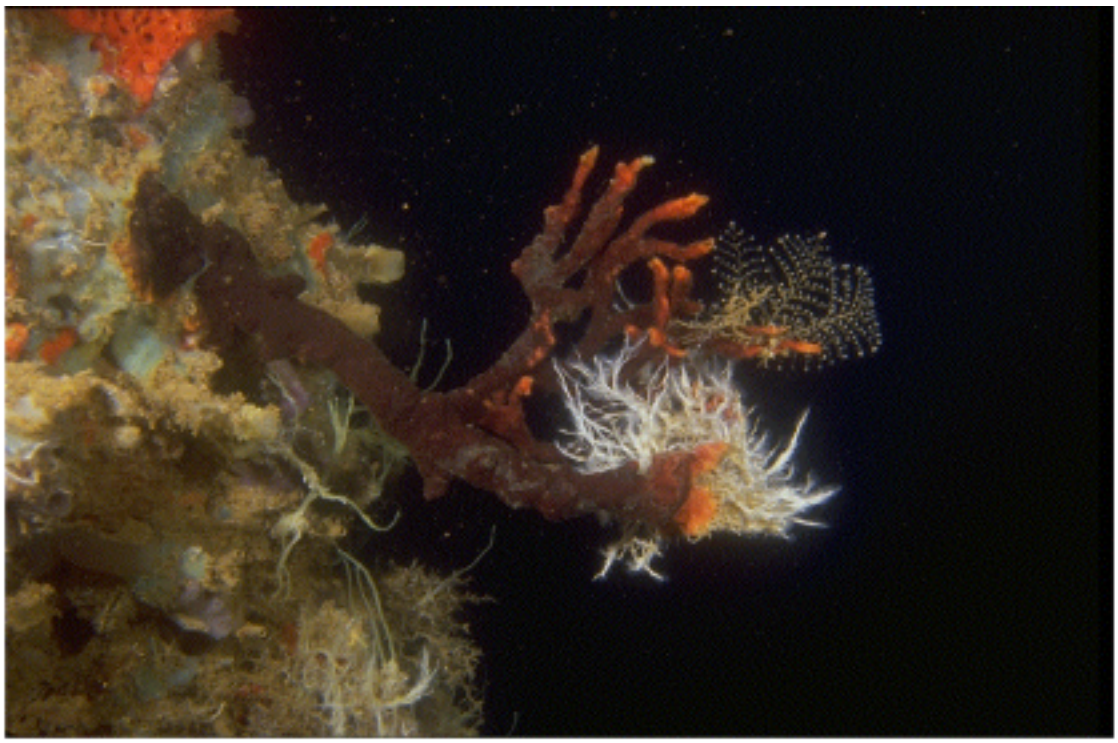

BIODIVERSITY OF MARINE COMMUNITIES IN PEARL HARBOR, OAHU, HAWAII WITH OBSERVATIONS ON INTRODUCED EXOTIC SPECIES

August 1997

Department of Defense Legacy Project Number 106

COVER

Fouling organisms growing at 3 m depth on a concrete piling at Station 6, Hospital Point Drydock. Projecting from the piling at center is a colony of *Schizoporella errata,* on which is growing a colony of *Halocordyle disticha* at upper right and numerous white tubes of the polychaete *Salmacina dyster*i at lower right. Visible among the dense fouling on the surface of the piling is the red sponge *Mycale (Aegogropila) armata* at upper left, many ascidians such as *Phallusia nigra* in the background at center left just above the *Schizoporella* stalk, and a colony of the bryozoan *Amathia distans* in the background at lower center.

BIODIVERSITY OF MARINE COMMUNITIES IN PEARL HARBOR, OAHU, HAWAII WITH OBSERVATIONS ON INTRODUCED EXOTIC SPECIES

Final Report prepared for the U. S. Navy

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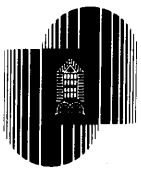

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Contribution No. 1997-014 to the Hawaii Biological Survey

EXECUTIVE SUMMARY

The marine and estuarine invertebrate and fish communities in Pearl Harbor, Oahu, Hawaii were surveyed between January and October, 1996. Samples were taken and observations were made at fifteen stations throughout the harbor, in a variety of environments ranging from near oceanic conditions at the harbor entrance channel to areas receiving land runoff with high sediment loads and turbidity. All organisms were identified to species or the highest practicable taxonomic level, and results were compared to previous published and unpublished marine biological surveys conducted in the harbor, published taxonomic descriptions of organisms collected from the harbor and Pearl Harbor specimens cataloged in the Bernice P. Bishop Museum collections. All data were entered on a relational database which enables tracking the appearance of individual species with time. Based on a number of criteria, nonindigenous and cryptogenic (i. e. origin unsure, but with good evidence of being introduced) species were designated and their introductions noted on a timeline beginning from the first organisms reported in Pearl Harbor in the last century.

Although Pearl Harbor was heavily utilized by Hawaiians for fishing, food gathering and fish cultivation in dozens of fishponds prior to twentieth century, it was relatively isolated from the open ocean before completion of the Pearl Harbor entrance channel in 1911. This marked the beginning of access to the harbor of ocean going vessels with a draft of greater than 5 m and greatly increased the opportunity for species introductions. Other dramatic environmental changes such as the increased runoff of sediment-laden water from the Pearl Harbor watershed that began in the middle of the nineteenth century, filling of fishponds and conversion of shorelines to accommodate docking of U. S. Navy ships and disposal of wastes into the harbor greatly altered the conditions in which organisms lived. The habitat of Pearl Harbor has therefore been an environment of shifting characteristics since at least the beginning of European contact at the end of the eighteenth century.

This study collected or observed a total of 434 species or higher taxa (36 algae, 1 spermatophyte, 338 invertebrate and 59 fish) from the 15 stations sampled, the highest number of taxa that have been collected for any Pearl Harbor study. Ninety six species, or about 22%, are considered to be introduced or cryptogenic. The areas of highest species richness were in the entrance channel and in Rainbow Bay at the northeast head of East Loch where number of taxa were around 150. Lowest species richness occurred in the areas of high sedimentation and turbidity at the head of West Loch where fewer than 50 taxa occurred. Dendrographs based on Sorensen Indices of Similarity of species composition among stations suggest three types of communities in the harbor, one associated with relatively oceanic conditions in channel areas, one with the highly

turbid West Loch sedimentary environment and one with conditions prevailing throughout the rest of the harbor.

Historically, a total of 1141 taxa have been reported by all sources (including the present study) for the harbor, with 1061 of these reports dated. One hundred sixty six of the total 434 taxa found in the present study are new species reports for Pearl Harbor, and 33 of these are new reports for Hawaii. Analysis of the data for numbers of taxa reported for Pearl Harbor by decade suggests three periods when there were large increases in the numbers of species reported: in the 1920s to 1930s, the 1970s and the 1990s. All of these correspond to periods of increased sampling activity in the harbor and are therefore primarily effort related.

The 96 species collected in the present study that are considered to be introduced or cryptogenic include 55 previously reported in Hawaii and considered introduced, 19 previously reported and considered cryptogenic, 14 new reports for Hawaii considered cryptogenic and eight new reports considered introduced. The eight new introductions were comprised of four bivalve molluscs, one pycnogonid, one barnacle, one grapsid crab and one ascidian. Except for the barnacle, none of these recently introduced species have attained large population sizes or wide distributions, and none appear to represent a serious competition to other species already established in Pearl Harbor or elsewhere in Hawaii. By contrast, the barnacle *Chthamalus proteus*, which is widespread in the Pearl Harbor intertidal and appears to have been introduced to Hawaii since the early 1970's, is now the most abundant intertidal organism in many areas in the harbor and abounds in other Hawaiian embayments on Oahu, Maui, Hawaii and Kauai.

A total on 99 species that are considered to be nonindigenous and introduced have been collected from Pearl Harbor since sampling began at the beginning of this century. The 63 introduced species that occurred in the harbor in 1996 represent an average of 64% of total introductions, indicating a high level of persistence of introduced species after their introduction. Persistence rates by decade ranged from as high as 100% for the six species that were first collected in the harbor in 1911-1920, to 30% for the six introduced species first reported in the 1960s.

Most of the introduced species (42%) occur in tropical or temperate oceans worldwide, prohibiting conclusions about their origin of introduction. For the reminder, the majority (27%) have previously known distributions or origins extending to the western Indo-Pacific and Red Sea, and the general Indo-Pacific region (12%). Introduced species from the eastern Pacific region accounted for only 3% of the total introductions, and species with Atlantic and Mediterranean distributions were only 15%, with over half of these coming from the western Atlantic region.

Comparison of the present study's results with comprehensive surveys that were conducted in Pearl Harbor in the early 1970s suggests that the environmental conditions in the harbor are higher in quality and can support more stenotopic marine organisms than was the case 20 years ago. Naval shipboard effluent release in the harbor ceased in 1975, sewage discharges were removed in the 1980s except at the Fort Kamehameha outfall in the ship channel, and non-point source runoff has probably decreased in East and Middle Lochs due to completion of development and better land management practices. Probably as a result, reef corals are beginning to colonize hard substrata in the harbor along the ship entrance channel, West Loch and Middle Loch channels, near the entrance to Southeast Loch, and even on the Hawaiian Electric Co.'s discharge sheet piling and along the shoreline at Rainbow Bay in East Loch. No corals were found in the extensive studies conducted in the 1970s, and this change may suggest a reversion to conditions that probably have not existed in the harbor since pre-European contact.

In contrast to conditions that have been reported in many areas where recent introductions of nonindigenous aquatic species have eliminated native residents through rapid growth rates, competition for food resources and/or predation, we found little or no indication of monopolization of resources by a single species or population outbreaks of a recently introduced species. With the exception of the intertidal barnacle *Chthamalus proteus,* recently introduced species were few in number or single reports. Most previously reported introduced or cryptogenic species showed high abundances primarily in areas receiving specific environmental stress or enriched energy sources that favored the development of low diversity communities. Further studies should be conducted to determine whether other harbors and embayments in Hawaii have shown a similar levels of invasion by nonindigenous species or indications of recent introductions.

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I. INTRODUCTION

A. Marine Invasions as a Worldwide Problem

Since the 1970s a striking surge of exotic species invasions, largely resulting from shipping activities, has occurred in harbors, ports, and other coastal ecosystems around the world (Carlton, 1987, 1989, 1996c). However, human-mediated transport of nonindigenous species is not a new phenomenon. Vessels have sailed across and between oceans for thousands of years, and there is little question that they have transported boring organisms such as shipworms and gribbles and fouling organisms such as barnacles and seaweeds (Carlton, 1992b; Carlton and Hodder, 1995). However, because few marine biological surveys are available prior to the mid-nineteenth century - thousands of years after ocean-going vessels first crossed the seas and 500 years after European-based exploration and colonization began - the scale of these early transports remains largely speculative. Nevertheless, some of the earliest biological collections from Pacific Rim ports - such as barnacles collected in the 1850s in San Francisco Bay - revealed that introductions had indeed already occurred (Carlton and Zullo, 1969).

Global exploration and colonization by ships were not the only means of introduction of non-native species (Carlton, 1992a, 1994). Simultaneous with human colonization around the world was the transport of foods from the colonists' homelands, such that many edible species were transported and released in bays and estuaries in the hopes of establishing new harvestable resources. An important example of this was the global movement of commercial oysters, commencing after the mid-nineteenth century. Accompanying them were the many species that lived on and in the oyster shells as epizoics, predators, commensals, and parasites. Often the oysters died out, never to become established or support new fisheries, whereas the species unintentionally transported with the oysters often flourished (Carlton, 1979).

An inevitable result of these and other commercial activities was to produce the initial stages of a global harbor dwelling biota, with the same species of barnacles, sea squirts and bryozoans often occurring around the world in major port estuaries with similar climates. Many of these species came to be so widely distributed that they were recognized in the nineteenth and twentieth centuries as part of a so-called "natural" cosmopolitan biota whose modern distributions had resulted from centuries of post-invasion dispersal. The result of this dispersion is that numbers of introduced species are almost always underestimated in marine environments which are subjected to human activities that transport species. Many such species must now be recognized as cryptogenic because their natural distribution is now obscured (Carlton, 1996a).

With this "background" cosmopolitan harbor biota having been seeded and spread through the centuries, a new wave of invasions began to appear in the last quarter of the twentieth century, despite the fact that modern, global commercial shipping has been in place for well over a century. Carlton (1996b) has examined six hypotheses that attempt to explain this apparent new invasion surge, which, in some regions, appears to continue essentially unabated. Cohen and Carlton (1995) have estimated that a new invasion now occurs in San Francisco Bay on the average of one new species every 12 to 24 weeks, and new introductions continue to be documented (Cohen et al., 1995; Gosliner, 1995; Mills and Sommer, 1995, Cohen and Carlton, 1997). The responsible vector for many of these invasions is the ballast (not bilge) water of ocean-going ships (Carlton, 1985). Ballast water is taken up in one port or coastal and released at distant ports or coastal regions, inoculating regions across or between oceans with a rich diversity of holoplanktonic and meroplanktonic life (Carlton and Geller, 1993). It is estimated that 3000 or more species are now moved globally on a daily basis in ships' ballast water and sediments.

Since the 1970s critical changes in dominant and functionally dominant species of coastal ecosystems have resulted from these invasions and are now found on virtually every studied coastline:

- In California scores of ballast-mediated invasions appeared in San Francisco Bay in the 1980s and 1990s - notable among them being the Chinese river clam *Potamocorbula amurensis*, which has established populations in the hundreds of millions in the Bay, sufficient to strip the bay of phytoplankton blooms that form the basis of the food chain (Carlton et al., 1990).

- In the Great Lakes of the United States and Canada, a series of mollusc, crustacean, and fish invasions commencing in the early 1980s - all due to ballast water - led to striking ecosystem alterations and tens of millions of dollars in management costs. The most famous of these species, which single-handedly resulted in federal government legislation on the control of ballast water, is the European zebra mussel *Dreissena polymorpha* (and its sibling species the quagga mussel *Dreissena bugensis*) (Nalepa and Schloesser, 1992). A major fouling organism that blocks water pipes and water treatment plants, *Dreissena* has, like the Chinese river clam in San Francisco Bay, led to fundamental ecosystem alterations in North American freshwater ecosystems. The economic costs of cleaning clogged pipes and water intakes plugged by the uncontrolled growth this species have been estimated to be between $2 and $3 billion by the end of this century (Ruiz et al., 1995).

- In the Gulf of Mexico, the fouling mussel *Perna perna* appeared in the late 1980s and began to spread along Texas coast jetties to the point that it now forms monospecific reefs (Hicks and Tunnell, 1993). *Perna* is believed to have been introduced by ballast water or in a ship's fouling community - perhaps in the sea chests of bulk carriers on global trade routes.

- In Long Island Sound, the Japanese shore crab *Hemigrapsus sanguineus* became the second most common intertidal crab by 1996, following its invasion of the Sound in 1993 (Carlton, pers. obs.). It was first found in New Jersey in 1988, where it is believed to have been introduced by ballast water (McDermott, 1991).

- In the Black and Azov Seas a North American comb jellyfish (ctenophore), *Mnemiopsis leidyi*, was introduced by ballast water in the early 1980s, and within ten years had become a primary cause of the demise of the anchovy fishery, leading to millions of dollars of lost revenue and jobs (Shushkina et al. 1990).

- In Australia in the late 1980s, Japanese red tide-causing dinoflagellates (*Alexandrium* spp.) closed commercial shellfish operations, a Japanese seaweed (*Undaria pinnatifida*) began to proliferate across sublittoral ecosystems, and a Japanese starfish (*Asterias amurensis*) became abundant on natural abalone beds. All were introduced by ballast water (Sanderson, 1990; Hallegraeff and Bolch, 1991; Buttermore et al. 1994).

These are only a few examples of hundreds of invasions that began to first appear in new regions in the last quarter century. As noted above, the majority of these invasions are believed to be related to shipping activities and specifically to ballast water release. Contributing to this late twentieth century surge of invasions may be a number of factors, including faster and larger ships, the universal adaptation of segregated ballast tanks and thus cleaner ballast water (without petroleum contamination), and improved water quality conditions both in donor and recipient regions. This could lead to higher diversity in the former regions (thus more species to "donate" to transport corridors such as ballast water) and to higher susceptibility to invasions in the latter regions (Carlton, 1996b). These and other factors may operate synergistically, and, as in the case of Pearl Harbor discussed below, port water quality may have improved over the last decade. In addition, ship fouling - long "depressed" by advanced antifouling chemicals, faster ships and low port residency times - may be on the increase due to the decreased usage of Tri Butyl Tin-based antifouling paints (A. Taylor, BHP, Australia, personal communication, 1996).

