscoguttatus	McCosker & Smith, 1997																						
			Schultz, 1953							x	x														
		Uropterygius inornatus	Gosline, 1958															x							
		Uropterygius polyspilus	Regan, 1905							x															
		Uropterygius supraforatus	(Regan, 1909)				x			x	x														
		Uropterygius macrocephalus	(Bleeker, 1865)								x														
		Uropterygius tigrinus	(Lesson, 1829)	x						x															
	Ophichthidae	*Brachysomophis sauropsis*	Schultz, 1943							x	x														
		Leiuranus semicinctus	(Lay & Bennett, 1839)			x				x	x														
		Muraenchelys cookei	Fowler, 1928							x	x														
		Muraenichthys gymnotus	Bleeker, 1857							x															
		Muraenichthys schultzei	Bleeker, 1864			x				x	x														
		Myrichthys bleekeri				x				x															
		Myrichthys maculosus	(Cuvier, 1917)			x				x	x							x				x	x		
		Phyllophichthus xenodontus	Gosline, 1951								x														
		Schizomorhynchus labialis	Seale, 1917							x															

Taxa1	Taxa 2	Genus/Species	Authority	Reference Number 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
		Schultzidia johnstonensis	(Schultz & Woods, 1917)							x	x														
	Oplegnathidae	*Oplegnathus punctatus*	(Temminck & Schlegel, 1844)															x							
	Ostraciontidae	*Ostracion cubicus*	L., 1758					x																	
		Ostracion meleagris	Shaw, 1796	x		x				x	x	x													
		Ostracion whitleyi	Fowler, 1931			x					x	x													
	Percophididae	*Chrionema chyseres*	Gilbert, 1905															x							
		Chrionema squamiceps	Gilbert, 1905															x							
	Pleuronectidae	*Samariscus triocellatus*	Woods, 1966																	x					
	Polynemidae	*Polydactylus sexfilis*	(Cuvier and Valenciennes, 1931)	x																					
	Pomacanthidae	*Centropyge fisheri*	(Snyder, 1904)															x							
		Centropyge loriculus	(Gunther, 1873)			x	x			x		x													
		Centropyge multicolor	Randall & Wass, 1974																	x					
		Centropyge nahackyi	Kosaki, 1989																	x					
		Centropyge nigriocellus	Woods & Schultz, 1953				x				x														
		Centropyge potteri	(Jordan & Metz, 1912)															x							
		Desmoholocanthus arcuatus	(Gray, 1831)															x				x	x		
	Pomacentridae	*Abudefduf abdominalis*	(Quoy & Gaimard, 1824)																	x					
		Abudefduf sordidus	(Forsskal, 1775)			x						x													
		Chromis acares	Randall & Swerdloff, 1973							x								x							
		Chromis agilis	Smith, 1950			x				x	x	x													
		Chromis verater	Jordan & Metz																			x	x		
		Dascyllus albisella	Gill, 1863							x	x	x										x	x		
		Dascyllus marginatus				x																			
		Plectroglyphidodon imparipennis	(Vaillant & Sauvage, 1875)			x				x		x													
		Plectroglyphidodon johnstonianus	Fowler and Ball, 1925			x				x	x	x													
		Plectroglyphidodon phoenixensis	Schultz, 1843			x				x															
	Priacanthidae	*Cookeolus boops*	(Schneider, 1801)															x							
		Heteropriacanthus cruentatus	(Lacepede, 1801)					x		x	x														
		Priacanthus alalaua	Jordan & Evermann																			x	x		
		Priacanthus meeki	Jenkins, 1903																	x					
	Scaridae	*Calotomus carolinus*	(Valenciennes, 1839)							x	x	x													
		Chlorurus sordidus	(Forsskal, 1775)			x				x	x	x													
		Scarus cyanogrammus		x																					
		Scarus dubius	Bennett, 1828	x						x	x	x													
		Scarus duperreyi		x																					
		Scarus perspicillatus	Steindacher, 1897	x						x	x	x													
		Scarus psittacus	Forsskal, 1775					x																	
		Scarus rubroviolaceus	Bleekeer, 1849															x							
	Scombridae	*Acanthocybium solanderi*	(Cuvier, 1831)															x							
		Euthynnus affinis	(Cantor, 1849)															x							
		Katsuwonis pelamis	(L., 1758)															x							

				Reference Number																					
Taxa1	Taxa 2	Genus/Species	Authority	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
		Thunnus albacarea	(Bonnaterre, 1788)															x							
	Scorpaenidae	*Dendrochirus barberi*	(Steindachner, 1900)															x							
		Neomerinthe rufescens	(Gilbert)																			x	x		
		Pontinus macrocephalus	(Sauvage, 1882)															x				x	x		
		Scorpaena colorata	(Gilbert, 1905)															x							
		Scorpaena kelloggi	(Jenkins, 1903)															x							
		Scorpaenodes hirsutus	(Smith, 1957)																	x					
		Scorpaenodes parvipinnis	(Garrett, 1864)								x														
		Scorpaenopsis diabolus	(Cuvier and Valenciennes, 1829)															x							
		Scorpaenopsis fowleri	(Pietschmann, 1934)																	x					
		Sebastapistes ballieui	(Sauvage, 1875)							x															
		Sebastapistes coniorta	(Jenkins, 1903)							x															
	Serranidae	*Anthias fuscinus*	Randall & Ralston, 1984															x							
		Anthias ventalis	Randall 1979															x							
		Aporops bilinearis	Schultz, 1943																	x					
		Epinephalus quernus	Seale, 1901															x				x	x		
		Holanthias elizabethae	(Fowler, 1923)															x				x	x		
		Holanthias fuscipinnis	(Jenkins, 1901)															x				x	x		
		Liopropoma collettei	Randall & Taylor, 1988																	x					
		Plectranthias helenae	Randall, 1980															x				x	x		
		Plectranthias winniensis	(Tyler, 1966)																	x					
		Promicrops lanceolatus	(Bloch, 1790)															x							
		Pseudanthias bicolor	(Randall, 1979)																	x					
		Pseudanthias fucinus	(Randall & Ralston)																			x	x		
		Pseudanthias randalli	(Lubbock & Allen, 1978)																	x					
	Sphyraenidae	*Sphyraena barracuda*	(Walbaum, 1792)															x							
		Sphyraena helleri	Jenkins, 1901			x																			
	Syngnathidae	*Doryrhamphus excisis*	Kaup, 1856								x														
	Synodontidae	*Saurida flamma*	Waples, 1982															x							
		Saurida gracillis	Quoy & Gaimard, 1824							x	x														
		Synodus binotatus	Schultz, 1953							x	x														
		Synodus engelmani	Schultz, 1953															x							
		Synodus variegatus	Lacepede, 1803								x														
	Tetraodontidae	*Arothron meleagris*	(Bloch & Schneider, 1801)	x						x	x	x													
		Canthigaster coronata	(Vaillant & Sauvage, 1875)																	x					
		Canthigaster inframacula	Allan & Randall, 1977															x							
		Canthigaster jactator	(Jenkins, 1901)					x		x	x	x													
	Triacanthodidae	*Hollardia goslinei*	Tyler, 1968															x							
	Triglidae	*Satyricthys engyceros*	(Gunther, 1871)															x				x	x		
	Xenocongridae	*Kaupichthys hyproroides*	(Stromamm, 1896)								x														
	Zanclidae	*Zanclus cornutus*	(Linnaeus, 1758)			x				x		x										x	x		
Reptilia	Cheloniidae	*Chelonia mydas*	Bocourt, 1835																						
Total Reports				25	92	68	4	12	11	113	148	77	85	149	4	149	6	102	32	26	12	61	102	195	165