The total number of new global invasions recorded since the 1970s remains to be calculated. Such is the frequency of invasions worldwide that every major port (especially those that have not been resurveyed since the 1970s or early 1980s) receiving international shipping that has been investigated has revealed new invasions, suggesting that species introductions are steadily increasing.

B. Status of Native and Introduced Marine Species in Hawaii

An estimated 6500 marine species are known from Hawaiian waters, with approximately 1100 (17%) considered to be endemic (occurring only in Hawaii) (Allison et al., 1995). The most diverse animal groups are the cnidarians, parasitic flatworms, molluscs, polychaete annelids, crustaceans, and echinoderms.

The marine and aquatic organisms of Hawaii have recently been reviewed in regard to their status as introduced or cryptogenic species (Carlton and Eldredge, ms in prep.). To date more than 150 marine and brackish water species are considered to be introduced or cryptogenic. The majority of these species are sponges, polychaete annelids, molluscs, crustaceans, and bryozoans. Recently introduced aquatic species reported in Hawaii include the blue crab *Callinectes sapidus* (Eldredge, 1995), some bivalve molluscs (Paulay, 1996) and the Asian freshwater clam *Corbicula*. A number of species need further investigation to determine whether or not they might be introduced.

The potential importance of species invasions in Hawaii has recently received attention. In 1992, the transport of a floating drydock, the USS *Machinist,* to Pearl Harbor from Subic Bay, Philippines caused considerable concern for the potential opportunity this large structure might present for introducing nonindigenous species into Pearl Harbor and from there elsewhere to Hawaii. The policies and legislation pertaining to marine species introductions into Hawaiian waters have been described and needed programs for increasing public awareness of this issue have been proposed (Mundy, 1994). The subject has even received recent coverage in a Hawaiian shipping industry publication (Pochereva, 1996).

C. Hawaii's Remote Location vs. Crossroads of World Shipping

The main Hawaiian Islands are the most isolated land area in the world, lying more than 2666 miles (4300 kilometers) from the nearest major landfalls in North America and the South Pacific and more than 3968 miles (6400 kilometers) from Japan, the nearest Asian land mass. Prior to the arrival of Europeans in the Islands in the late eighteenth century, the only opportunity for introductions of new species of marine benthic organisms or non-pelagic fishes to Hawaiian waters was in fouling communities attached to drifting objects or infrequently arriving Polynesian canoes from the South Pacific, or by settlement of planktonic larvae that had survived the time required to be carried to Hawaii by ocean currents.

In the 81 years after European discovery of the Hawaiian Islands in 1778, more than 300 ships from foreign ports made landfall in Hawaii, with the maximum number of arrivals (78) occurring in the 1840s, coinciding with the peak of whaling activity and the discovery of gold in California (Judd, 1920). This was only the beginning of Hawaii's interaction with the outside world, and shipping traffic continued to increased as steam replaced sail and Hawaii commercial and shipping requirements expanded with urbanization and development of the plantation-based economy.

Development of Hawaii as a crossroads of the Pacific Ocean has meant increasing frequency of ship and boat arrivals and increased probability of introductions of nonindigenous marine species from foreign origins. Carlton (1987) analyzed the potential dispersal patterns from ports in the Pacific and determined at least 14 intra-oceanic and four inter-oceanic routes for introduced species (Figure 1). Of these, Hawaii is the major receiver area, with incoming transport routes from six major origins within the Pacific, four from the western Pacific, one from French Polynesia, and one from western North America. An additional inter-oceanic route to Hawaii may originate in the Atlantic Oceanic through the Panama Canal.

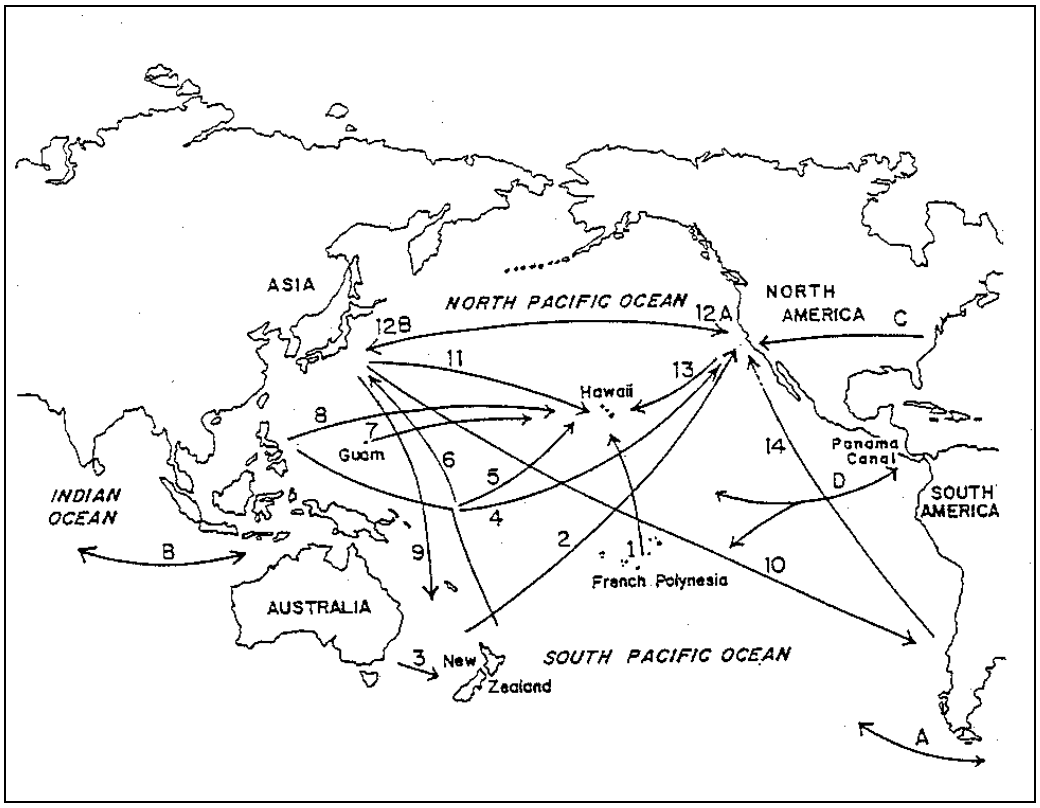

Figure 1. Dispersal routes of introduced species in the North and South Pacific Oceans (from Carlton, J. T. (1987). Patterns of transoceanic marine biological invasions in the Pacific Ocean. Bull Mar Sci. 41:452-465).

Carlton (1987) estimated a total of 25 to 28 Western Pacific and two Pacific Coast species to have been transported to Hawaii, but surmised that investigations would show the actual number to be many times greater, especially in the fouling and benthic communities of Kaneohe Bay and Pearl Harbor. To date no studies have been conducted to specifically define the presence or abundance of nonindigenous marine organisms in Hawaiian waters which would revise or refine the Carlton (1987) estimates. The present study, conducted in Pearl Harbor, compares the marine and estuarine organisms sampled in 1996 with all previous reports of organisms collected from the harbor with the objective of detecting recent introductions.

D. Pearl Harbor

1. Environmental Setting and Biological Communities

According to Handy and Handy (1972) the original Hawaiian name for Pearl Harbor was *Ke-awa-lau-o-Pu'uloa* (The Many Harbors of Pu'uloa), or *Awawa-lei* (Garland of Harbors). Another early name used for the harbor was *Waimomi* or Pearl River (Sterling and Summers, 1978). Pearl Harbor is a coastal plain estuary located between the Koolau and Waianae mountain ranges in central Oahu, Hawaii (Plate 1). The harbor is the most landlocked large estuarine body of water in Hawaii and has about 8 square miles (21 square kilometers) of surface water area with a mean depth of 28 feet (9.2 meters) and about 36 miles (58 kilometers) of shoreline. It is divided into three main lochs (East, Middle and West Lochs) and one smaller loch (Southeast Loch) which are remnants of drowned river valleys joined together by a main channel connecting the harbor with the open ocean. With this relative isolation of the harbor from oceanic circulation, water exchange of the harbor with the open ocean is relatively slow, and residence time of water within the harbor has been estimated as about six days maximum for bottom water and one to three days for surface water (Grovhoug, 1992).

Water temperature in the harbor varies annually from 23 to 29^{o}C, and salinities have ranged from 10 to 37‰ (mean 33‰). Salinity is highly influenced by terrestrial and ground water runoff, especially at the heads of the three main lochs. The harbor receives five perennial streams and three intermittent streams draining approximately 109 square miles (285 square kilometers) of watershed and the discharges from five large springs along the lochs' shorelines. Warming of surface water and freshwater discharge contribute to the development of a pronounced vertical stratification of harbor waters, which in turn promotes differing current conditions between surface and bottom and relative isolation between surface and bottom water masses. Surface water circulation is primarily offshore and driven by tradewinds, while weak tidal flood and ebb flows of 0.15-0.3 m/s control the movement of bottom water in and out of the harbor (Grovhoug, 1992).

Vegetation along the shoreline is dominated by mangroves (*Rhizophora mangle*) at the heads of the three main lochs, which has formed dense growths of bushes and trees up to 10 m high. Elsewhere the shoreline vegetation is cultivated grass, trees and plants in populated areas and kiawe trees (*Prosopis* sp.) along channels.

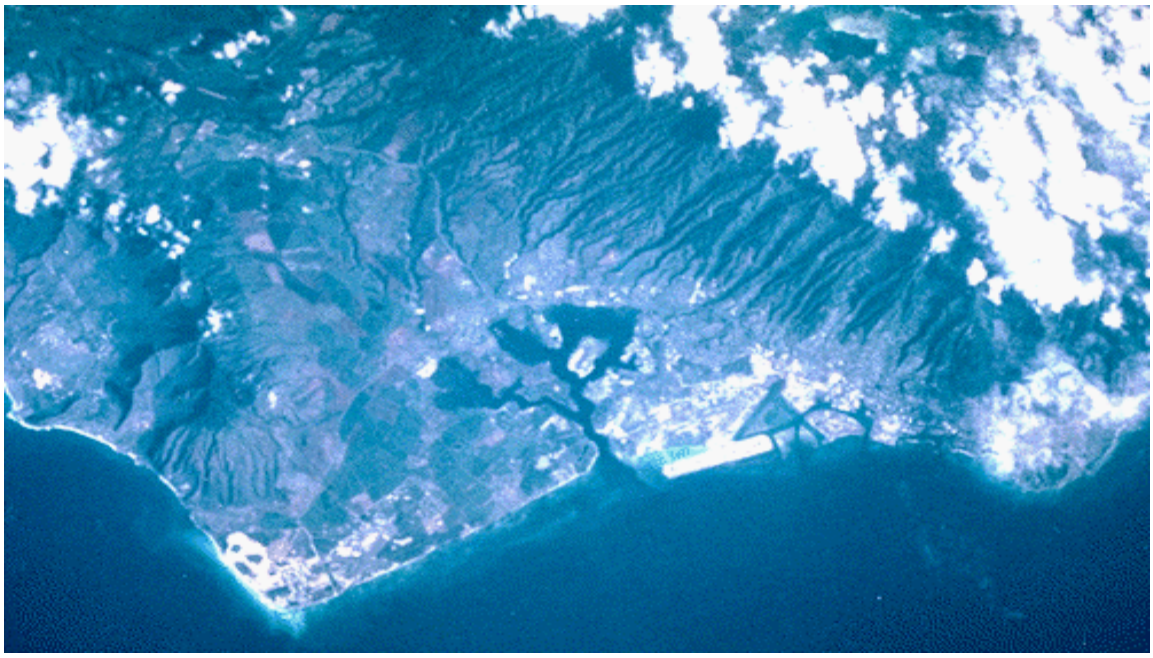

Plate 1. Space Shuttle telephoto showing Pearl Harbor on the Ewa plain between the Koolau Mountains to the right and the Waianae Range to the left.

The water of Pearl Harbor has apparently always been relatively turbid from stream runoff and other sources of sediment. A traditional Hawaiian chant recites “Ewa’s lagoon is red with dirt/…A plumage red on the taro leaf/ An ocherous tint in the bay” (Emerson, 1909). However, runoff related sedimentation undoubtedly increased dramatically in the nineteenth century with deforestation, ranching and grazing of hillsides, declining use of taro ponds which would act to retain storm water, and development of sugar cane cultivation. S. Bishop (1901, in Sterling and Summers, 1978) described her memories of Pearl Harbor of 1836: “The lochs or lagoons of Pearl Harbor were not then as shoal as now. The subsequent occupation of the uplands by cattle denuded the country of herbage and caused vast quantities of earth to be washed down by storms into the lagoons…”. This resulted in the harbor historically being a highly turbid environment, with thick deposits of fine silt on the bottom throughout most of the lochs. Stream input of sediments have been estimated to exceed 96 thousand tons annually, and maintenance dredging of about nine million cu. yd. has been required by the Navy on four to five year cycles (Nystedt, 1977 in Grovhoug, 1992). Turbidity measurements indicated by Secchi disk readings in 1990 averaged only 2.5 m harbor-wide, resulting from suspended sediments and organic material produced by eutrophic conditions (Grovhoug, 1992).

Since the beginning of this century Pearl Harbor has been the center of Pacific Naval Operations and the Pearl Harbor Naval Base, with berthing and maintenance facilities for hundreds of ships. In addition, two recreational marinas are located in the harbor at Iroquois Point near the channel

entrance and at Rainbow Bay at the head of East Loch. Development of the naval base and urbanization of the watershed areas has greatly altered the shoreline and quality of water entering the harbor in this century. At one time more than 100 treated or untreated sewage discharges were estimated to enter the harbor, and coliform bacterial levels indicated extremely polluted conditions. Heavy metals and pesticides in sediments indicated further environmental degradation. These conditions have been largely abated in the last twenty years with the removal of sewage effluents from the harbor and changes in naval operations (Grovhoug, 1992).

Early reports (see below) abound describing the abundance of fish and shellfish in Pearl Harbor and the importance of the area as a major Hawaiian population center supported by numerous and extensive fish ponds. According to Handy and Handy (1972) the bays of the harbor "offered the most favorable locality in all the Hawaiian islands for the building of fish ponds and fish traps into which deep sea fish came on the inflow of tidal water…(the bays) provided a greater variety and abundance of edible shellfish, and were famous as the summer home of mullet". Like many aspects of the Hawaiian culture, fish traps and fishing in the harbor declined in the nineteenth century. However, more than 30 fish traps still existed by the early 1930s (Costa-Pierce, 1987) and oysters introduced in the 1920s thrived for a time. By 1972 the number of fishponds had decreased by 1972 to four, and 99% of the oysters in Pearl Harbor died that year from an undetermined cause that appeared related to a fungal infection (Kawamoto and Sakuda, 1973). Even at that time, however, an extensive survey of the harbor's biota revealed a diverse and abundant estuarine community (Evans et al., 1974), and abundant fish and invertebrates continued into the 1990s when water quality improved (Grovhoug, 1992).

This brief introduction to the physical and biological characteristics of Pearl Harbor points out the uniqueness of its environment in Hawaii and suggests many events that could have influenced the capacity of the harbor to receive, support and propagate introduced marine species. These events are described below and discussed from the perspective of their possible influence on producing changes in the harbor's biodiversity, as well as affecting marine communities in Hawaii.

2. Historical Perspective

A detailed chronology of events important in the development, utilization and ecology of Pearl Harbor is presented and referenced in Appendix A. These events are here reviewed in terms of their potential for influencing biodiversity in Pearl Harbor and promoting introduction of exotic species into harbor habitats.

The events can be grouped into four main periods. In the first period, prior to the twentieth century and the construction of the Pearl Harbor entrance channel, the harbor was more restricted

from the open ocean by a sand barrier at the entrance which limited depth to about 5 m and prohibited access of all but the most shallow draft ocean going vessels (Figures 2 and 3). The harbor may have been even more isolated in the past if the legend of the deepening and widening of the channel by the chief Keauniu is accepted. With a more restricted ocean access, the harbor is likely to have been less saline, considerably more estuarine and much less likely to have received immigrant species that could have colonized and prospered in the relatively pristine environment that characterized the harbor waters at that time. Prior to European contact and through most of the last century, the harbor was intensively utilized by Hawaiians and supported the abundant fishponds and shellfish, including the pearl oysters from which the harbor derived its English name. Water quality was reportedly high and sedimentation and turbidity low until damaging land practices in the mid-nineteenth century increased the sediment load of land runoff reaching the harbor. The first attempts to introduce a non-native species, the commercial oyster *Crassostrea virginica*, apparently were of only limited success, perhaps because of relatively low levels of phytoplankton productivity or detrital food in the water at that time. Other intentional introductions in this period were mosquito fish (*Gambusia affinis*), sailfin mollys (*Mollinesia latipinna*) and kilifish (*Fundulis grandis*) in 1905, and the red mangrove (*Rhizophora mangle*) which probably began colonizing the harbor shores not long after it was introduced to Molokai in 1902 (Wagner, et al, 1990).