APPENDIX B

Previous Reports of Marine Organisms Observed or Collected at Johnston Atoll with 1-2 Listings

Reference	Taxa 1	Taxa2	Genus, Species	Authority, Date	Cited as	Year
Baker et al. 1997	Planta	Chlorophyta	*Borzia elongata*			1995
Moul 1964	Planta	Chlorophyta	*Halimeda tuna*	Moul		1953
Cohen 1997	Anthozoa	Pocilloporidae	*Pocillopora meandrina*	(Dana, 1846)		1996
Cohen 1997	Anthozoa	Acroporidae	*Acropora cythera*	(Dana, 1846)		1996
Cairns 1984	Anthozoa	Flabellidae	*Javania lamprotichum*	Mosley, 1880		
Kay 1961	Gastropoda	Cypraeidae	*Cypraea tigris*	Linn., 1758	*Cypraea tigris schilderiana*	
Brock 1979	Gastropoda	Cypraeidae	*Cypraea tigris*	Linn., 1758		1970
Economakis and Lobel 1998	Elasmobranchii	Carcharhinidae	*Carcharhinus amblyrhynchos*	(Bleeker, 1856)		1992-95
Randall et al. 1977	Elasmobranchii	Carcharhinidae	*Triaenodon obesus*	(Ruppel, 1837)		1968-71
McCosker and Smith 1997	Osteichthyes	Muraenidae	*Uropterygius fuscoguttatus*	McCosker & Smith, 1997		1968
Dee and Parrish 1994	Osteichthyes	Holocentridae	*Myripristis amaena*	(Castelnau, 1873)		1993
Randall 1999	Osteichthyes	Callionymidae	*Synchiropus rosulentus*	Randall, 1999		
Irons 1989	Osteichthyes	Chaetodontidae	*Chaetodon trifascialis*	(Quoy & Gaimard, 1825)		1988
Irons 1990	Osteichthyes	Chaetodontidae	*Chaetodon trifascialis*	(Quoy & Gaimard, 1825)		1988
Kosaki 1989	Osteichthyes	Pomacanthidae	*Centropyge nahackyi*	Kosaki, 1989		1987-88
Kerr and Lobel 1997	Osteichthyes	Pomacentridae	*Abudefduf sordidus*	(Forsskal, 1775)		1995
Mann and Lobel 1995	Osteichthyes	Pomacentridae	*Dascyllus albisella*	Gill, 1863		1995
Mann and Lobel 1998	Osteichthyes	Pomacentridae	*Dascyllus albisella*	Gill, 1863		1995
Lobel 1997	Osteichthyes	Pomacentridae	*Plectroglyphidodon imparipennis*	(Vaillant & Sauvage, 1875)		1995
Randall 1972	Osteichthyes	Labridae	*Anampses cuvier*	Quoy & Gaimard, 1824		1970
Randall 1972	Osteichthyes	Labridae	*Anampses cuvier*	Quoy & Gaimard, 1824		1970
Gorka et al. 1997	Osteichthyes	Acanthuridae	*Ctenochaetus strigosus*	(Bennett, 1828)		1995
Ackman et al. 1992	Reptilia	Cheloniidae	*Chelonia mydas*	Bocourt, 1835		1992
Balazs 1994	Reptilia	Cheloniidae	*Chelonia mydas*	Bocourt, 1835		1992

APPENDIX C

Marine Organisms Observed or Collected in Present Study Listed by Station
Nonindigenous or Cryptogenic Species in Bold
New Johnston Atoll Reports Marked by Asterisks

Taxa	Genus_Species	Author, Date	Station 1	2	3	4	5	6	7	8	9	10	11
Macroalgae													
Cyanophyta	*Ulothrix pseudoflacca**	Wille		X		X							
	Unidentified spp.			X				X					
Chlorophyta	*Acetabularia* sp.							X					
	*Bryopsis hypnoides**	Lamouroux		X				X				X	X
	Bryopsis pennata	Lamouroux									X	X	
	Bryopsis sp.					X							
	Caulerpa ambigua	(Okamura) Prudhomme van Reine & Lockhorst					X						
	*Caulerpa lentillifera**	J. Agardh		X									
	Caulerpa racemosa	(Forsskål) J. Agardh		X									X
	*Caulerpa serrulata**	(Forsskål) J. Agardh	X	X		X	X						
	*Caulerpa webbiana**	Montagne			X							X	
	Cladophora sp.			X						X		X	
	*Dictyosphaeria cavernosa**	(Forsskål) Børgesen			X	X					X		
	Dictyosphaeria versluysii	Weber-van Bosse		X				X		X			
	*Enteromorpha clathrata**	(Roth) Greville		X								X	
	Halimeda discoidea	Decaisne			X	X							
	*Halimeda opuntia**	(Linnaeus) Lamouroux								X			
	*Trichosolen oahuensis**	Egerod					X						
	Trichosolen sp.		X										
	Unidentified sp.				X								
Phaeophyta	*Dictyopteris repens**	(Okamura) Børgesen	X				X						
	Dictyopteris sp.			X									
	*Dictyota acutiloba**	J. Agardh										X	
	*Dictyota divaricata**	Lamouroux		X			X						
	Dictyota sp.				X	X		X	X			X	
	Lobophora variegata	(Lamouroux) Womersley		X	X	X	X	X	X	X	X		X
	Rosenvingea sp.*							X	X				
	Sphacelaria novae-hollandiae	Sonder		X						X			
	Sphacelaria tribuloides	Meneghini							X				
Rhodophyta	*Aglaothamnion boergesenii**	(Aponte & Ballintine) L'Hardy-Halos										X	
	Anotrichium secundum	(C. Agardh) Nageli				X							
	Anotrichium tenue	(C. Agardh) Nageli	X		X				X		X		
	Antithamnion antillanum	Børgsen			X		X			X		X	
	Antithamnion sp.					X							
	*Antithamnionella breviramosa**	Dawson		X									
	Botryocladia sp.*								X				
	*Caulacanthus ustulatus**	(Mertens) Kützing	X				X		X				
	Centroceras clavulatum	(C.Agardh) Montagne					X						
	*Centroceras minutum**	Yamada						X					
	*Ceramium aduncum**	Nakamura		X									
	*Ceramium borneense**	Weber Bosse										X	
	Ceramium codii	(Richards) G. Mazoyer	X						X				
	Ceramium flaccidum	(Harvey) Mazoyer		X	X	X	X						
	*Ceramium macilentum**	J.Agardh				X		X		X			X
	*Ceramium serpens**	Setchell & Gardner									X		
	Ceramium vagans	Silva	X		X								
	Champia parvula	(C. Agardh) Harvey				X						X	
	Chondracanthus sp*.					X							
	Chondria polyrhiza	Collins & Hervey										X	
	Chondria sp.				X	X							
	*Corallophila apiculata**	(Yamada) R.E. Norris				X							
	Corallophila huysmansii	(Weber Bosse) R.E. Norris			X	X				X			
	Crouania	Itono								X			