The second period was from about 1910 to 1940, beginning with the completion of the entrance channel and ending with the start of World War II (Figure 4). With the access provided by the dredged channel, ocean going vessels were no longer restricted from the harbor, and the potential for introduction of exotic marine species from hull fouling or ballast water increased dramatically. The first collections of introduced marine species in the harbor other than cultured organisms occurred just after the turn of the century. Following completion of the entrance channel in 1911, many habitats of the harbor were drastically altered as shorelines, especially in the Southeast Loch and Ford Island areas, were converted to docks and naval operations facilities. Formerly shallow areas in the lochs were deepened by dredging to accommodate ships, and fish ponds in the vicinity of the naval base were filled with dredged material. Urbanization of the East Loch area progressed as the Pearl City area was developed, and the HECO Waiau Power Station began discharging heated effluent. Discharge of sewage waste, pollution by metals from shipyard

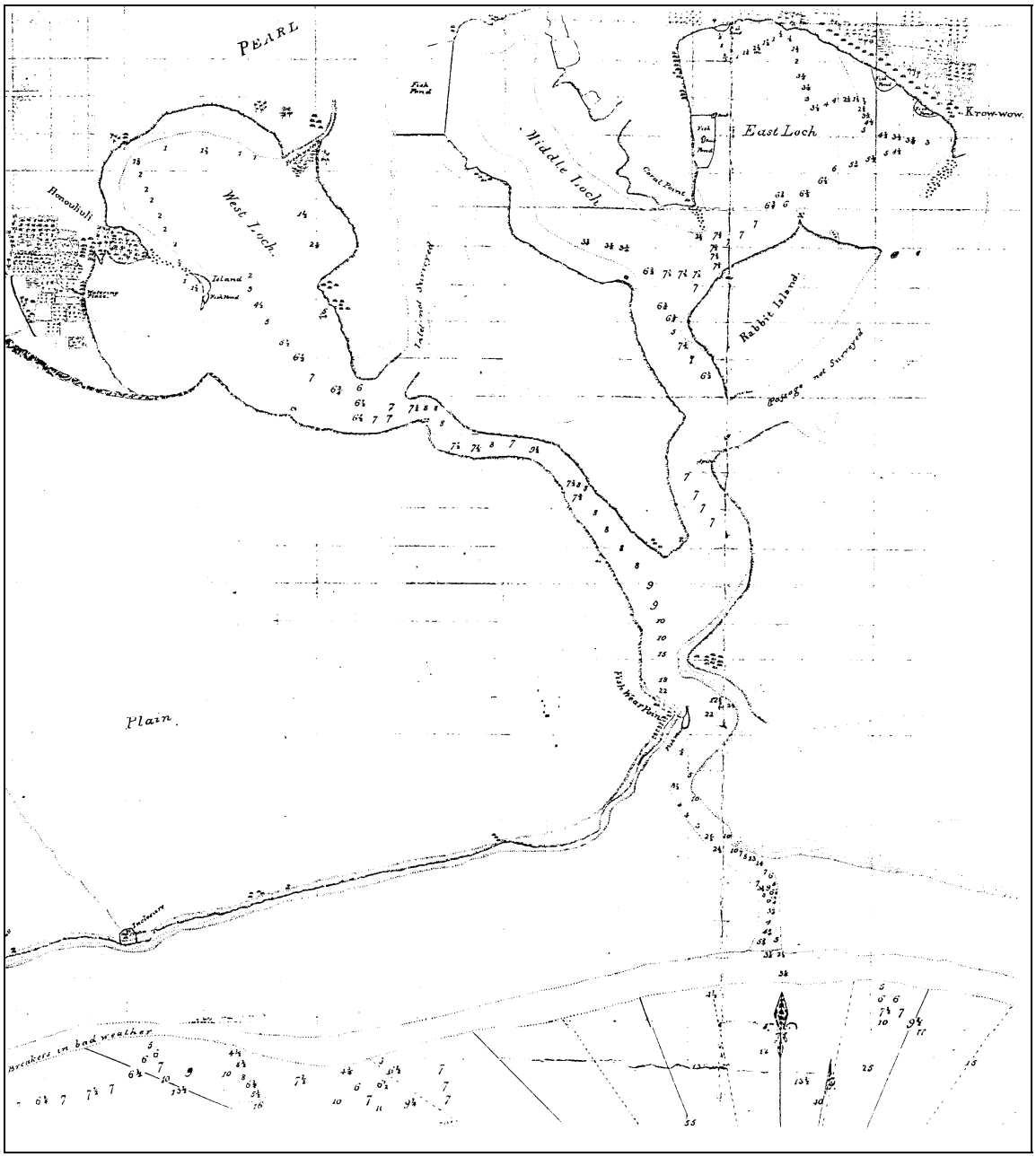

Figure 2. First chart of Pearl Harbor, prepared from surveys by Malden and Frembley of the *HMS Blonde* in 1824-25. Note minimum depth at channel entrance of 2 1/2 fathoms and 3 ½ fathoms at entrance to Middle Loch.

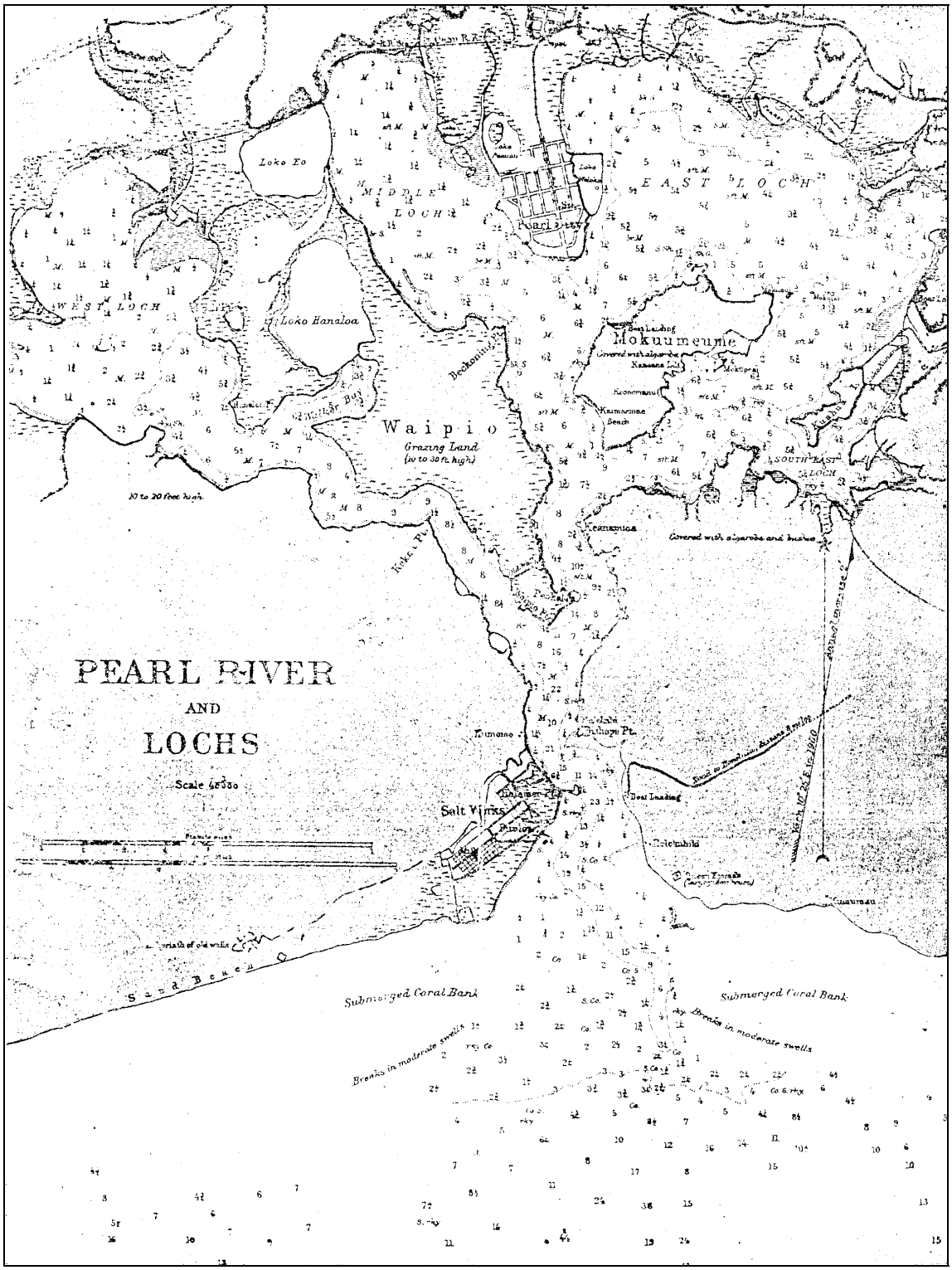

Figure 3. Pearl Harbor in 1902, prior to deepening of entrance channel, dredging of lochs, or alteration of shoreline in Southeast Loch (Map from Paradise of the Pacific; Anon. 1902, 15(12), "based on latest government surveys").

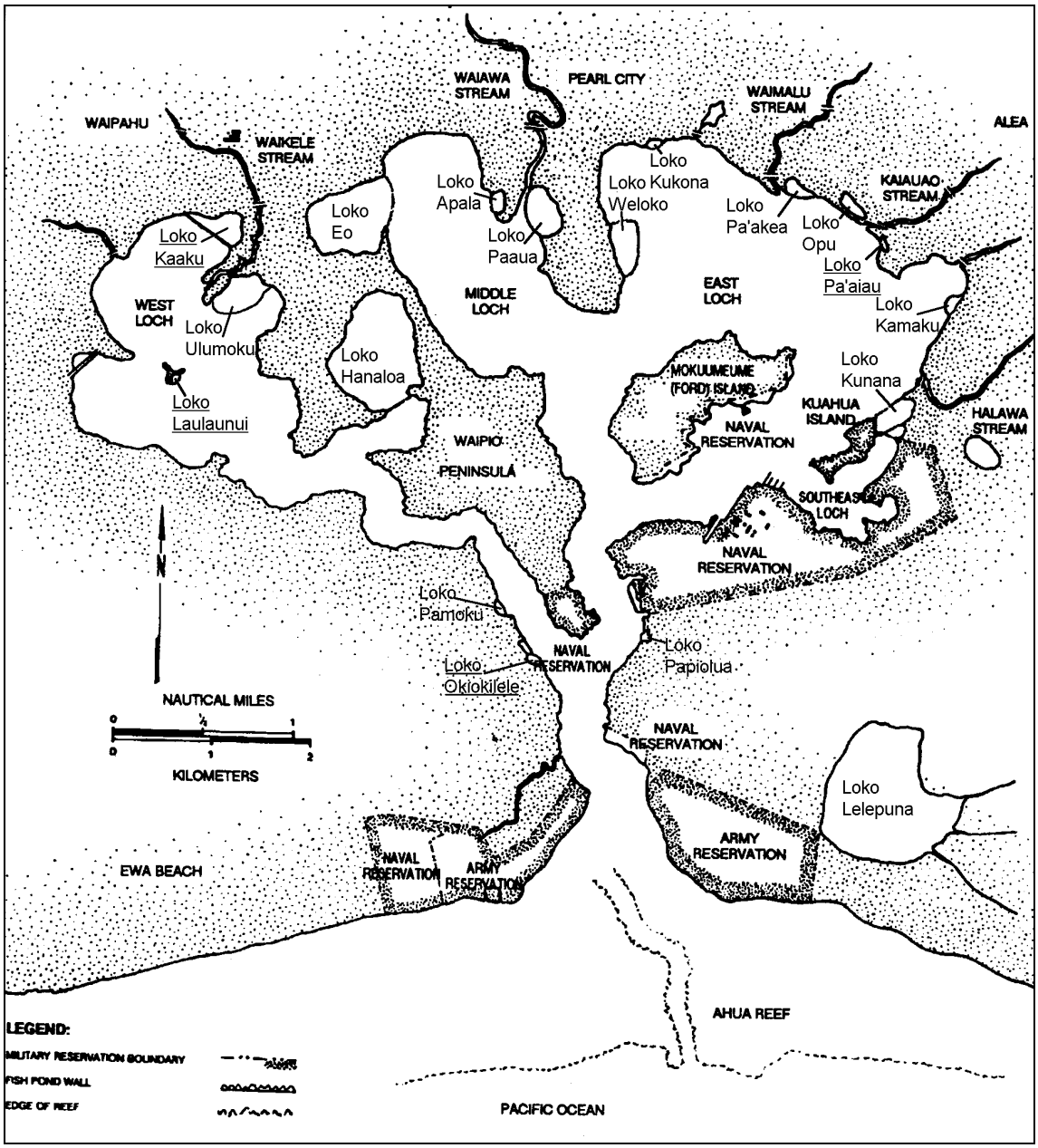

Figure 4. Pearl Harbor in about 1920, showing many of the fishponds that still remained after the initial development of the naval base. Of these only the four underlined still existed in 1972 (adapted from Grovhoug, 1992 and based on an undated Oahu Fisheries chart).

activities and nutrification of waters receiving runoff from sugarcane cultivation can all be assumed to have increased greatly during this period. Further attempts to introduce eastern oysters (*Crassostrea virginica*) as commercial species were made, which apparently established a breeding and thriving population, especially in West Loch. Introductions of Japanese clams (*Venerupis* (*Ruditapes*) *philippinarum*) and Japanese oysters (*Crassostrea gigas*) were also attempted.

In the third period, from 1940 to 1970, Pearl Harbor ship traffic and shipyard activities were at their peak and the environmental quality of the harbor reached its lowest point. Introduced marine species were sampled from fouling on ships and barges brought into the harbor, and at least one of species thought to be introduced by this means, the alga *Acanthophora spicifera*, became dominant throughout Hawaii's marine environment (Doty, 1961). Alteration of the shoreline and nearshore areas in the harbor continued, and all but four of the more than 30 fishponds that had still remained in 1920 were eliminated. The harbor became a receiving vessel for an estimated more than 100 treated or untreated sewage discharges and uncontrolled runoff from sugarcane plantations and mill wastes. Non-point pollution sources from hillsides under urban development and naval shipyard activities further degraded water quality. Coliform bacterial counts at stream mouths in East Loch and near oyster beds in West Loch ranged from hundreds of thousands to billions of bacteria per 100 ml. Possibly because of such a ready, albeit polluted, supply of particulate food, the oyster population soared, reaching an estimated 36 million oysters in West Loch in the 1960s. However, this was followed by a massive die-off of 99% of the oyster population in West Loch and a fish and invertebrate kill in Middle Loch in 1972 (Kawamoto and Sakuda, 1973).

Early in the final period from 1970 to the present, the first major surveys of Pearl Harbor water quality, sediment pollution load and biological communities were conducted by the Navy and by the Hawaiian Electric Co. for its thermal outfall in East Loch. Despite the considerably degraded conditions in the harbor at that time and the occurrence of the mass mortalities described above, the Navy survey (Evans, et al., 1974) found 394 species or higher taxa, including 90 species of fish from 46 families, living in the harbor environment. Diverse communities were also found by the HECO surveys. Although the studies were not evaluated from the standpoint of introduction of introduced species, their extensive data provides a resource for investigating this question per conditions of twenty years ago and comparing with results of the present study.

These studies in the early 1970s preceded the removal of substantial pollution sources from the harbor. In 1975 the Navy instituted shipboard wastewater collection, holding and transfer tank systems to replace release of vessel wastewater effluents into the harbor. Between 1982 and 1984 sewage effluent discharge ended from all major sources except the Fort Kamehameha plant, which still discharges treated sewage near the harbor entrance. Urbanization of hillsides of the East and Middle Loch watersheds moderated as developments were completed, and better land management practices during construction helped to alleviate surface runoff related sedimentation, although this continues to be a problem in West Loch. Generally, Pearl Harbor water quality is indicated to have generally improved substantially since its low point in the 1970s. A 1990 study in the East and Southeast Lochs indicated that, water quality parameters were within acute state water quality standards and that sediment concentrations were significantly less than 1972 values for most metals, although polychlorinated biphenyl (PCB) concentrations were substantially elevated in the Southeast Loch shipyard area (Grovhoug, 1992).