	*mageshimensis**												
	*Dasya iridescens**	(Schlech) Milar & Abbott		X									
	*Dasya kristeniae**	Abbott				X							
	*Dasya murrayana**	Abbott & Millar			X								
	Dasya sp.*									X		X	
	Diplothamnion jolyi	van den Hoek										X	
	Gelidiella sp.*					X	X						X
	*Gelidiopsis variabilis**	(J. Agardh) Schmitz						X					
	*Griffithsia heteromorpha**	Kützing		X		X	X		X	X	X		X
	*Griffithsia schousboei**	Montagne										X	
	*Griffithsia subcylindrica**	Okamura			X						X		
	*Herposiphonia arcuata**	Hollenberg					X						
	*Herposiphonia crassa**	Hollenberg				X							
	*Herposiphonia delicatula**	Hollenberg	X	X									
	*Herposiphonia parca**	Setchell										X	
	*Herposiphonia secunda**	(C. Agardh) Ambronn								X			
	*Herposiphonia sp.**							X				X	X
	*Herposiphonia variabilis**	Hollenberg			X								
	*Heterosiphonia crispella**	(C. Agardh) Wynne			X							X	
	*Hypnea pannosa**	J.Agardh		X									
	Hypnea sp.			X								X	
	*Hypnea spinella**	(C. Agardh) Kützing		X	X	X		X		X			
	*Hypnea valentiae**	(Turner) Montagne					X						X
	*Jania adhaerens**	Lamouroux											X
	*Jania pumila**	Lamouroux				X		X					
	Jania sp.			X									
	Kallymenia sp.*			X									
	*Laurencia majuscula**	(Harvey) Lucas			X								
	Laurencia sp.*				X	X				X			
	Lomentaria hakodatensis	Yendo			X		X	X			X	X	
	Lomentaria sp.*					X							X
	*Lophosiphonia prostrata**	(Harvey) Falkenberg								X			
	*Monosporus indicus**	Børgesen							X				X
	Neosiphonia sphaerocarpa*				X								
	*Peyssonnelia conchicola**	Piccone & Grunow			X								
	*Peyssonnelia inamoena**	Pilger					X						X
	Peyssonnelia sp.*			X			X				X	X	
	*Polysiphonia delicatula**	Hollenberg		X									
	*Polysiphonia exilis**	Harvey									X		
	*Polysiphonia howei**	Hollenberg		X									
	*Polysiphonia scopulorum**	Harvey					X			X			
	Polysiphonia sp.*		X		X	X			X				
	*Pterocladiella caloglossoides**	(Howe) Santelices						X					
	*Ptilothamnion cladophorae**	(Yamada &Tanaka) Feldmann		X									
	Spermathamnion sp.*				X			X					
	*Stylonema alsidii**	(Zanardini) Howe											X
	*Taenioma perpusillum**	(J. Agardh) J. Agardh								X			
	Tiffaniella sp.*						X						
	Total Algae		9	28	24	25	19	16	11	17	10	21	13
Porifera													
Callyspongiidae	*Callyspongia* sp.*					X							
Chondrillidae	*Chondrosia* sp.*				X	X							
Clionidae	*Cliona* sp.*											X	
Dysideidae	*Dysidea* sp.1*		X										
	Dysidea sp.2*		X						X				

	Dysidea sp.3*											X	
Mycalidae	*Mycale* sp.*				X								
Darwinellidae	*Chelonaplysilla violacea**	(Lendenfeld, 1883)						X	X				
Microcionidae	*Clathria (Microciona) sp.**											X	
Suberitidae	*Prosuberites* sp.1*					X							
	Prosuberites sp.2*									X			
Plankinidae	*Oscarella* sp.*											X	
Unknown	unid sponge #1								X		X		
	unid sponge #2					X							
	unid sponge #3											X	
	unid sponge #4		X										
	Total Porifera		3	0	2	4	0	1	3	1	1	5	0
Cnidaria													
Pennariidae	***Pennaria disticha****	(Goldfuss, 1820)					X		X				
Plumaridae	*Aglaophenia* sp.*					X							
Plumaridae	*Halopteris* sp.*								X				
Plumaridae	*Plumularia strictocarpa**	Pictet, 1893	X										
Milleporidae	*Millepora tenera?*	Boschma, 1949	X			X	X	X	X	X		X	
Stylasterinidae	*Distichopora* sp.					X							
Alcyoniidae	*Sinularia abrupta*	Tixier-Durivault, 1970								X			
Alciidae	*Triactis producta?*	Klunzinger 1877								X			
	?Thelactis simplex	Klunzinger 1878		X									
Isophellidae	*?Telmatactis spp.*						X					X	
Actiniidae?	Unident. Spp.						X						
Pocilloporidae	*Pocillopora damicornis*	(Linn., 1758)											X
	Pocillopora eydouxi	(Milne Edwards and Haime 1860)		X	X	X	X	X	X	X	X		
	Pocillopora meandrina	(Dana, 1846)	X	X	X	X	X	X	X	X	X	X	X
Acroporidae	*Acropora cythera*	(Dana, 1846)		X	X	X	X	X	X	X	X	X	X
	Acropora humilis	(Dana, 1846)				X	X	X	X	X			
	Acropora paniculata	Verrill, 1902									X		
	Acropora valida	(Dana, 1846)		X	X	X	X	X	X	X	X	X	
	Montipora capitata	(Dana, 1846)	X	X	X	X	X	X	X	X	X	X	X
	*Montipora hoffmeisteri**	Wells, 1956									X		
	Montipora patula	Verrill, 1864	X	X	X	X	X	X	X	X	X	X	X
Poritidae	*Porites lobata*	(Dana, 1846)	X			X		X		X	X		
	Portites lutea	(Milne Edwards and Haime 1860)								X			
Agariciidae	*Pavona duerdeni*	(Vaughan, 1907)			X			X	X				X
	Pavona varians	Verrill, 1864		X					X	X			
Fungiidae	*Fungia scutaria*	Lamarck, 1801		X				X	X				
Faviidae	*Cyphastrea ocellina*	(Dana, 1846)	X								X		X
Antipatharia	*Cirrhipathes* sp.					X							
	Total Cnidaria		7	9	7	12	11	11	13	13	11	7	7
Annelida-Polychaeta													
Aphroditidae	Aphroditidae sp.1*				X								
Chrysopetalidae	*Paleanotus* sp.1*			X	X	X				X	X		
Amphinomidae	Amphinomidae unid.		X										
	Eurythoe sp.1				X	X	X	X	X	X	X		X
	Pherecardia striata	(Kinberg, 1857)				X				X			
Glyceridae	*Glycera tesselata**	Grube, 1863	X	X	X	X	X			X	X		
Hesionidae	*Hesionidae* sp.1*				X		X	X	X		X		
Syllidae	*Branchiosyllis* sp.1*								X				
	Brania sp.*			X									
	*Exogone verugera**	(Claparede, 1868)					X	X	X	X			X
	*Haplosyllis spongicola**	(Grube, 1855)	X					X	X	X			
	Opisthosyllis sp.*			X									
	Sphaerosyllis sp.1*											X	
	Syllidae sp.03*		X					X	X				X
	Syllidae sp.12*		X				X	X					X
	Syllidae sp.13*			X	X								
	Syllidae sp.14*				X		X	X					
	Syllidae sp.15*						X						
	Syllidae unid.*		X	X	X	X	X	X	X	X	X	X	X
	Trypanosyllis sp.1*		X			X	X	X	X	X		X	X
	Trypanosyllis sp.2*									X			
	*Trypanosyllis zebra**	(Grube, 1860)									X		
	*Typosyllis hawaiiensis**	(Grube, 1860)	X										
	*Typosyllis hyalina**	(Grube, 1863)				X							
	*Typosyllis prolifera**	Krohn, 1852			X								
	Typosyllis sp.1*		X			X	X	X	X		X		X
	Typosyllis sp.2*		X				X	X	X				X