Two major petroleum hydrocarbon spills have occurred in Pearl Harbor, one of 100,000 gallons of aviation fuel at the head of Middle Loch in 1987 (AECOS, 1987) and one in 1996 of an estimated 39,000 gallons (982 barrels) of bunker fuel oil from the Chevron pipeline supplying the HECO station at the head of East Loch. The 1987 spill produced leaf yellowing, defoliation and some mortality for in about 9.5 acres of mangroves (*Rhizophora mangle*) along the Middle Loch shoreline (AECOS, 1987). The 1996 spill resulted in intense oiling of the intertidal flats at the point of discharge near the HECO station intake, and deposition of oil and tar in the intertidal zone along the shores of Ford Island and Waipio Peninsula that were in the direct path of the oil spill. Although initial mortality to marine organisms or birds was only four pufferfishes and two prawns, other organisms within the intertidal were directly exposed to oil and tar deposits which remained after the initial spill. The long term consequences of this spill on the intertidal and other communities in Pearl Harbor have not been assessed.

Opportunities for species introductions into Pearl Harbor have existed since the first Polynesians came to Oahu and have continued to the present, and colonizing organisms could have established themselves for the last half century from hull fouling or discharge of ballast water by ships within the harbor as part of their normal operations. However, an event which triggered substantial renewed interest in species introductions into the harbor was the relocation of the floating drydock *Machinist* from Subic Bay, Philippines in 1992. In correspondence and public affairs releases the Navy affirmed that the hull had been thoroughly cleaned and inspected before leaving the Philippines and the drydock deballasted at sea, that water from ballast tanks had been microscopically inspected for pathogens, and that the hull had been inspected and additional

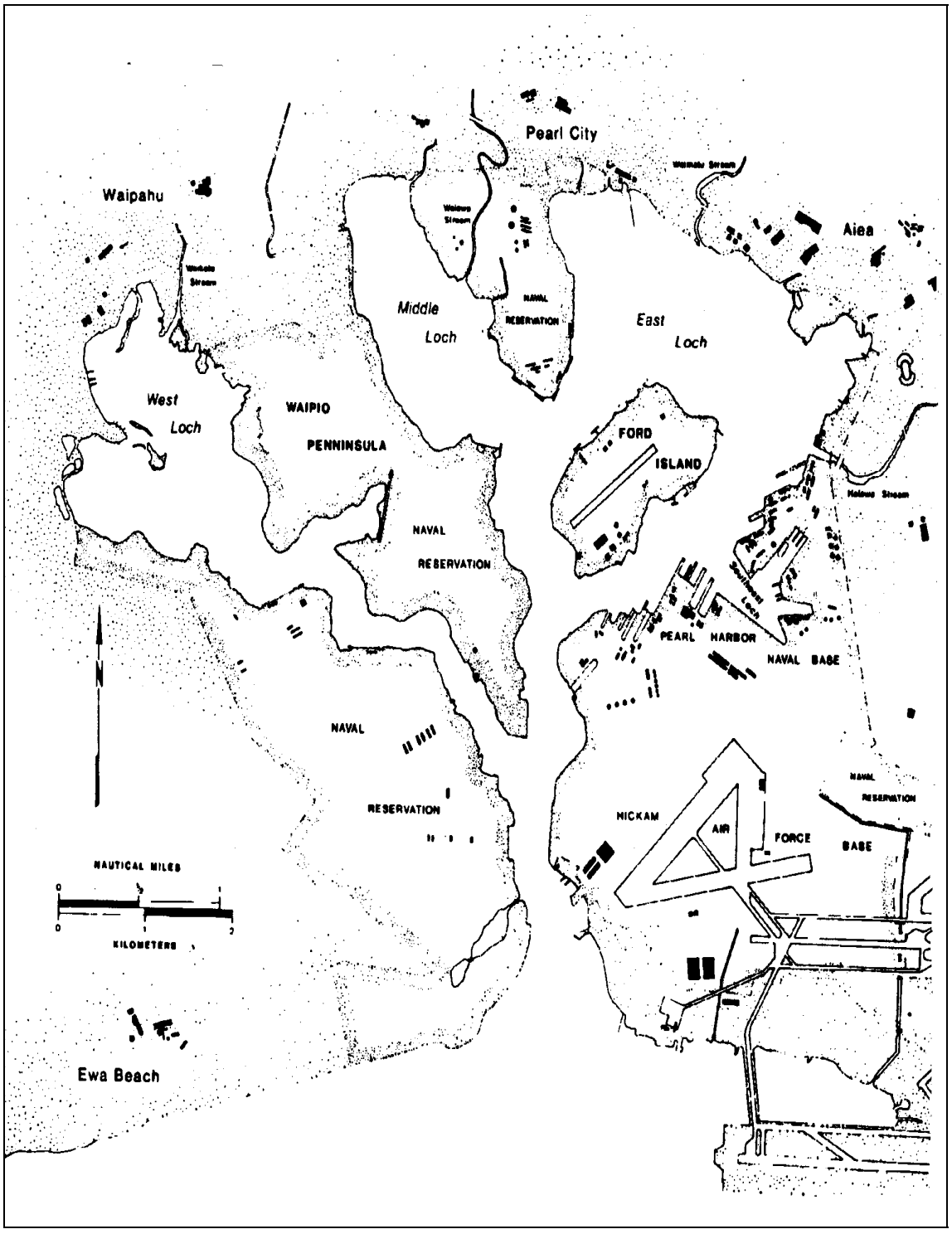

Figure 5. Pearl Harbor in 1990, at full development. All fishponds have been filled, including the large Loko Hanaloa and Loko Eo which formerly comprised a large part of Waipio Peninsula, and the shoreline of Southeast Loch has been greatly altered (from Grovhoug, 1992).

cleaning performed on arrival. However, no investigations have been made of whether marine introductions from this drydock have occurred or whether such introductions have had any measurable impact on the biota of Pearl Harbor or Hawaii.

The present study is the first attempt to evaluate the extent and impact of species introductions into Pearl Harbor in terms of the system's "natural" biodiversity. The latter concept is illusive, since the above historical summary has shown that the physical environment and ecology of the harbor has undergone numerous changes in the last hundred years, and extensive data on the characteristics of the biological communities of the harbor were first determined only twenty years ago. Nonetheless, analysis of species introductions will be attempted based upon the information available for species records in the harbor and knowledge of the origins and normal distributions of exotic species.

3. Previous Biological Studies

Information on the marine and estuarine life of Pearl Harbor prior to the year 1900 is sketchy. Pearl oysters and other mollusks were reported from what was to become the modern Pearl Harbor as early as the eighteenth century (Appendix A). Early expeditions collected marine invertebrates, particularly mollusks, from Pearl Harbor, before 1850 (thus, for example, the type locality of the mussel *Brachidontes crebristriatus*, described by Conrad in 1837, is Pearl Harbor (Kay, 1979, p. 511). Newspaper accounts exist of the introduction into Pearl Harbor of the Atlantic oyster *Crassostrea virginica* from the 1860s to the 1890s (Kay, 1979). Indicative of the absence of formal surveys is that the first living organisms collected from Pearl Harbor that are in the Bishop Museum collections date only from 1902, and were collected by J. W. Thompson and the U.S. S. Albatross. Rathbun (1906) described many crabs that had been taken from Pearl Harbor, and the type specimen of the soft sea cucumber *Ophiodesoma spectabilis* (Plate 3) was described by Fisher (1907) from a specimen that had been collected from Rainbow Bay at the head of the Harbor's East Loch. After 1910 collecting activity, especially of molluscs (Plate 2), increased in the harbor. Taxonomic descriptions and monographs on Hawaiian marine molluscs and other fouling organisms were published up through the 1930s which included many type specimens collected from Pearl Harbor (Pilsbry, 1917, 1921, 1928; Bartsch, 1921; Miller, 1924; Dall, Bartsch and Rehder, 1938). Pilsbry (1928) also published a report of the first barnacles collected from Pearl Harbor in 1913.

Plate 2. Hawaiian rock oyster *Ostrea sandvichensis* on wooden piling at Station 2, Middle Loch channel. (Photo by John Hoover).

Plate 3. Soft bodied sea cucumber *Ophiodesoma spectabilis*, first identified and described from specimens collected in 1906 from near Station 15 in Rainbow Bay, East Loch. (Photo by S. Arthur Reed).

Earlier work on fouling organisms was later expanded on by C. H. and Edmondson and W. M. Ingram who sampled fouling panels in Pearl Harbor in 1936. This study was the basis of series of papers on Hawaiian fouling organisms (Ingram, 1937; Edmondson and Ingram, 1939; Edmondson, 1940, 1942, 1944) Additional work on Pearl Harbor fouling was done in the 1940s by Hutchins (1944, 1949). Other studies by Edmondson in Pearl Harbor during the 1930s produced reports of the first introductions of crustacean crabs into the harbor (Edmondson, 1931).and collections of the first caprellid amphipods (Edmondson and Mansfield,1948) and isopods (Miller, 1941). Access to the harbor was restricted during World War II, but some sampling by C. H. Edmondson continued. Buoy fouling communities were extensively sampled by the U. S. Navy and the Woods Hole Oceanographic Institution during World War II in Pearl Harbor (Hutchins, 1944), but few of these samples were ever formally worked up (an exception being the work of Miller (1968) on isopods from these buoys). The increased opportunity for species introductions during this period of high shipping activity was reflected in numerous reports of nonindigenous species introductions sampled in the 1940s and early 1950s (Edmondson 1951, 1952, 1954; Doty, 1961). This period also marked the first sampling and identification of Pearl Harbor sponges (de Laubenfels, 1950).

The only significant sampling activity in the vicinity of Pearl Harbor in the 1960s was done outside of the harbor entrance by the privately owned research vessel *Pele*. However, in the 1970s the most comprehensive sampling which has been done in the harbor was conducted. Long (1969, 1970, 1972) conducted fouling studies inside and outside of the harbor on contract to the U. S. Navy. The Naval Undersea Center (NUC) conducted its own extensive biological studies of the East, Southeast, and Middle Loch areas of the harbor that has been the most comprehensive study of the harbor's ecology to date (Evans, et al. 1971, 1972, 1974; Grovhoug, 1976). Further studies were made of the biological effects of the Navy's three small power stations in Southeast Loch (Grovhoug, 1979), and Hawaiian Electric conducted extensive marine environmental and biological studies in the vicinity of its Waiau Power Station in East Loch (McCain, 1972, 1974, 1975, 1977). The combined results of these studies more than doubled the total number of taxa that had been reported for Pearl Harbor during the previous six decades.

Environmental studies by the Navy continued in Pearl Harbor during the 1980s and 1990s (Grovhoug and Rastetter, 1980; Grovhoug et al., 1987; Grovhoug, 1992; Seligman et al., 1989a, 1989b; Lenihan, 1990), and at least 15 project related marine environmental studies were conducted by private consultants during this period. Marine monitoring continued in the vicinity of at the Waiau Power Station outfall (Brock, 1994, 1995). Reports of taxa were somewhat increased by these activities, but not nearly to the extent that occurred in the 1970s.

The present study is the first attempt to comprehensively examine Pearl Harbor marine and estuarine biological communities since the NUC study of the early 1970s. Many stations in the East, Southeast and Middle Lochs originally sampled in the NUC study and by the HECO Environmental Department were re-sampled in the present study to detect specific changes in the biota that may have occurred in the approximate 20 years between the surveys. In addition, stations were located in West Loch, which was not sampled in the NUC study, in order to more comprehensively determine the composition of the present Pearl Harbor biological communities.

II. METHODS

A. Literature Search

A variety of sources of information on the environmental conditions and biological communities of Pearl Harbor were examined. Literature consulted included published papers in the open scientific literature, taxonomy-based monographs and books reporting organisms collected from Pearl Harbor, unpublished reports for environmental studies in the harbor performed by and for the U. S. Navy and private organizations, and newspaper and magazine articles that were concerned with the development or environmental and biological communities of the harbor. Resources that were consulted in this search were the libraries of Bishop Museum, the University of Hawaii, and the Pacific Division, Naval Facilities Command at Pearl Harbor. Environmental reports and Environmental Impact Statements and Assessments were reviewed from the University of Hawaii Environmental Center, the Hawaiian Electric Co. Environmental Department and AECOS Inc. An annotated bibliography of all the literature assembled is presented in Appendix B.

B. Bernice P. Bishop Museum Collections

Bishop Museum collections for algae, invertebrates, malacology and ichthyology were reviewed for all marine or estuarine organisms indicated to have been collected in or near the entrance of Pearl Harbor. For the malacology and ichthyology collections this involved noting the specimens in the collection catalogs that were designated as collected from Pearl Harbor and entering these on a database with information on species name, year of collection, collectors name, and collectors notes if available. For the algal and invertebrate collections the entire collections were entered on a database and the Pearl Harbor specimens were retrieved by computer query. The retrieved data were combined and assembled into a general computer Access database of Pearl Harbor organisms which have been cataloged and stored in Bishop Museum. This information is included with the general listing of all taxa in Pearl Harbor developed from all sources and presented in Appendix C.

C. Field Surveys

Benthic biota were sampled and observations of fishes were made at 15 stations in 1996. Station locations are shown in Figure 6, and dates of sampling and descriptions of type sampling activity are given in Table 1. Eight sampling sites in Southeast, East and Middle Lochs and in the

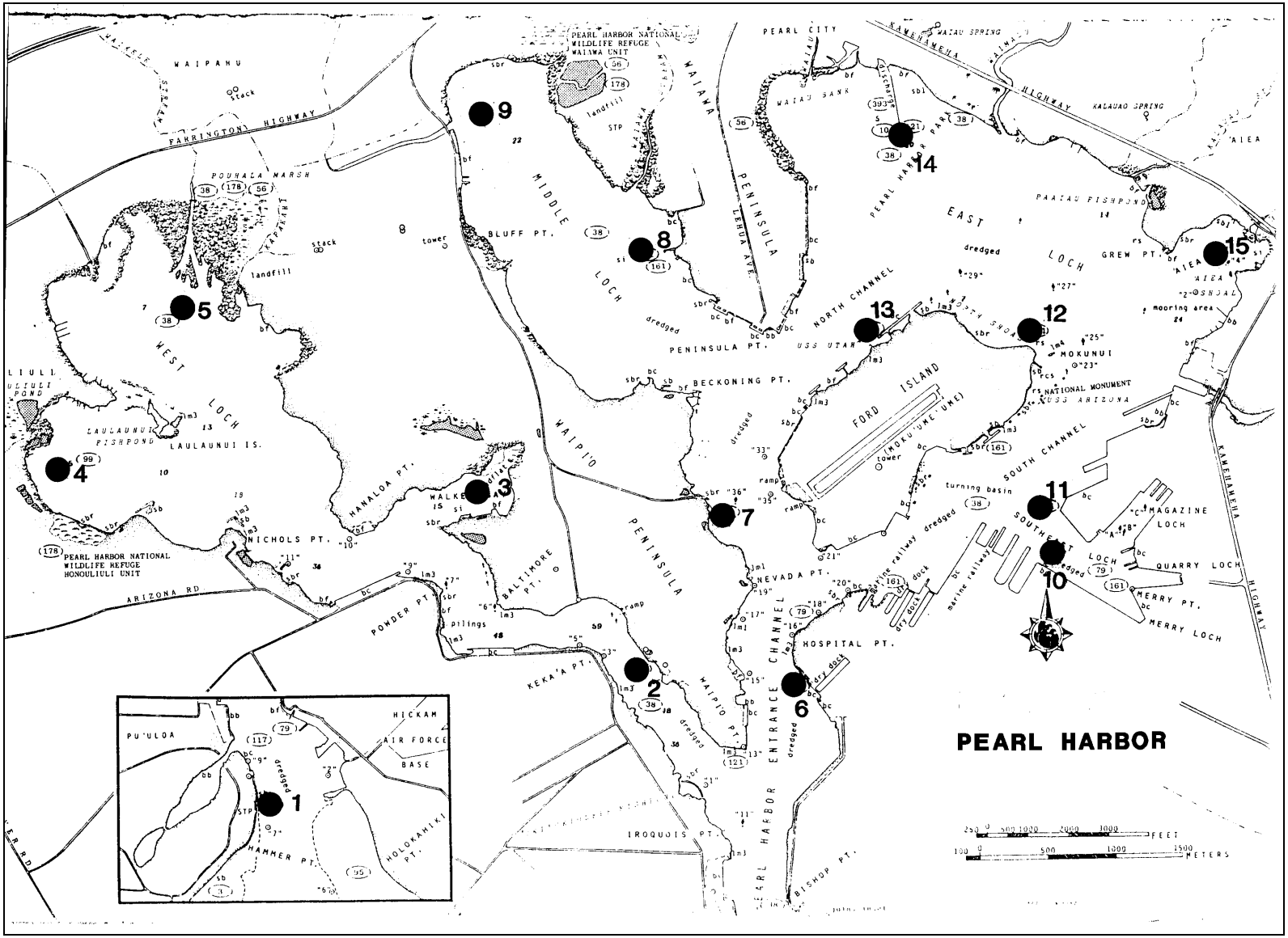

Figure 6. Map of Pearl Harbor showing sampling stations.

Table 1. Sampling dates and activities for Pearl Harbor stations. SL=Shoreline, BF=Benthic Fouling, BC=Benthic Sediments, FO=Fish Observations

Station	Depths Sampled (m)	Sampling Date	NUC Analogue	Sampling Activity
1	0.5-4.0	13Feb96	BC11	BF BS FO
	0.5-2.0	30Apr96		BF FO
2	0-4.0	16Apr96	BW13	BF BS FO
3	0-1.0	6Feb96	None	SL BF BS FO
4	0.5-1.0	16Apr96	None	BF BS FO
5	0-0.5	16Apr96	None	BF BS FO
6	0-5.0	30Apr96	BC10	SL BF BS FO
7	0-0.5	11Jan06	BC09	SL BF
	0.5-2.0	27Feb96		BF BC FO
8	0-0.5	13Feb96	BC07	SL BF
	0-5.0	21Feb96		BF BS FO
9	0-5.0	27Feb96	None	BF BS FO
	0-7.0	12Sep96		BF FO
	0-8.0	18Sep96		BF FO
10	0-8.0	2Apr96	BE17	BF BS FO
11	0-5.0	2Apr96	BE03	SL BF BS FO
12	1.0-5.0	27Mar96	BE05	BF BS FO
13	0-7.0	21Mar96	None	BF BS FO
14	0-2.0	12Mar96	None	BF BS FO
	0-2.0	21Mar96		BF BS FO
15	0-0.5	11Jan96	None	SL BF
	0-2.0	5Feb96		BF BS FO

entrance and West Loch channels corresponded to previous sites used in the 1971-73 NUC study (Evans et al., 1974). In addition, three stations were located in West loch, one in Middle Loch at the moored USS *Machinist*, and three in East Loch which were not sampled in the NUC study.

Sampling at each station consisted of collecting fouling organisms growing on hard surfaces from the intertidal zone to the bottom, which ranged in depth from 0.5 to 8 m for stations not at the shoreline. Collections were made by two experienced investigators sampling as large a variety of habitats as possible while snorkeling or using scuba. Both organisms and the substrata they were growing in were collected, retained in a 200 nm mesh net and then preserved in 70% alcohol on site before returning the samples to the laboratory for sorting and identification of organisms. Investigators also recorded presence of megafauna, macroalgae and fish species observed at each station.

Sediment-dwelling organisms and their substratum were collected at Stations 1-14 by inserting a 12.5 cm cylinder 15 cm into the sediment, closing off the bottom and top with lids and then transporting the sample to the laboratory where it was sieved through a 0.5 mm mesh size screen. A subsample of 10 to 25 cm^3 was retained from each sample for determination of micromollusc populations.

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

A trapping program was conducted for six weeks from 12 September to 23 October 1996 at stations in East, Middle and West Lochs and the entrance channel. Locations and dates for the trap deployments are shown in Figure 7. Traps were rectangular (79x76x38 cm) with one funnel opening each and a mesh size of 1.27 cm. Five traps were used in each deployment, checked weekly and were at each site a total of two weeks. Fish and invertebrates caught in the traps were identified on site and released, or returned to laboratory for identification when identification on site was not feasible.

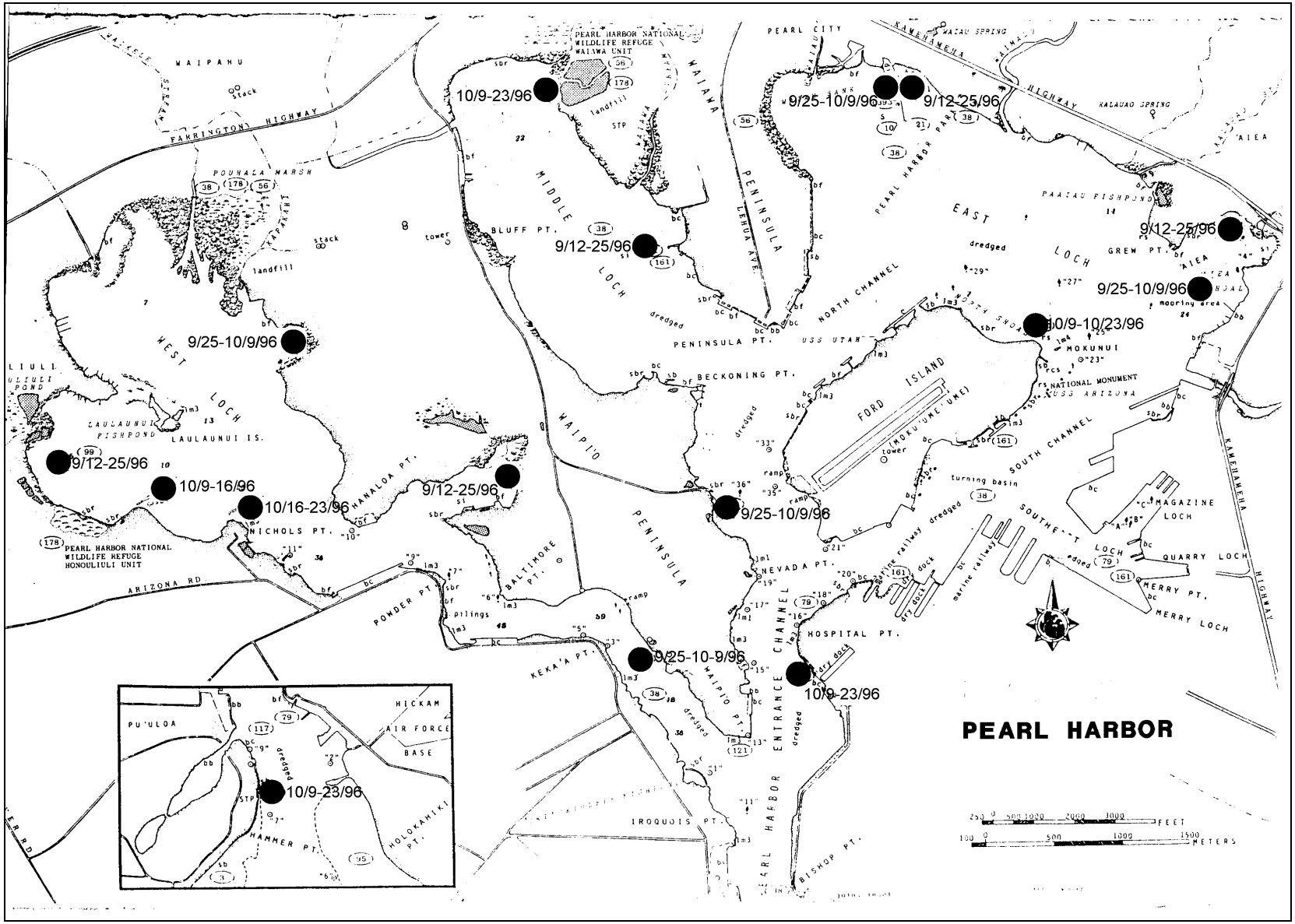

Figure 7. Locations and dates of fish traps deployed 12 September to 23October 1996.

D. Data Analysis

All organisms identified from the field study were entered on an Access database relational with the databases for previous literature reports and museum collections of organisms from Pearl Harbor. The combined information was used to track the occurrence of species chronologically as they were reported in Pearl Harbor.

The Sorenson's Index of 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 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 (see Figures 11-13). Calculation of the similarity measures and cluster analysis were performed using the Multi-Variate Statistical Package, ver. 2.1 (Kovach 1993).

III. RESULTS

A. Station Locations and Descriptions

Station 1. (Latitude 21°19.453'N, Longitude 157°58.206'W)

North side of entrance channel to Pearl Harbor, adjacent to a now unused discharge pipeline from Iroquois Point sewage treatment plant. This station is the most exposed to oceanic conditions, with characteristics of a coral reef environment. A shallow shoreline bench about 0.5 m deep lies along a calcareous sand beach and rises from the adjacent channel of about 10 m depth. The primary substrata are consolidated calcareous submerged beach rock, reef with a low coverage of live corals, and intermittent coral boulders and cobbles. The site is frequently exposed to short period waves generated by northeast trade winds and shows characteristics of a windward reef environment. It also is directly exposed to large storm waves from the south generated by local Kona storms. A variety of reef fish are present. Benthic fauna are dominated by sponges, tunicates, bryozoans and macroalgae, with a few reef corals.

Station 2. (Latitude 21°20.828, Longitude 157°58.677'W)

North side of West Loch entrance channel about 600 m SE of Kekaa Point, on the western shore of Waipio Peninsula. The substratum is consolidated limestone, within medium to fine calcareous white sand areas on the shore and channel sides of the hard substrata. Bottom depths range from 6 m outside of the hard substratum to 1-3 m inshore. Many abandoned wooden pilings provide habitat for wood borers and fouling organisms. This is one of the two sites within the harbor where numerous reef corals occur. A single colony of *Porites compressa* (Plate 4) and small *Leptastrea purpurea* colonies occur in shallow areas. Many live *Pocillopora damicornis* corals (Plate 5) occur along the edge of the hard substratum at approximately 4 m depth.

Station 3. (Latitude 21°21.802'N, Longitude 157°58.555'W)

Shoreline of Walker Bay, on the west shore of Waipio Peninsula, about half way up West Loch. Substratum is fine, loose silt and mud sediment, with abundant mangroves along a calcareous shoreline bench. Macrofauna growing in and on sponges occur only on mangrove roots and on debris in shallow water offshore. Water is highly turbid and sediment laden; depth is 0.5 m Oysters are abundant on mangrove prop roots.

Plate 4. *Pocillopora damicornis* coral at Station 6, Hospital Point Drydock, at 3 m depth. (Photos by John Hoover).

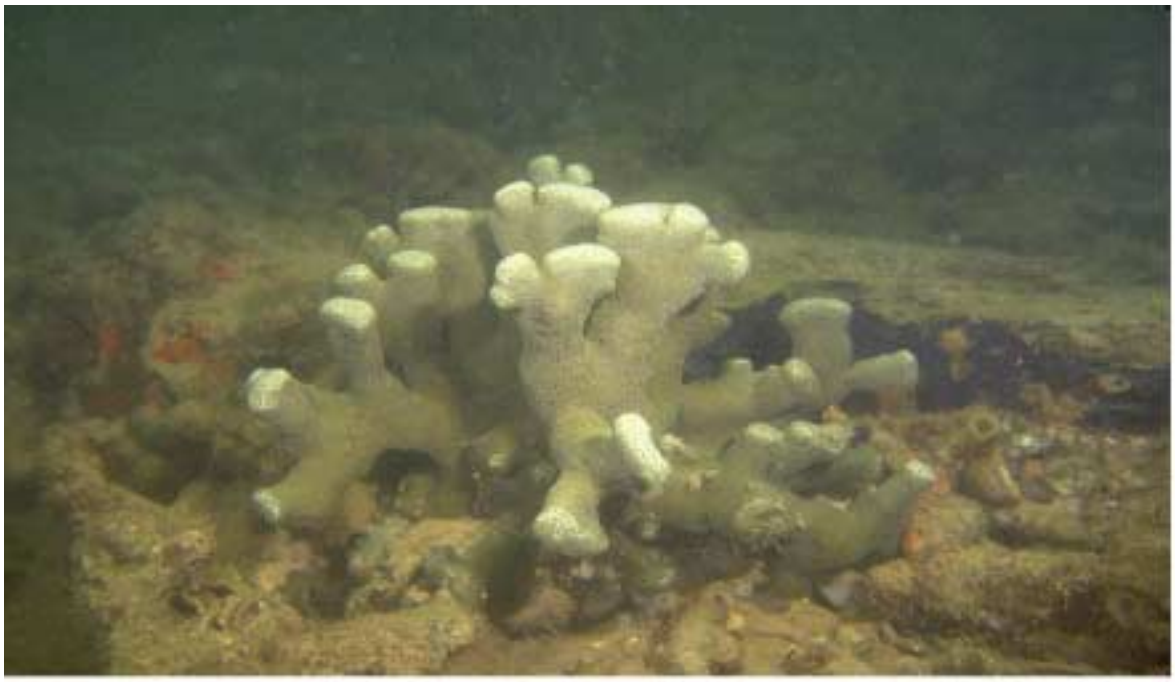

Plate 5. *Porites compressa* coral at Station 2, West Loch Channel at 4 m depth.

Station 4. (Latitude 21°21.831'N, Longitude 158°01.386'W)

West bay at head of West Loch near Pearl Harbor National Wildlife Refuge, 100 m offshore of mangroves. Substratum is the remains of a metal hull of boat wreck covered with a heavy growth of oysters and sponges. Depth 0.5-1.0 m; water highly turbid and sediment laden.

Station 5. (Latitude 21°22.469'N, Longitude 158°00.742'W)

In mangrove area at head of West Loch at mouth of Waikele stream. Environment similar to Station 3, with substratum mostly deep, soft, mud-silt sediments and intermittent sponges. Water is highly turbid and sediment laden, depth is 0.5 m. Large oysters are very abundant on mangrove prop roots. Numerous shells of the Japanese little-neck clam *Venerupis (Ruditapes) phillippinarum* were found in the sediments. None of these were alive, but the shells were intact and appeared to be recently formed.

Station 6. (Latitude 21°20.835'N, Longitude 157°58.025'W)

West side of channel entrance just northwest of Drydock Number 4 and Hospital Point and south of the presently unused thermal outfall from the Naval Station Power Plant Number 3. Substrata are concrete wall shoreline and a calcareous bench and slope ranging from 1 m depth to a flat sand bottom at 6 m, and concrete walls and pilings of the drydock. Macrofauna varies from reef coral and associated organisms (Plate 4) on the bench to a very dense coverage of a suspension feeding fouling community on walls and pilings (Cover Plate) of the drydock, especially chaetopterid polychaete worms (Plate 6) and sponges, bryozoans and tunicates (Plates 7-9). Water turbidity was generally low, with underwater visibility of ca. 5 m. An oil sheen was often observed on the water at this station, and the shoreline showed tar deposits from previous oil exposures. Macrofauna varies from reef coral and associated organisms (Plate 4) on the bench to a very dense coverage of a suspension feeding fouling community on the drydockwalls and pilings, especially chaetopterid polychaete worms (Plate 6) and sponges, bryozoans and tunicates (Plates 7-9) and the introduced gorgonian *Carijoa (=Testeo) riissei* (Plate 10).

Station 7. (Latitude 21°21.595'N, Longitude 157°58.555'W)

Shallow bench area in Middle Loch Channel along the west side of Waipio Peninsula and across from Ford Island. Bench is approximately 10 m wide and covered with a dense growth of the red

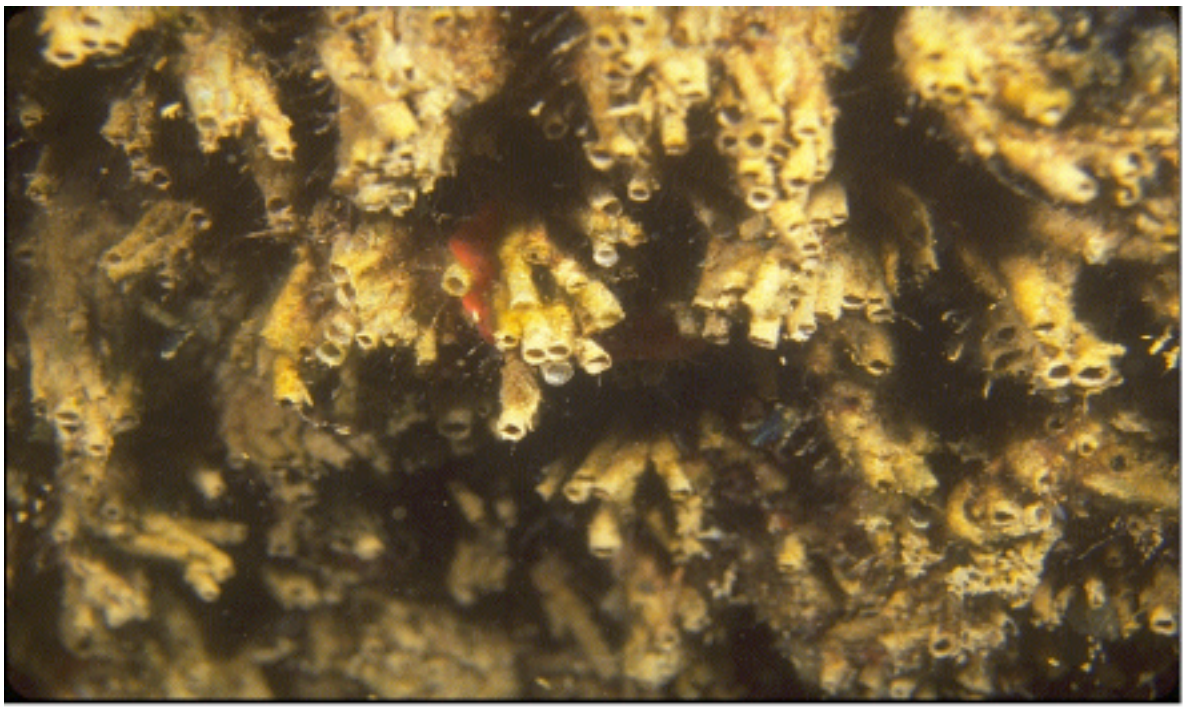

Plate 6. Heavy growth of polychaete tubeworm *Chaetopterus variopedatus* at Station 6, Hospital Point Drydock. (Photos by John Hoover).