	Typosyllis sp.3*		X										
	Typosyllis sp.4*		X										
	Typosyllis sp.5*		X										
	Typosyllis sp.6*				X		X	X			X		X
	Typosyllis sp.7*				X								
	Typosyllis sp.8*						X	X				X	
	*Typosyllis variegata**	(Grube, 1860)		X									
Phyllodocidae	*Phyllodoce* sp.1		X					X	X		X	X	
	Phyllodoce sp.2											X	
Nereididae	Nereidae sp.3								X				
	Nereidae sp.4		X	X			X		X				
	Nereidae sp.5			X	X							X	X
Eunicidae	*Eunice antennata**	(Savigny, 1820)	X				X		X				
	*Eunice cariboea**	(Grube, 1856)		X	X		X	X			X	X	X
	*Eunice vittata**	(delle Chiaje, 1828)					X	X				X	
	Eunicidae sp.3		X										
	*Lysidice ninetta**	Audouin and Milne Edwards, 1833	X	X		X	X	X	X			X	X
	*Nematonereis unicornis**	Schmarda, 1861	X	X	X	X	X	X	X		X	X	X
	Oenone sp.			X									
Lumbrineridae	*Lumbrineris* sp.1*							X					X
Spionidae	Spionidae unid.*		X	X	X			X		X	X		
Dorvilleidae	Dorvilleidae sp.1*		X	X	X	X	X	X	X	X	X	X	X
Sabellidae	***Branchiomma nigromaculata****	(Baird, 1865)					X					X	
	*Megalomma intermedium**	(Beddard, 1888)	X						X				
Terebellidae	Terebellidae unid.*			X		X					X		X
Serpulidae	Serpulidae unid.*							X					
	*Vermiliopsis torquata**	Treadwell, 1943				X		X	X				X
Spirorbidae	Spirorbidae unid				X		X	X			X		
Cirratulidae	Cirriformia spp.*		X				X	X			X	X	
	Dodecaeria sp.*							X					
Opheliidae	***Armandia intermedia****	Fauvel, 1901	X										
	*Polyophthalmus pictus**		X	X	X	X	X	X	X	X	X	X	
	Total Polychaeta		25	17	18	14	24	27	20	12	17	15	17
Sipunculida													
Aspidosiphonidae	*Aspidosiphon elegans**	(Chamisso and Eysenhardt, 1821)	X	X		X	X	X					X
	*Lithacrosiphon cristatus**	(Sluiter, 1902)	X		X	X							
Phascolosomatidae	*Phascolosoma nigrescens**			X									
	*Phascolosoma stephensoni**		X										
	Total Sipunculidae		3	2	1	2	1	1					1
Arthropoda-Crustacea													
Cirripedia	*Nesochthamalus intertextus**	(Darwin, 1854)	X										
Cumacea	unid. Cumaceans*				X	X	X	X	X	X		X	
Tanaidacea	unid. Tanaids*				X	X	X	X	X	X	X	X	X
Isopoda	*Apanthura* sp.*		X	X				X	X			X	
	asellotes*			X		X		X	X		X	X	X
	Carpias sp.*		X	X	X	X	X	X	X	X	X	X	X
	Cirolana sp.*									X			X
	Gnathia sp.*			X	X		X		X	X			X
	Hadromastax sp.*									X			
	Joeropsis sp.*			X	X	X				X	X	X	X
	Lepanthura sp.*								X				
	Mesanthura sp.*						X		X	X			X
	Mizothenar sp.*									X			
	Munna sp.*							X	X				
	Panathura sp.*			X	X	X		X	X	X	X	X	X
	Paranthura sp.*											X	X
	Santia sp.*						X			X		X	
	sphaeromatids*		X			X				X			
	Stenetrium sp.*			X	X		X		X	X		X	X
Amphipoda	*Amphilocus likelike**	Barnard, 1970		X		X			X				
	*Amphilocus menehune**	Barnard, 1970	X		X	X	X	X		X	X	X	X
	*Ampithoe kaneohe**	Barnard, 1970	X			X				X			X
	*Ampithoe poipu**	Barnard, 1970		X	X	X	X	X					X
	*Ampithoe ramondi**	Audouin, 1826		X		X	X	X	X				X
	*Ampithoe sp.**						X	X					
	*Ampithoe waialua**	Barnard, 1970	X	X	X	X	X			X	X	X	X

	*Aoroides nahili**	Barnard, 1970		X				X	X				X
	Caprellid unid.			X	X	X	X	X	X		X		
	*Ceradocus hawaiiensis**	Barnard, 1955			X	X		X		X	X	X	
	*Colomastix sp.1**									X			
	*Elasmopus ecuadorensis**	Schellenberg, 1938											X
	*Elasmopus hooheno**	Barnard, 1970	X	X	X	X	X	X	X	X	X	X	X
	*Elasmopus piikoi**	Barnard, 1970						X				X	X
	*Elasmopus pocillimanus**	(Bate, 1862)			X	X				X			X
	*Ericthonius brasiliensis**	(Dana, 1853)											X
	*Eusiroides diplonyx**		X							X			
	*Gammaropsis abbotti?**		X		X	X				X	X	X	
	*Gammaropsis atlantica-afra**	Stebbing, 1888								X		X	
	*Gammaropsis pokipoki?**	Barnard, 1970				X							
	*Gammaropsis sp.**												X
	*Gitana sp.**				X	X							X
	*Hyale affinis**	Chevreux, 1908										X	X
	*Hyale honoluluensis**	Schellenberg, 1938											X
	*Ischyrocerus kapu**	Barnard, 1970										X	
	*Lembos kamanu**	Barnard, 1970			X								
	*Lembos leapakahi**	Barnard, 1970	X	X	X		X	X	X		X	X	
	*Lembos sp.1**					X				X		X	X
	*Leucothoe hyhelia**	Barnard, 1965		X	X	X	X	X	X	X	X	X	X
	*Leucothoe sp.1**					X	X			X			
	*Leucothoe sp.2**								X			X	
	*Leucothoella bannwarthi**					X		X		X			
	*Liljeborgia laniloa**	Barnard, 1970		X	X			X	X	X	X	X	X
	*Listriella sp.1**				X	X	X	X	X	X		X	X
	*Maera kaiulani?**	Barnard, 1970						X					
	*Maera pacifica**	Schellenberg, 1938		X					X				
	*Maera quadrimana**	(Dana, 1853)	X	X	X	X		X	X	X	X	X	X
	*Maera sp.1**		X	X	X			X	X			X	
	*Maera sp.2**					X				X			
	*Melita sp.1**								X		X		
	*Nuuanu amikai**	Barnard, 1970						X		X			
	*Photis aina**	Barnard, 1970				X			X	X		X	
	*Seba? sp.**				X								
	*Stenethoe sp.1**									X			
	*Tepidopleustes honomu**					X							
	*unid Amphilochidae**					X							
	*unid amphipod A**												X
	*unid amphipod B**			X									
	*unid Exoedicerotidae**					X							
	*unid Gammaridae**							X					X
	*unid Phoxocephalidae**											X	
Palaemonidae	*Harpiliopsis depressa*	(Stimpson, 1860)		X	X						X		
	Jocaste lucina?	(Nobili, 1901)									X		
Pontoniidae	*Palaemonella rotumana**	Borradaile	X	X							X		
	unid Pontoniidae		X										
Alpheidae	*Alpheus amirantei**	Coutiere, 1908			X	X							
	Alpheus brevipes	Stimpson, 1860		X	X	X		X			X	X	
	Metalpheus rostratipes (=A. nanus)	(Pocock, 1890)				X				X			
	Alpheus diadema	Dana, 1852						X					X
	Alpheus lottini	Guerin, 1830									X		
	Alpheus paracrinatus	Miers, 1881		X									
	*Alpheus pugnax**	Dana, 1852				X							
	*Alpheus rapax**	Fabricius, 1789									X		
	*Synalpheus charon**	(Heller, 1861)				X							
	Synalpheus paraneomeris	Coutiere, 1905	X	X	X	X		X	X	X			
Hippolytidae	*Hippolyte sp.**						X					X	X
	*Saron sp.**									X		X	
	*Thor paschalis**	(Heller)										X	
	*Thorina maldivensis**	Borradaile	X		X				X	X	X		
	unid Hippolytidae								X				
Diogenidae	*Calcinus haigae?**									X			
	Calcinus latens	Randall									X	X	
	Calcinus sp.1		X										
	Calcinus sp.2			X		X							