Plate 7. Polychaete tubeworm *Salmacina dysteri* with red sponge *Mycale (Aegogropila) armata* at Station 6, Hospital Point Drydock.

Plate 8. Colony of the broyozoan *Amathia distans* and polychaete tubeworms *Chaeotopterus variopedatus* at Station 6, Hospital Point. (Photos by John Hoover).

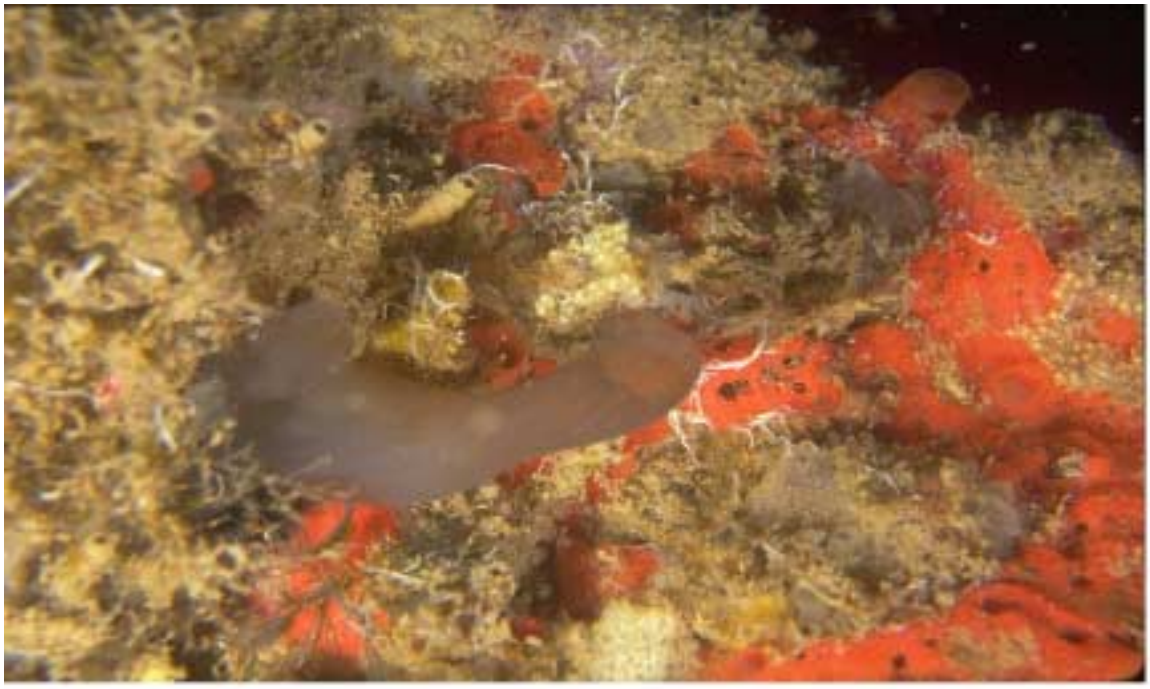

Plate 9. Solitary tunicate *Phallusia nigra,* red sponge *Mycale (Aegogropila) armata* and tubeworm *Chaetopterus variopedatus* on piling at Station 6, Hospital Point Drydock.

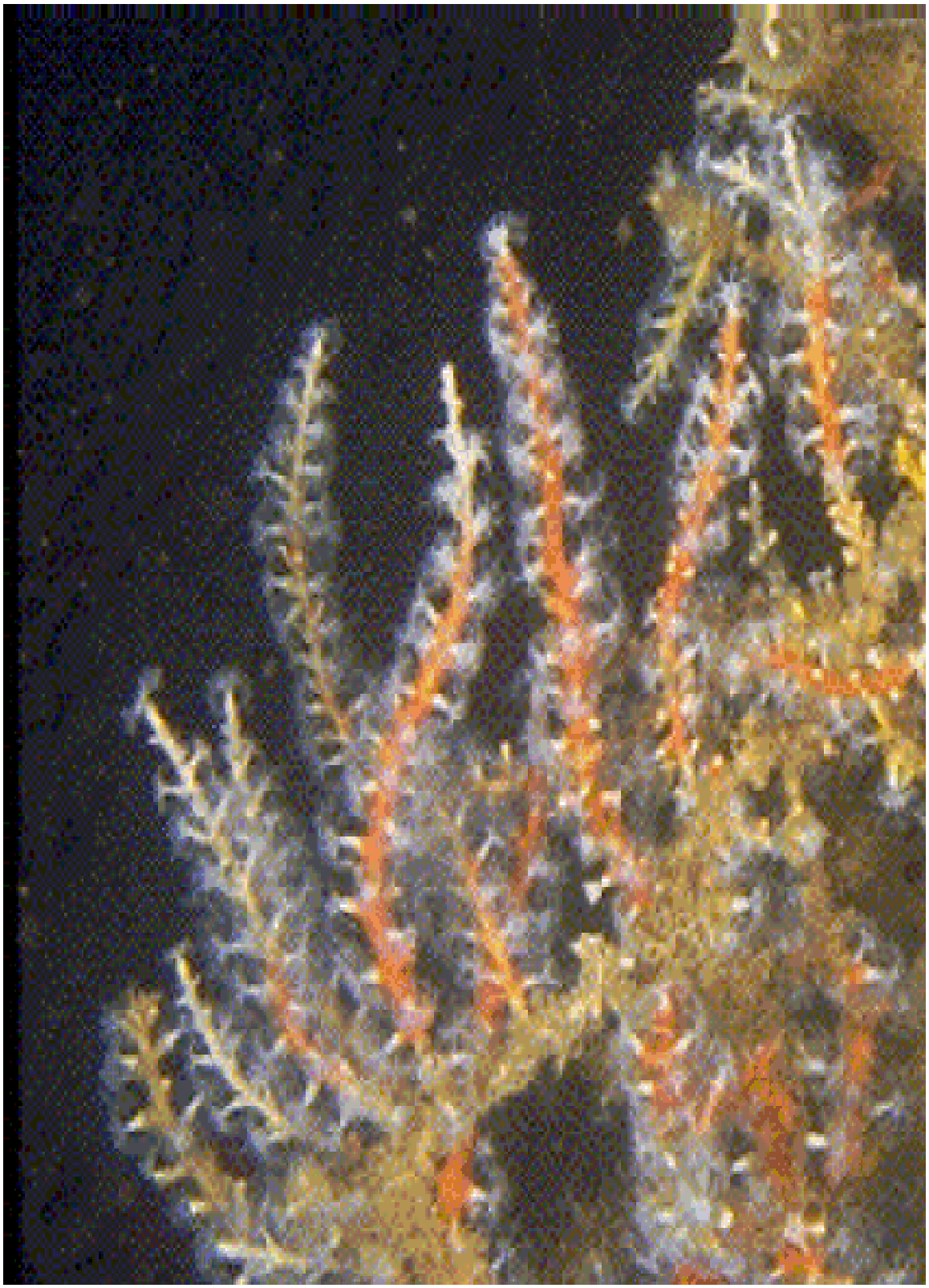

Plate 10. Colonies of *Carijoa* (=*Telesteo) riisei* growing on piling at Station 6, Hospital Point Drydock.

macroalgae *Gracilaria salicornia* which forms a substratum for macroinvertebrates. At edge of the bench depth increases to 2-3 m to a flat, coarse sand bottom with abundant coral rubble.

Station 8. (Latitude 21°22.498'N, Longitude 157°58.658'W)

On west side of Waiawa Peninsula on Middle Loch, at the former Pan American Clipper Landing Dock. Two sites were sampled, one at the shoreline which has a dense coverage of *Gracilaria salicornia* on a shallow bench similar to Station 7. The other site was on concrete and wood pilings offshore of the dock, from the intertidal zone down to 5 m depth.

Station 9. (Latitude 21°23.197'N, Longitude 157°59.440'W)

At the head of Middle Loch in the vicinity of the floating drydock *USS Machinist*, which was brought to Pearl Harbor from the Philippines in 1992. Samples were taken from the steel hull of the *Machinist* itself from the shallow subtidal to the bottom of the hull at 8 m depth, and from nearby wooden pilings from the intertidal to 4 m depth.

Station 10. (Latitude 21°21.457'N, Longitude 157°57.190'W)

East of the repair basin in Southeast Loch on pilings of Dock B-21, adjacent to Pearl Harbor Navy Shipyard. This is the site most exposed to Navy and industrial operations, with considerable ship traffic, hull cleaning and ship maintenance being conducted in the area. Despite this high industrial use of the area, a very abundant fouling fauna was noted on all hard surfaces present. A light sheen of oil was noted on the water at the time of sampling. Sampling was conducted on wooden and concrete dock pilings from the shallow subtidal down to 6 m, and in the sediment at 8 m.

Station 11. (Latitude 21°21.687'N, Longitude 157°57.064'W)

North side of the entrance to Southeast Loch, on concrete pilings, the concrete dock wall and a fossil oyster reef at the bottom of the concrete wall. Samples were taken from 0.5 to 5 m. Despite the proximity to the industrial operations of Southeast Loch and the distance of this area into Pearl Harbor, water clarity was relatively high and a few *Pocillopora damicornis* and *Leptastrea purpurea* reef corals were found.

Station 12. (Latitude 21°22.263'N, Longitude 157°57.038'W)

Northeast of Ford Island and the *USS Arizona* Memorial and just northwest of Mokunui Island, near the terminus of the new Ford Island bridge. Substratum is clay, compacted to the consistency of rock but still capable of being broken apart by hand, and outcroppings of calcareous beach rock and reef. The compacted clay supported a high density of polychaetes that could be seen when the clay was broken apart. An encrusted anchor chain provided additional hard substratum. The bottom ranges from a nearshore flat area of 1 m depth to a rugose vertical face extending down to 5 m which provided habitat for abundant fishes, especially the yellow fin surgeonfish, *Acanthurus xanthopterus.*

Station 13. (Latitude 21°22.154'N, Longitude 157°57.639'W)

On the northwest side of Ford Island, on concrete dock pilings near the *USS Utah* Memorial along the north channel into East Loch. Samples were taken from the intertidal to 7 m depth on the concrete pilings. Underwater visibility ranged from about 3 m near the surface to 5 m near the bottom.

Station 14. (Latitude 21°23.064'N, Longitude 157°57.601'W)

On the sheet piling separating the intake and discharge zones for cooling water used for the Hawaiian Electric Waiau Generating Station at the head of East loch on its northwest side. Samples were taken from the discharge side near the end of the sheet piling from the intertidal to the base of the piling at 2 m, about 500 m from the thermal effluent discharge point where the temperature is approximately 3°C above ambient. More observations were made next to the discharge point, where temperatures are about 5°C above ambient. Fish are very abundant next to the discharge, where the substratum is a massive sponge reef which covers the entire bottom along the sheet piling side of the discharge. Sponges also abound on the sheet piling along its entire length, along with dense populations of the anemone *Aiptastia puchella*, hydroids and bryozoans.

Station 15. (Latitude 21°22.282'N, Longitude 157°56.138'W)

Rainbow Bay Marina, at the northeast head of East Loch. The substratum is a shallow, gently sloping intertidal to subtidal zone composed of calcareous rock and rubblewith a thin sediment cover, and soft sediments dominating further offshore. Both substrata were dominated by a moderately heavy growth of a fine filamentous green algae (cf. *Chloradesmis caespitosa*), and the soft sediments offshore also have intermittent patches of high coverage of the branching leafy green macroalga *Caulerpa sertularoides*. Two areas were sampled, one at the boat launching

ramp from the shoreline to the shallow subtidal at 0.5, the other from the surfaces of floating buoys and dock floats of the Marina's piers and docks.

B. Benthic Macrofauna and Visual Fish Surveys

The organisms observed or collected at the fifteen stations of the present study are listed in Appendix B, and total numbers of taxa at each station are shown in Table 2. A total of 394 species or higher taxa occurred at the various stations, ranging from a maximum of 169 at Station 1 in the entrance channel to only 31 at Station 5, in a mangrove area at the head of West Loch. Of the total taxa observed or collected, crustacean arthropods accounted for 108 taxa (27.4%), fishes 59 taxa (15.0%) polychaete annelids 54 taxa (13.7%), molluscs 46 taxa (11.7%), sponges 33 taxa (8.4%), ascidians 19 taxa (4.8%) and the remaining groups less than 15 taxa each.

Table 2. Total number of non-sediment taxa observed or sampled at Pearl Harbor stations in 1996 and numbers of genera or species never previously reported in Pearl Harbor.

Phylum or Lower Taxa	Total Number of Taxa	% of Total Taxa	New Pearl Harbor Reports	% of New P. H. Reports
Algae	36	9.1	23	14.6
Angiosperms	1	0.3	1	0.6
Sponges	33	8.4	27	17.2
Cnidarians	10	2.5	4	2.5
Nematods	1	0.3	0	0
Sipunculids	1	0.3	0	0
Platyheminths	1	0.3	0	0
Polychaetes	54	13.7	12	7.6
Molluscs	46	11.7	12	7.6
Pycnogonids	4	1.0	3	1.9
Crustaceans	108	27.4	52	33.1
Bryozoans	13	3.3	1	0.6
Echinoderms	7	1.8	3	1.9
Ascidians	19	4.8	7	4.5
Urochordates	1	0.3	0	0
Fishes	59	15.0	12	7.6
Total	394	100.0	157	100

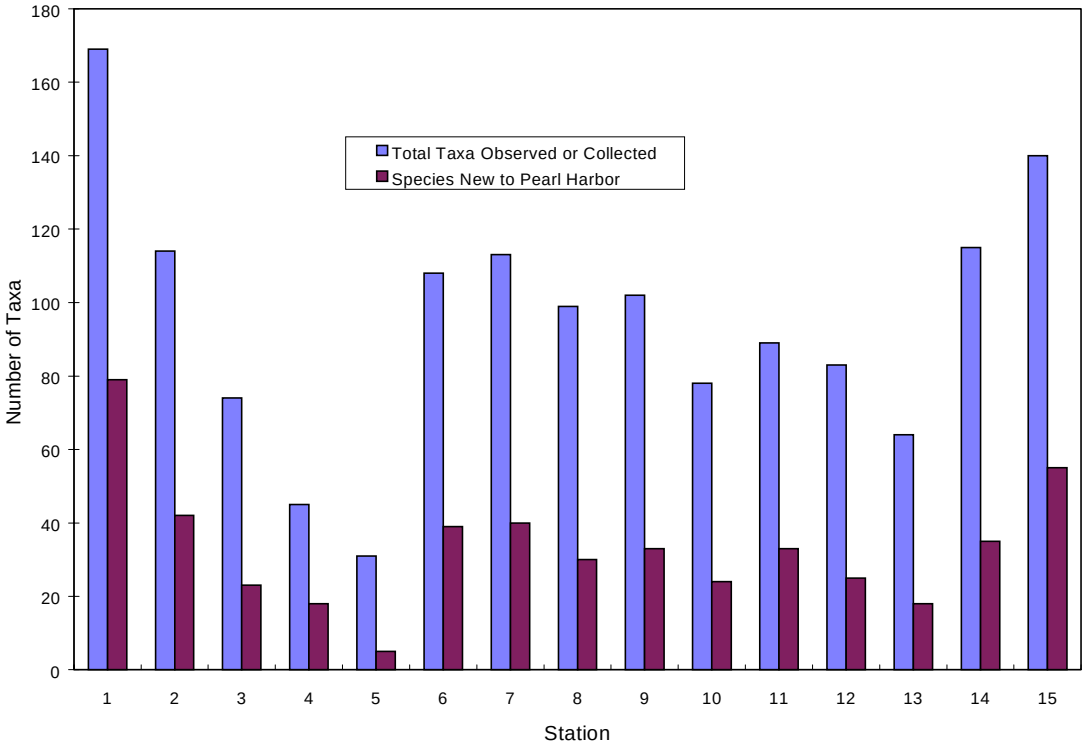

Figure 8. Total Numbers of non-sediment taxa and new species collected or observed at Pearl Harbor stations in 1996 survey

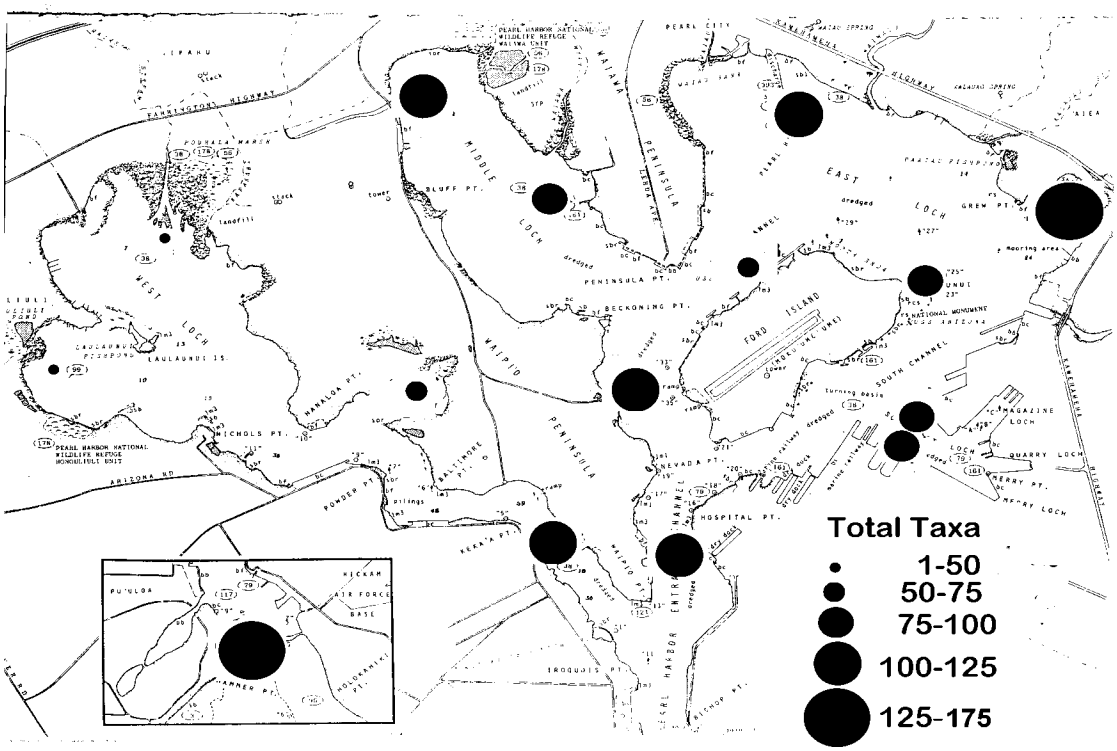

Figure 9. Total non-sediment taxa observed or collected at Pearl Harbor stations in 1996.

The distribution pattern of total numbers of non-sediment taxa at the 15 stations is shown in Figures 8 and 9. The greatest numbers of taxa were found at Station 1 in the mouth of the main entrance channel, and Station 15, at the northeast end of East Loch. The next most abundant taxa were in the West and Middle Loch channels and the main channel at Hospital Point Drydock, and at Stations 9 at the *USS Machinist* and on the HECO discharge sheet piling at Station 14. The remaining stations had intermediate numbers of taxa ranging from 50 to 100, except for Stations 4 and 5 in the highly turbid areas at the head of West Loch, which had less than 50 taxa.

Figure 10 shows the distribution abundances for the principal taxonomic groups making up the total community represented in Figures 8 and 9. All groups had minimal numbers of taxa at Stations 4 and 5 in West Loch, with bryozoans, echinoderms and ascidians not occurring at all in this area. Station 1 at the harbor entrance had the greatest number of taxa in most of the groups, ranking first for cnidarians, arthropods, echinoderms and fishes. Station 15 in Rainbow Bay at the head of East Loch had the most taxa of sponges, polychaetes and ascidians, whereas Stations 10 and 11 in Southeast Loch tied for the most taxa of bryozoans. Station 9 had the highest number of mollusc taxa, and this station, in the vicinity of the *USS Machinist*, also had the second highest number of polychaetes taxa. Station 11 was second for numbers of cnidarians and ascidians, and Station 14 at the HECO discharge had the second highest numbers of crustacean taxa.

A dendrograph of the Sorensen's Indices of Similarity among the stations based upon presence or absence of all benthic fouling and fish taxa is shown in Figure 11. Three distinct clusters are indicated, with a high degree of association within those clusters. Cluster A is comprised of Stations 1, 6 and 7, which had high to intermediate numbers of total taxa and were located along main channels where they were probably directly influenced by various degrees of ocean circulation. These were also stations which had a well developed carbonate subtidal benches which may have offered a suitable natural substratum for settlement of organisms requiring a hard surface. Cluster C has only Stations 4 and 5, the two stations furthest inside of West Loch and which had the lowest numbers of total taxa. These stations were the most obviously influenced by land runoff, high sediment load and turbidity and were dominated by oysters and associated fauna. Cluster B is comprised of the remaining stations, which included all areas in Middle, East and Southeast Lochs.

The dendrograph in Figure 12 shows the grouping of Sorensen Indices of Similarity of the benthic fouling community with no fish included. Clustering of stations is less distinct than for all the taxa

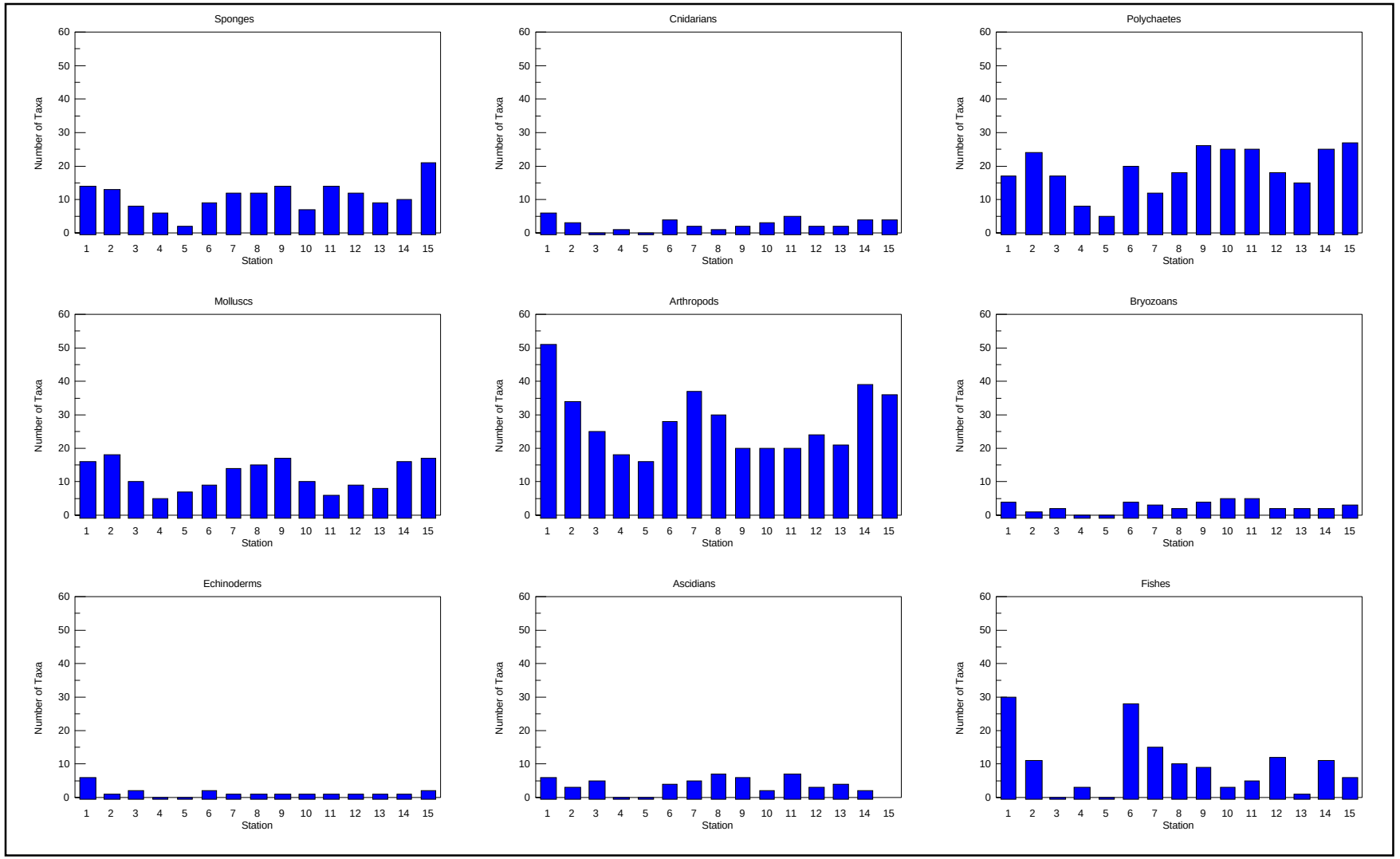

Figure 10. Abundances of non-sediment taxonomic groups at Pearl Harbor stations in 1996

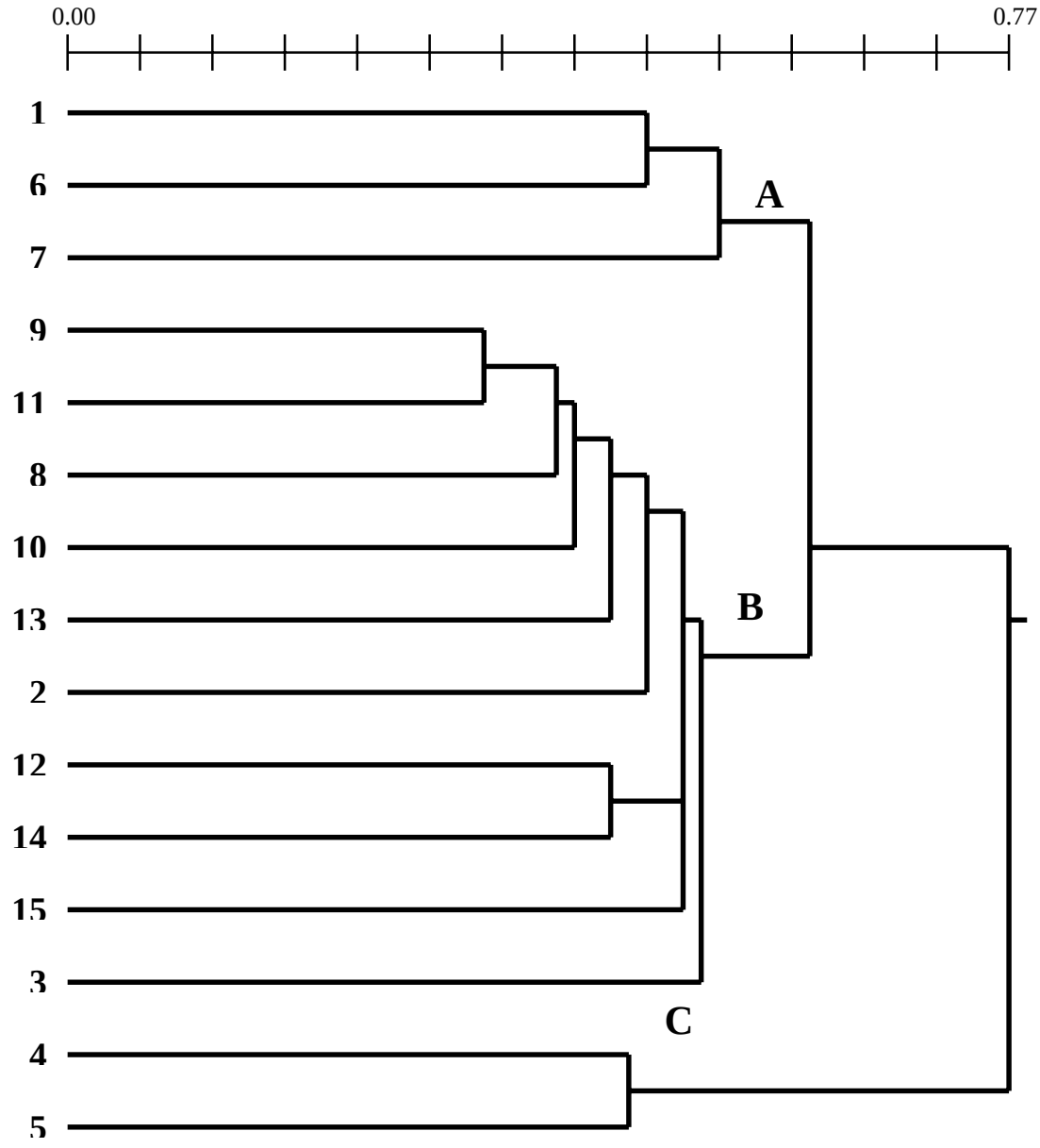

Figure 11. Dendrograph of stations based on benthic fouling and fish species presence and absence

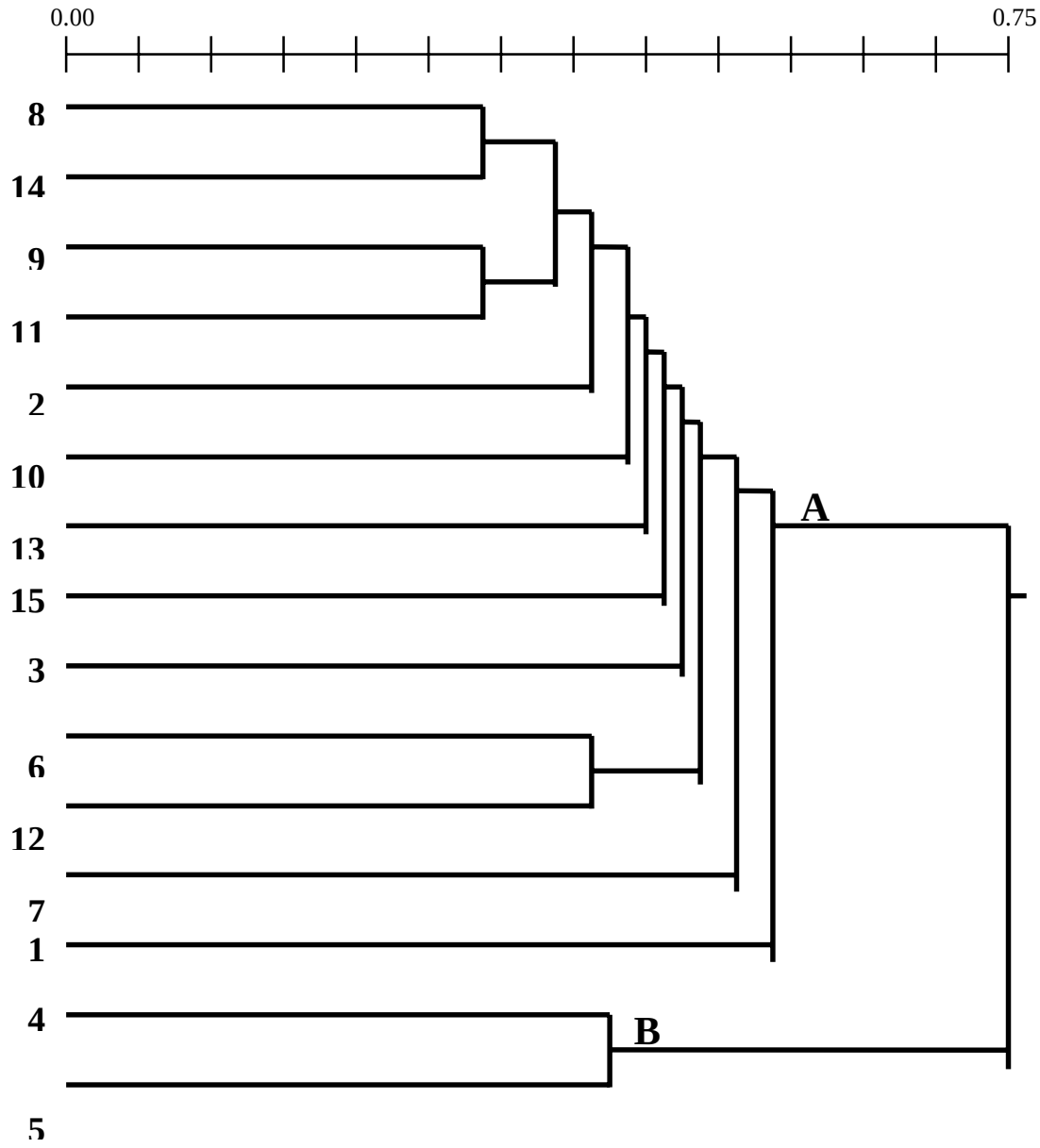

Figure 12. Dendrograph of stations based on benthic fouling taxa with no fish included.