	*Dardanus sanguinocarpus**					X							
Portunidae	*Catoptrus inaequalis*	(Rathbun, 1906)				X			X				
	*Thalamita edwardsi**		X		X			X			X	X	
	Thalamitoides sp.					X				X			
Grapsidae	*Pachygrapsus plicatus**	(A.Milne Edwards, 1873)	X										
Majidae	*Perinea tumida*	Dana, 1852	X	X	X	X	X	X				X	X
	unid majid		X				X						
Xanthidae	*Actaea nodulosa**	(White, 1947)								X			
	Chlorodiella laevissima	(Dana, 1852)	X	X	X	X	X	X	X	X	X	X	X
	*Domecia glabra**	Alcock, 1899									X		
	Domecia sp.			X	X		X				X		
	*Etisus demani**	Odhner, 1925									X		
	Etisus electra	(Herbst, 1801)		X				X			X		
	Etisus sp.								X				
	*Garthiella aberrans**	(Rathbun, 1906)		X					X			X	
	Leptodius sanguineus	(H. Milne-Edwards, 1834)	X										
	Leptodius sp.							X			X		
	Liocarpilodes interrimus	Dana, 1852	X	X	X	X	X	X	X	X	X	X	X
	Liomera bella	(Dana, 1852)	X						X				
	Lophozozymus ?dodone	(Herbst, 1801)				X							
	*Medaeus elegans?**	A. Milne-Edwards, 1867									X		
	Phymodius nitidus	(Dana, 1852)	X		X								
	Phymodius sp.						X						
	*Phymodius ungulatus**	(H. Milne-Edwards, 1834)	X						X				
	Pilodius areolatus	(H. Milne-Edwards, 1834)	X						X			X	
	Pilodius sp.		X										
	*Platypodia semigranosa**	(Heller, 1861)							X				
	*Tetraloides heterodactyla**	(Heller, 1861)									X		
	*Tetraloides nigrifons**	(Dana, 1852)									X		
	Tetraloides sp.			X		X					X		
	*Tetraloides vanninii**	Gabil & Clark, 1988									X		
	Trapezia digitalis	(Dana, 1852)									X		
	Trapezia ferruginea	Latreille, 1823									X		
	Trapezia sp.					X		X					
	*Trapezia speciosa**	Dana, 1852									X		
	Trapezia tigrina	Eydoux & Souleyet, 1842									X		
	Tweedieia laysani	(Rathbun, 1906)	X	X	X	X	X	X	X	X	X	X	X
	unid xanthid			X	X								
Cryptochiridae	*Cryptochirus coralliodytes**	Heller, 1861			X								X
Bresiliidae	*Discias sp.*												X
Dromiidae	*Dromia dormia**	(Linnaeus, 1763)		X	X								
Galatheidae	*Galathea spinosorostris*	Dana, 1852	X		X	X				X	X	X	
	Total Crustacea		32	37	40	49	26	37	39	45	43	42	40
Mollusca-Gastropoda													
Scissurellidae	*Scissurella pseudoequatoria**	Kay, 1979											X
	*Sinezona insignis**	Smith, 1910				X							
Fissurellidae	*Diodora granifera*	Pease, 1861	X	X	X		X	X					
Patellidae	*Emarginula sp.*				X		X						
Eatoniellidae	*Eatoniella pigmenta**	Kay, 1979			X								
	Eatoniella sp.			X	X	X	X	X					X
Rissoidae	*Barleeia calcarea**	Kay, 1979	X	X		X	X		X	X			X
	Merelina sp2.								X				X
	Merelina wanawana	Kay, 1979	X	X		X	X	X	X	X	X		X
	*Parashiela beetsi**	Ladd, 1966	X										
	Rissoina ambigua	Gould, 1849		X		X							
	Rissoina costata	A. Adams, 1851	X	X		X	X			X			X
	*Rissoina pulchella**	Brazier, 1877											X
	*Zebina tridentata**	Michaud, 1830	X										
Trochidae	*Euchelus angulata*	Pease, 1865	X	X		X	X	X					X
	Gibbula marmorea	Pease, 1861			X			X					X
	Gibbula sp.			X	X	X	X	X	X				X
Stomatellidae	*Synaptocochlea concinna**	Gould, 1845		X							X		
Skeneidae	*Lophocochlias minutissimus**	Pilsbry, 1921		X		X		X	X	X			X
Turbinidae	*Leptothyra rubricincta*	Mighels, 1845	X	X	X	X	X	X	X	X	X		X
	*Turbo sandwicensis**	Pease, 1861	X		X		X			X			
	*Turbo sandwichensis (juv)**	Pease, 1861		X									
Omalogyridae	*Omalogyra japonica*	Habe, 1972		X	X		X						X
Orbitestellidae	*Orbitestella emeryi**	(Ladd, 1966)		X	X		X						X

Rissoellidae	*Rissoella longispira**	Kay, 1979			X		X						X
	Rissoella sp.			X			X						
Phasianellidae	*Tricolia variabalis*	Pease, 1861	X	X	X	X	X	X	X	X	X		
Muricidae	*Aspella producta?*	Pease, 1861				X							X
	Chicorous sp.					X							
Architectonicidae	*Philippia radiata**	Röding, 1798							X				
Thaididae	*Drupa ricina*	Linnaeus, 1758				X	X						
	Drupa rubusidaeus	Röding, 1798				X							X
	*Drupella elata**	Blainville, 1832					X						
	Drupella ochrostoma	(Blainville, 1832)	X	X	X	X	X			X		X	
	Morula granulata	(Duclos, 1832)		X	X								
	*Morula uva**	Röding, 1798			X								X
	Thais armigera	Link, 1807				X	X			X			
Coralliophilidae	*Coralliophila erosa*	Röding, 1798		X									
	*Lataxis sp. (like L. idoleum)**			X									
	Quoyula madreporarum	Sowerby, 1834									X		
Phenacolepadidae	*Phenacolepaes scobinata**	Gould, 1859					X						
Littorinidae	*Littoraria pintado*	(Wood, 1828)	X										
	Littoraria scabra	(Linnaeus, 1758)	X										
Terebridae	*Duplicaria (Terebra) gouldi**	Deshayes, 1859		X							X		
	Terebra crenulata	(Linn., 1758)		X		X							
	Terebra guttata	(Roding, 1798)									X		
Vermetidae	*Dendropoma platypus*	Morch , 1861	X						X				
	Dendropoma platypus (juv)		X	X	X		X	X	X	X	X		
Ceacidae	*Caecum sp.*			X	X	X	X		X	X	X		X
Modulidae	*Modulus candidus**				X								
Cypraeidae	*Cypraea caputserpentis*	Linnaeus, 1758										X	
	Cypraea helvola	Linnaeus, 1758								X			
	Cypraea isabella	Linnaeus, 1758		X								X	
	Cypraea moneta	Linnaeus, 1758		X									
	Cypraea tigris	Linnaeus, 1758		X						X			
	Cypraea vitellus	Linnaeus, 1758										X	
Naticidae	*Polinices melanostomus*	Gmelin, 1791									X		
Vasidae	*Vasum ceramicum**	Linnaeus, 1758		X									
	Vasum sp. (juv)				X								
	Vasum turbinelles	Linnaeus, 1758	X			X		X	X				X
Dialidae	*Cerithidium perparvulum*	Watson, 1886	X										X
Cerithiidae	*Bittium sp.*										X	X	
	Cerithium columna	Sowerby, 1841	X	X				X					
	Cerithium interstriatum	Sowerby, 1841	X										
	Cerithium nesioticum	Pilsbry and Vanatta, 1905	X	X	X	X		X	X		X		
	Cerithium sp.											X	
	*Cerithium zebrum**	Kiener, 1841										X	
	Plesiotrochus luteus	Gould, 1861		X	X	X			X	X			
	Rhinoclavis sinensis	Gmelin, 1791			X							X	
Cerithopsidae	*Joculator ridicula?**	Watson, 1886			X								
Epitoniidae	*Epitonium kanemoe?**	Pilsbry, 1921									X		
Eulimidae	*Balcis spp.*			X	X						X		
	Stilifer sp. (linckiae?)						X						
	*Thyca crystallina**	Gould,1846		X									
Fossaridae	*Fossarus sp.*			X									
Hipponicidae	*Antisabia foliacea*	Knudsen, 1993			X								X
	Hipponicid (juv)			X			X	X	X		X		
	*Hipponix australis**	Lamarck, 1819		X	X		X	X					
	Hipponix sp.						X						
Cymatiidae	*Cymatium nicobaricum?*	Röding, 1798	X										
	*Cymatium pileare**	Linnaeus, 1758									X	X	
Turridae	*Daphnella sp.*			X									
	Kermia sp1.									X	X		
	Kermia sp2.			X									
	Macteola segesta	Chenu, 1850						X					
Bursidae	*Bursa cruentata*	Sowerby, 1841					X						
Columbellidae	*Anachis miser**	Sowerby, 1844						X					
	Collumbelid sp.												X
	Seminella smithi	Angas, 1877				X				X			
	Seminella virginea	Gould, 1860		X		X	X	X		X			
Nassariidae	*Nassarius crematus*	Hinds, 1844						X					
	Nassarius papillosus	Linnaeus, 1758								X			
	Nassarius pauperus	Gould, 1850	X				X	X			X	X	
Fasciolariidae	*Peristernia ochrostoma**	(Sowerby,1825)	X	X	X		X	X	X	X	X	X	

	Peristernia sp. (juv)					X							X
Olividae	*Oliva sp.*						X			X		X	X
Marginellidae	*Dentimargo sp.*		X			X	X						
	Gramelina sp.		X										
	*Granula sandwicensis**	Pease, 1860				X							X
	Granulina		X	X		X	X	X					X
	Gyrincum sp.									X			
	Marginella sp.1		X				X						X
	Marginella sp.2			X							X		
	Volvarina sp.			X									
Mitridae	*Imbricaria olivaeformis*	Swainson, 1821		X			X				X		X
	Mitridae sp.										X		
Costellaridae	*Vexillum unifasciatum**	Wood, 1828		X							X		
Pyramidellidae	*Evalea sp. (waikikiensis?)**	Pilsbry, 1918						X					
	*Herviera gliriella**	Melville and Standen, 1896		X									
	*Koloonella sp. (hawaiiensis?)**	Kay, 1979					X	X					
	Miralda sp.		X	X					X				X
	Odostomia gulicki	Pilsbry, 1918											X
	*Odostomia oxia**	Watson, 1886											X
	*Otopleura mitralis**	Adams, 1854		X									
	*Turbonilla cornelliana**	Newcomb, 1870					X						
Actaeonidae	*Pupa tessellata*	Reeve, 1842		X									X
Siphonariidae	*Williamia radiata*	Pease, 1861	X										X
	Siphonaria sp.							X					
Scaphandridae	*Acteocina sp.*			X									
Conidae	*Conus lividus*	Hwass in Bruguière, 1792					X						
	Conus lividus (juv)	Hwass in Bruguière, 1792				X	X						X
	Conus miles	Linnaeus, 1758				X							
	Conus pulicarius	Hwass in Bruguière, 1792		X							X		
	Conus rattus	Hwass in Bruguière, 1792				X	X				X		
	Conus sp. (juv)					X							
Costellariidae	c.f. *Pusia microzonias**	Lamarck, 1811			X								
Mollusca-Opisthobranchia													
Atyidae	*Atys curta**	Adams, 1850					X						
	Atys debilis	Pease, 1860		X	X		X	X					
	Atys semistriata	Pease, 1860		X									
	Diniatys dentifer	Adams, 1850			X		X						
Aglajidae	*Philinopsis sp.*			X									
Aplysiidae	*Aplysia sp*					X						X	
	*Aplysia sp. (juiliana?)**	Quoy and Gaimard, 1832										X	X
	*Dolabella auricularia**		X										
Pleurobranchidae	*Berthellina citrina**	Rupell and Leuckart,1831		X	X								
	Pluerobranchia sp.			X									
Juliidae	*Julia exquisita**	Gould, 1862	X	X					X				X
Dorididae	*Chromodoris vibrata*	Pease, 1860										X	
	Chromosdoris sp.			X									
	*Risbecia imperialis**	Pease, 1860										X	
Dendrodorididae	*Dendrodoris nigra**	Stimpson, 1856										X	
Mollusca-Bivalvia													
Arcidae	*Arca ventricosa*	Lamarck, 1819		X		X				X			
	*Barbatia decussata**	Sowerby, 1823		X									
	*Barbatia divaricata**	Sowerby, 1833					X						
	Benthacara decorata?	Hayami and Kase, 1993					X						
Mytilidae	*Crenella sp. (c.f Hayami and Kase, 1993)*				X								
	Lithophaga sp.						X						
	Septifer bryanae	Pilsbry, 1921				X				X		X	X
Pinnidae	*Pinna muricata*	Linnaeus, 1758		X									
Pteriidae	*Pinctada margaritifera*	Linnaeus, 1758	X		X								
	*Pinctada radiata**	Leach, 1814	X									X	
	Pteria sp.				X								
Isognomonidae	*Isognomon perna*	Linnaeus, 1767	X	X		X					X		
Malleidae	*Malleus regula*	Forskål, 1775		X									
Pectinidae	*Chlamys coruscans hawaiensis**	Dall, Bartsch, and Rehder, 1938		X									
	Mirapecten mirificus	Reeve, 1853			X								
Spondylidae	*Spondylus sp1.*		X							X			
	Spondylus sp2.									X			
	Spondylus sp3.									X			

Chamidae	*Chama iostoma*	Conrad, 1837	X					X					
Lucinidae	*Ctena bella*	Conrad, 1837		X			X						
	Ctena sp.												X
	Lucina edentula	Linnaeus, 1758									X		
Lasaeidae	*Radobornia bryani**	Pilsbry, 1921		X									
Cardiidae	*Fragum mundum*	Reeve, 1845		X			X	X					
	*Trachycardium orbita**	Sowerby, 1833		X			X						
Mesodesmatidae	*Ervilia bisculpta**	Gould, 1861					X						X
	Rochefortina sandwichensis	Smith, 1885		X		X	X		X	X	X		
Tellinidae	*Macoma obliquilineata*	Conrad, 1837					X				X		
	Tellina crucigera	Lamarck, 1818		X									
	*Tellina robusta**	Hanley, 1844					X				X		
	*Tellina scobinata**			X							X		
Veneridae	*Periglypta reticulata**	Linnaeus, 1758						X					
Philobryidae	*Cratis sp (kanekoi?)**	Hayami and Kase, 1993			X						X		
Chitonidae			X										
	Total Mollusca		37	71	36	37	53	29	19	27	32	19	40
Ectoprocta													
Buguliidae	***Bugula vectifera?****					X							
	Caulibugula dendrograpta*		X										
Crisiidae	*Crisia circinata**	Waters, 1914	X										
Celleporaridae	*Celleporaria aperta**	Hincks, 1882							X				
	*Celleporaria fusca**	Busk, 1854	X										
	*Celleporaria pilaefera**	Canu and Bassler, 1927					X						
Hippopodinidae	*Hippopodina feegeensis**	(Busk, 1884)		X									
Microporellidae	*Microporella orientalis**	Harmer, 1957	X										
Smittinidae	*Parasmittina sp.**		X										
Scrupocellariidae	*Scrupocellaria sinuosa**	Canu and Bassler, 1927			X							X	
Farciminariidae	***Didymozoum triseriale****	(Philipps, 1899)				X							
Savignyellidae	*Halysis diaphana**	(Busk, 1860)				X							
	Total Ectoprocta		5	1	1	3	1	0	1	0	0	1	0
Ecchinodermata													
Amphiuridae	*Amphipholis squamata**	Delle Chiaje, 1828)											X
Ophiotrichidae	*Ophiactis savignyi*	(Muller and Troschel)	X	X					X				
	Ophiactis sp. 1*		X										
	Ophiactis sp. 2*									X			
Ophicomidae	*Ophiocoma erinaceus*	Muller and Troschel, 1842			X	X							
	Ophiocoma pica	Muller and Troschel, 1842			X								
Ophiodermitidae	*Ophioconis permixta?**					X							
	Ophiopeza sp.					X							
Unident.	*Ophiuroidea juvs.*					X							
Acanthasteridae	*Acanthaster planci*	(Linn., 1758)				X				X			
Ophidiasteridae	*Linckia multifora*	(Lamarck, 1816)						X					
Cidaridae	*Chondrocidaris gigantea**	A. Agassiz, 1863								X			
Diadematidae	*Diadema paucispinum**	Agassiz, 1863	X			X	X			X			
	Echinothrix calamaris	(Pallas, 1774)								X			
	Echinothrix diadema	(Linn., 1758)		X	X	X				X	X		
Cidaridae	*Eucidaris metularia**	Lamarck, 1816)			X					X			
Toxopneustidae	*Tripneustes gratilla*	(Linn., 1758)	X	X	X	X			X	X			
Cidaridae	*Actinocidaris thomasi*	Agassiz & Clark, 1907					X						
Echinometridae	*Echinometra mathaei*	(de Blainville, 1826)		X	X	X				X	X		
	Echinostrephus aciculatus	A. Agassiz, 1863				X				X			
	Heterocentrotus mammillatus	(Linn., 1758)		X	X	X				X	X		
Holothuriidae	*Bohadschia paradoxa**	(Selenka, 1867)		X	X	X				X		X	
	Holothuria (Cystipus) rigida										X		
	*Holothuria arenicola?**	Semper, 1868		X									
	Holothuria atra	Jaeger, 1883		X	X	X				X	X		
	Holothuria edulis	Lesson, 1830		X									
	Holothuria hilla	Lesson, 1830						X					
	*Holothuria whitmaei**	Bell, 1887		X						X			
Synaptidae	*Euapta godeffroyi**	(Semper, 1868)								X			
	*Polyplectana kefersteinii**	Selenka, 1867			X								
	Total Echinodermata		4	10	10	13	2	2	2	15	5	1	1
Ascidiacea													
Polyclinidae	*Aplidium sp.**									X			
	*Polyclinum pute**	C. & F. Monniot, 1987				X				X		X	
	Polyclinum sp.*					X							

Didemnidae	*Didemnum* sp. 1*											X	
	Didemnum sp. 2*											X	
Perophoridae	*Ecteinascidia imperfecta**	Tokioka, 1970							X				
	*Perophora faaopa**	C. & F. Monniot, 1987										X	
	*Perophora multiclathrata**	(Sluiter, 1904)							X				
Ascidiidae	*Ascidia* sp.*		X			X			X	X			
	Ascidia sydneiensis*	Stimpson, 1855							X				
	Diplosoma listerianum*	(Milne-Edwards, 1841)	X	X			X		X				
Styelidae	*Symplegma* sp.*								X				
Pyuridae	***Microcosmus exasperatus****	Heller, 1878	X					X					
	Total Ascidia		3	1	0	3	1	1	6	3	0	4	0
Fish													
Rhincodontidae	*Rhincodon typus**	Smith, 1828					X						
Carcharhinidae	*Carcharhinus amblyrynchos*	(Bleeker, 1856)				X				X		X	
Myliobatidae	*Aetobatus narinari*	(Euphasen, 1790)				X							
Mobulidae	*Manta birostris**	Walbaum, 1792											X
Muraenidae	*Gymnothorax javanicus*	(Bleeker, 1859)		X		X							
	Gymnothorax meleagris	(Shaw and Nodder, 1795)				X							
Belonidae	*Platybelone argalus*	(Lesueur, 1821)					X						
Holocentridae	*Myripristis berndti*	Jordan and Everman, 1903	X	X	X	X	X			X			
	Sargocentron spiniferum	(Forssal, 1775)	X	X	X	X			X	X	X		
Aulostomidae	*Aulostomus chinensis*	(Linnaeus, 1766)			X	X	X		X				
Fistulariidae	*Fistularia commersonii*	Ruppell, 1838	X		X		X		X	X			
Scorpaenidae	*Dendrochirus barberi*	(Steindachner, 1900)				X							
Apogonidae	*Apogon* sp.				X		X						
Carangidae	*Carangoides orthogrammus*	Jordan & Gilbert, 1881				X							
	Caranx ignobilis	(Forsskal, 1775)										X	
	Caranx lugubris	Poey, 1860				X						X	
	Caranx melampygus	Cuvier and Valenciennes, 1833				X		X	X	X		X	X
	Scomberoides lysan	(Forsskal, 1775)							X	X			
	Seriola dumerili	(Risso, 1810)				X	X					X	
Lutjanidae	*Aphareus furca*	(Lecepede, 1802)				X							
Mullidae	*Mulloidichthys flavolineatus*	(Lacepede, 1801)		X			X	X	X		X		
	Mulloidichthys vanicolensis	(Valenciennes, 1831)	X	X	X				X				
	Parupeneus bifasciatus	(Lacepede, 1801)	X				X	X	X			X	X
	Parupeneus cyclostomus	(Lecepede, 1801)					X		X				
	Parupeneus multifasciatus	Quoy & Gaimard, 1824		X	X	X	X	X	X	X	X	X	X
	Parupeneus pleurostigma	(Bennett, 1830)										X	
Kyphosidae	*Kyphosus vaigiensis*	(Quoy & Gaimard, 1825)	X		X			X	X	X	X	X	X
Chaetodontidae	*Chaetodon auriga*	Forsskal, 1775	X			X	X		X	X		X	X
	Chaetodon citrinellus	Cuvier 1831							X	X			X
	Chaetodon ephippium	Cuvier 1831		X	X		X	X	X		X	X	X
	Chaetodon lunulatus	Quoy & Gaimard, 1825		X	X		X		X		X	X	X
	Chaetodon miliaris	(Quoy & Gaimard, 1835)				X							
	Chaetodon multicinctus	Garrett, 1863	X	X	X	X				X	X	X	X
	Chaetodon ornatissimus	Cuvier 1831				X	X		X		X	X	X
Chaetodontidae	*Chaetodon quadrimaculatus*	Gray, 1831								X			
	Chaetodon trifacialis	(Quoy & Gaimard, 1825)		X	X	X	X	X	X	X	X	X	X
	Chaetodon unimaculatus	Bloch, 1788	X	X	X	X	X		X			X	X
	Forciper flavissimus	Jorfan & McGregor, 1898			X					X			
Pomacanthidae	*Centropyge loricula*	(Gunther, 1873)		X		X				X		X	
	Centropyge nahackyi	Kosaki, 1989				X							
	Centropyge potteri	(Jordan & Metz, 1912)				X				X			
	Desmoholocanthus arcuatus	(Gray, 1831)				X							
Cirrhitidae	*Cirrhitus pinnulatus*	Bloch & Schneider, 1801			X	X				X			
	Paracirrhites arcatus	(Cuvier 1831)		X		X							
Pomacentridae	*Abudefduf abdominalis*	(Quoy & Gaimard, 1825)							X				
	Abudefduf sordidus	(Forsskal, 1775)	X				X	X	X	X			X
	Chromis agilis	Smith, 1960				X				X			
	Dascyllus albisella	Gill, 1863	X	X	X	X	X		X	X	X		
	Plectroglyphidodon imparipennis	(Vaillant & Sauvage, 1875)								X			
	Plectroglyphidodon johnstonianus	Fowler & Ball, 1924		X	X	X	X			X	X	X	
Labridae	*Bodianus bilunulatus*	(Valenciennes, 1839)								X			
	Coris flavovittata	(Bennett, 1829)								X		X	
	Epibulus insidiator	(Pallas, 1770)						X	X	X		X	X
	Gomphosus varius	Lacepede, 1801		X	X	X		X		X	X	X	X
	Halichoeres ornatissimus	(Garrett, 1863)						X					

	Labroides phthirophagus	Randall 1958								X			
	Novaculichthys taeniourus	(Lacepede, 1801)						X					X
	Oxycheilinus unifasciatus	Streets, 1877			X		X			X		X	X
	Pseudocheilinus octotaenia	Jenkins, 1900				X						X	
	Stethojulis balteata	(Quoy & Gaimard, 1824)			X	X				X		X	
	Thalassoma ballieui	(Vaillant and Sauvage, 1875		X	X	X				X			
	Thalassoma duperreyi	(Quoy and Gaimard, 1824)	X	X	X	X	X	X	X	X	X	X	X
	Thalassoma lutescens	(Lay and Bennett, 1839)		X		X	X			X	X		
Scaridae	*Chlorurus perspicillatus*	Steindacher, 1897							X				X
	Chlorurus sordidus	(Forsskal, 1775)	X	X	X	X	X	X	X	X	X	X	X
Gobiidae	*Nemateleotris magnifica*	Fowler, 1938				X				X			
Scombridae	*Thunnus albacarea*	(Bonnaterre, 1788)	X										
Acanthuridae	*Acanthurus achilles*	Shaw, 1803		X	X	X	X	X		X	X		X
	Acanthurus blochii	Valenciennes, 1835	X	X	X	X	X	X	X	X	X	X	X
	Acanthurus dussimeri	Valenciennes, 1835							X				
	Acanthurus nigroris	Valenciennes, 1835	X	X	X	X	X		X	X	X	X	X
	Acanthurus olivaceus	Forster & Schneider, 1801	X			X	X		X	X		X	
	Acanthurus thompsoni	(Fowler, 1923)				X							
	Acanthurus triostegus	(Linnaeus, 1758)	X	X	X			X	X		X	X	X
	Ctenochaetus hawaiiensis	Randall 1955		X	X					X			
	Ctenochaetus strigosus	(Bennett, 1828)	X	X	X	X	X	X	X	X	X	X	X
	Naso lituratus	Forster & Schneider, 1801	X	X	X	X	X	X	X	X	X	X	X
	Zebrasoma flavescens	(Bennett, 1828)		X	X	X	X		X	X		X	X
	Zebrasoma veliferum	(Bloch, 1797)										X	
Zanclidae	*Zanclus cornutus*	(Linnaeus, 1758)	X	X	X	X	X		X	X	X		
Bothidae	*Bothus mancus*	(Broussonet, 1782)	X										
Balistidae	*Melichthys niger*	(Bloch, 1786)		X	X	X	X			X	X		
	Melichthys vidua	(Solander, 1844)	X	X		X	X			X		X	
	Rhinecanthus aculeatus	(L., 1758)	X		X		X		X				X
	Sufflamen bursa	(Bloch & Schneider, 1801)				X				X			
	Xanthichthys auromarginatus	(Bennett, 1831)				X							
Monocanthidae	*Cantherhines dumerilii*	(Hollard, 1854)			X								
	Cantherhines sandwichiensis	(Quoy and Gaimard, 1824)				X	X						
	Pervagor spilosoma	(Lay &Bennett, 1839)										X	
Ostraciontidae	*Ostracion meleagris*	Shaw, 1796				X	X		X		X		
	Ostracion whitleyi	Fowler, 1931					X					X	
Tetraodontidae	*Arothron meleagris*	(Bloch & Schneider, 1801)		X	X		X	X	X	X	X		X
	Canthigaster jactator	(Jenkins, 1901)	X						X				
	Total Fish		25	32	36	52	39	20	38	47	25	37	30
	Total Taxa		153	208	175	214	177	145	152	180	144	152	149