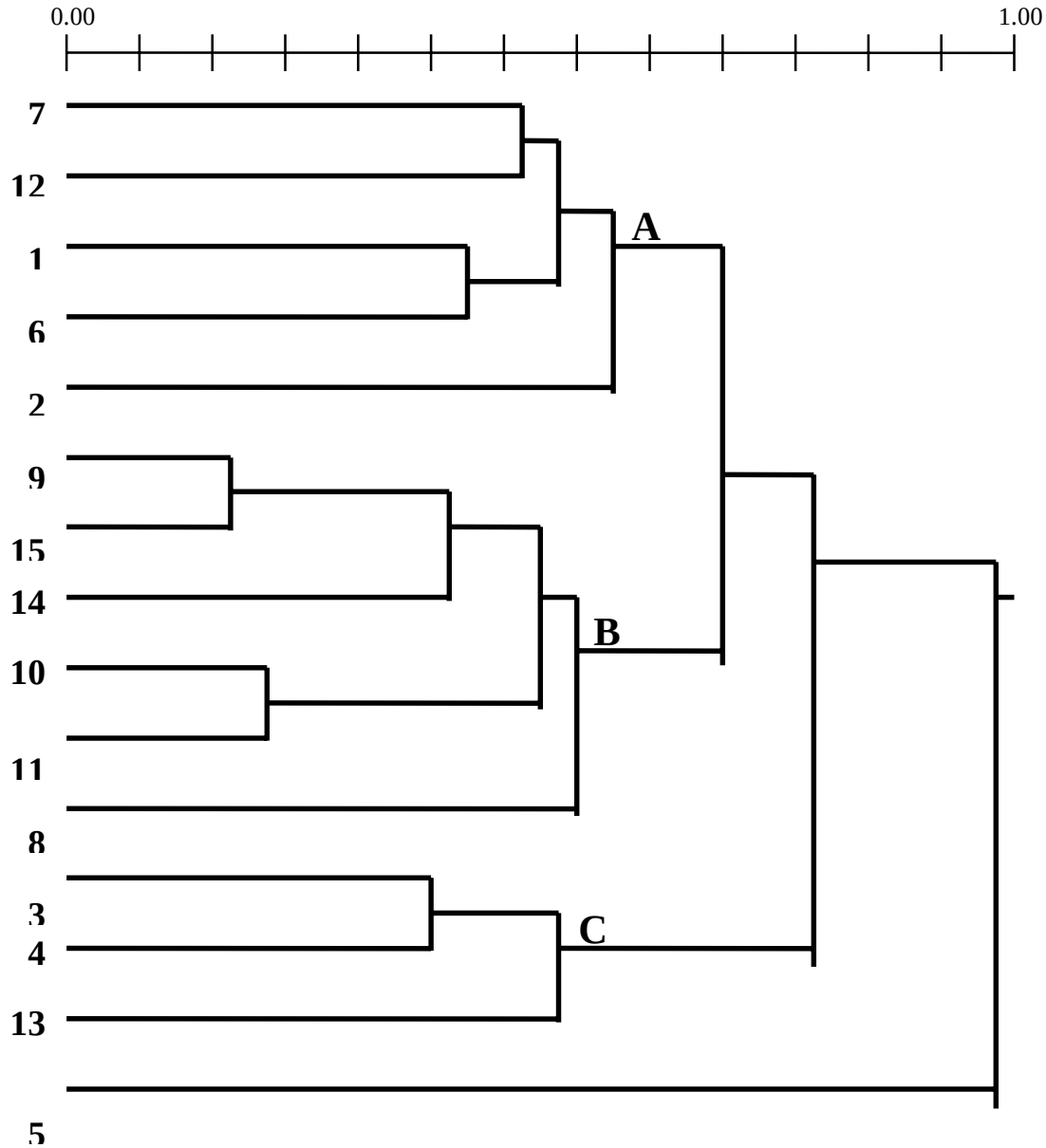

Figure 13. Dendrograph of stations based on fish taxa alone

in Figure 11, with Stations 4 and 5 in West loch showing the only clear separation from the remaining stations. This suggests limited sensitivity of this method for detecting relationships and differences among the Pearl Harbor benthic community except where the distinctions are obvious. The dendrograph for fish presence-absence (Figure 13) shows more distinct clustering, similar to the dendrograph in Figure 11. Three major station clusters occur, with Cluster A associated with Stations 1, 2, 6 and 7, all located on channels, and Station 12, northeast of Ford Island. Fishes were both abundant and diverse at these locations. Cluster C includes Stations 3 and 4 in West Loch and Station 13 on the northwest side of Ford Island, where fish were scarce and few species reported. Station 5, which had no fish reported, was separate from all other stations, and the remaining stations in Cluster B were all located well into the harbor's lochs, with intermediate numbers of fish species observed.

C. Fish Trap Catches

Results of the fish trapping program conducted from 12 September to 23 October 1996 at the locations shown in Figure 7 are listed in Table 3. A total of only 125 individuals among 13 species of fish and invertebrates entered the traps during the study. Most of the total catch was comprised of only three species, the portunid crab *Thalamita integra* (48 individuals), the puffer fish *Arothron hispidus* (25 individuals) and the nonindigenous snapper *Lutjanus fulvus* (23 individuals). These species also comprised most of the species obtained at the traps located at the heads of East, Middle and West Lochs. A single specimen of the nonindigenous Samoan mud crab *Scylla serrata* was observed but not trapped in the mangrove area at the head of Middle Loch, and one specimen of the sea cucumber *Ophiodesoma spectabilis* was trapped at the Middle Loch channel site. The remainder of the catch was reef-associated species such as the trumpet fish *Aulostomus chinensis* (6 individuals), the nightmare weke *Upaenus taeniopterus* (2 individuals), the Moorish idol *Zanclus cornutus*, the yellowfin goatfish *Mulloidicthyes vanicolensis*, the squirrelfish *Sargocentron* sp., and the white spotted toby *Canthagaster jactator* (1 individual each). All of these species were taken only at traps at the entrance channel, West Loch Channel or Hospital Point drydock where reef corals and reef conditions occur.

D. Sediment Fauna and Micromolluscs

The organisms that were collected from sediments at Pearl Harbor Stations 1 to 14 are listed in Table 4. These include the macrofauna that were sampled using the 12.5 diameter X 15 cm depth cylinder and the 10 to 25 cm^3 subsamples that were analyzed for micromollusc composition

Table 3. Fish and invertebrates caught in Pearl Harbor fish traps from 12 September to 23 October 1996. (See Figure 7 for sampling locations).

Trap	Location	Nearest Sta.	Dates	Species	Number
1	Rainbow Bay	15	Sep 12-18	*Thalamita integra*	1
			Sep 18-25	None	
			Sep 25-Oct 2	*Arothron hispidus*	1
				Foa brachygramma	3
			Oct 2-9	*Foa brachygramma*	2
	NE Ford Island	12	Oct 9-16	*Arothron hispidus*	2
				Scarus sp. juv.	3
			Oct 16-23	*Arothron hispidus*	1
2	HECO Discharge	14	Sep 12-18	*Arothron hispidus*	1
				Lutjanus fulvus	1
			Sep 18-25	*Arothron hispidus*	2
	HECO Intake		Sep 25-Oct 2	*Arothron hispidus*	3
				Foa brachygramma	1
				Thalamita integra	1
			Oct 2-9	*Arothron hispidus*	1
				Foa brachygramma	1
	Middle Loch Mangroves	9	Oct 9-16	*Thalamita integra*	1
			Oct 16-23	*Foa brachygramma*	1
				Thalamita integra	1
				Scylla serrata	1 observed
3	Middle Loch Pan Am Dock	8	Sep 12-18	*Thalamita integra*	2
			Sep 18-25	*Foa brachygramma*	3
				Thalamita integra	2
	Middle Loch Channel	7	Sep 25-Oct 2	*Foa brachygramma*	1
			Oct 2-9	*Arothron hispidus*	1
				Thalamita integra	1
				Ophiodesoma spectabilis	1
	Hospital Pt. Drydock	6	Oct 9-16	*Aulostoma chinensis*	1
				Arothron hispidus	1
			Oct 16-23	*Zanclus cornutus*	1
4	West Loch Walker Bay	3	Sep 12-18	*Arothron hispidus*	3
				Lutjanus fulvus	12
				Thalamita integra	6
			Sep 18-25	*Arothron hispidus*	3
				Thalamita integra	4
	West Loch Channel	2	Sep 25-Oct 2	*Upaenus taniopterus*	1
			Oct 2-9	*Arothron hispidus*	2
				Mulloidicthyes flavolineatus	1
				Upaenus taniopterus	1
		1	Oct 9-16	*Aulostoma chinensis*	4
				Canthagaster jactator	1
				Sargocentron sp.	1
			Oct 16-23	*Aulostoma chinensis*	1
5	West Loch Oyster Bank	4	Sep 12-18	*Arothron hispidus*	2
				Thalamita integra	2
			Sep 18-25	*Lutjanus fulvus*	10
				Thalamita integra	2
	West Loch Mangroves	5	Sep 25-Oct 2	*Thalamita integra*	4
			Oct 2-9	*Thalamita integra*	6
	West Loch Coral Bench	4	Oct 9-16	*Arothron hispidus*	1
				Thalamita integra	7
			Oct 16-23	*Arothron hispidus*	2
				Thalamita integra	8
				Total Species	13
				Total Individuals	125

Table 4. Organisms occurring in sediments at Pearl Harbor stations, 1996.

			Station													
Phylum	**Family**	**Genus and Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
MOLLUSCA	BIVALVIA	Unident. spp.		X			X	X	X					X		
MOLLUSCA	EURYCYNIDAE	Unident. sp.	X		X											
MOLLUSCA	OSTREIDAE	*Ostrea* sp.	X	X	X	X		X				X		X	X	
MOLLUSCA	HIATELLIDAE	*Hiatella arctica*	X	X	X			X	X					X	X	
MOLLUSCA	MYIDAE	*Sphenia* sp. A														X
MOLLUSCA	LUCINIDAE	*Ctena bella*			X			X	X					X	X	
MOLLUSCA	LUCINIDAE	*Pillucina spaldingi*													X	
MOLLUSCA	SEMELIDAE	*Abra* sp. A												X		
MOLLUSCA	TELLINIDAE	*Tellina* sp.	X		X		X									X
MOLLUSCA	TELLINIDAE	Unident. sp.						X								
MOLLUSCA	VENERIDAE	*Lioconcha hieroglyphica*						X	X					X		
MOLLUSCA	VENERIDAE	*Venerupis (Ruditapes) phillipinarum*					X									
MOLLUSCA	CAECIDAE	*Caecum sepimentum*	X													
MOLLUSCA	CEPHALASPIDAE	Unident. sp.						X								
MOLLUSCA	DIALIDAE	*Cerithidium perparvalum*	X													
MOLLUSCA	DIALIDAE	*Diala varia*			X											
MOLLUSCA	EATONIELLIDAE	*Eatoniella* sp.	X					X								
MOLLUSCA	FISSURELLIDAE	*Diodora granifera*							X							
MOLLUSCA	FISSURELLIDAE	*Diodora octogona*							X							
MOLLUSCA	TURBINIDAE	*Leptothyra candida*						X								
MOLLUSCA	TURBINIDAE	*Leptothyra rubricincta*	X													
MOLLUSCA	SIPHONARIIDAE	*Williamia* cf. *radiata*												X		
MOLLUSCA	BULLIDAE	*Bulla vernicosa*						X								
MOLLUSCA	HAMINOEIDAE	*Atys kuhnsi*						X								
MOLLUSCA	CALYPTRAEIDAE	*Crepidula aculeata*	X	X	X			X	X			X			X	
MOLLUSCA	CALYPTRAEIDAE	*Crucibulum spinosum*	X													
MOLLUSCA	CERITHIIDAE	*Bittium zebrum*	X	X	X			X	X					X	X	
MOLLUSCA	CERITHIIDAE	*Cerithiopsis* sp. A		X	X				X			X				
MOLLUSCA	CERITHIIDAE	*Finella pupoides*		X	X			X	X							
MOLLUSCA	EULIMIDAE	*Balcis* sp.			X											
MOLLUSCA	HIPPONICIDAE	*Hipponix* sp.	X		X			X	X			X				
MOLLUSCA	RISSOIDAE	*Rissoina miltozona*	X													
MOLLUSCA	RISSOIDAE	*Rissoina turricula*							X							
MOLLUSCA	RISSOIDAE	*Zebina tridentata*	X													
MOLLUSCA	TRIPHORIDAE	*Triphora {Triphoridae}*	X	X	X											
MOLLUSCA	COLUMBELLIDAE	*Seminella* sp.			X			X								
MOLLUSCA	FASCIOLARIIDAE	*Peristernia chlorostoma*	X													
MOLLUSCA	PYRAMIDELLIDAE	*Hinemoa indica*	X		X			X	X						X	
MOLLUSCA	PYRAMIDELLIDAE	*Odostomia stearnsiella*	X		X			X	X							
MOLLUSCA	PYRAMIDELLIDAE	*Pyramidella* sp.	X		X			X								
MOLLUSCA	PYRAMIDELLIDAE	*Pyrgulina oodes*						X	X					X		
MOLLUSCA	TURRIDAE	*Kermia* sp.												X		
MOLLUSCA	UMBRACULIDAE	*Umbraculum* sp.			X											
MOLLUSCA	PUPILLIDAE	*Gastrocopta servilis*						X								
		TOTAL MOLLUSCA	19	8	18	1	3	21	15	0	0	4	0	10	7	2
ARTHROPODA	COPEPODA	Unident. sp.														X
ARTHROPODA	OSTRACODA	*Unident.* sp.														X
ARTHROPODA	AMPHILOCHIDAE	*Amphilochus likelike*						X								
ARTHROPODA	AORIDAE	*Grandidierella japonica*					X							X		
ARTHROPODA	AORIDAE	*Lembos macromanus*						X								
ARTHROPODA	COROPHIIDAE	*Corophium insidiosum*				X	X									
ARTHROPODA	GAMMARIDAE	*Eriopisa hamakua*						X								
ARTHROPODA	GAMMARIDAE	*Eriopisella sechellensis upolu*						X						X		
ARTHROPODA	ALPHEIDAE	*Alpheus* sp.						X						X		
ARTHROPODA	ALPHEIDAE	*Alpheus paracrinitus*						X								
ARTHROPODA	CALLIANASSIDAE	*Callianassa variabilis*		X												
ARTHROPODA	PALAEMONIDAE	Unident. sp.													X	
ARTHROPODA	PORTUNIDAE	*Thalamita integra*			X			X							X	
ARTHROPODA	XANTHIDAE	Unident. sp.	X													
ARTHROPODA	APSEUDIDAE	*Apseudes* sp. A						X								
		TOTAL ARTHROPODA	1	1	1	1	2	8	0	0	0	0	0	3	2	2
ECHINODERMATA	OPHIACTIDAE	*Ophiactis savignyi*						X								
		TOTAL TAXA	20	9	19	2	5	30	15	0	0	4	0	13	9	4

by Dr. E. Allison Kay (see Appendix E for detailed results of the micromollusc analysis). A total of 60 taxa occurred in these samples, including 36 taxa in the micromollusc samples and 26 taxa in the sediment samples, with two taxa (*Ctena bella* and *Tellina* sp.) common to both collections. The sediment samples consisted of 10 micromollusc taxa, 15 crustacea and one echinodermata, and included many species that also occurred in the fouling community.

Micromollusc and sediment fauna were unevenly distributed among the Pearl Harbor stations, with no organisms found at Stations 8, 9 and 11, and only 2 to 5 taxa found at Stations 4, 5 and 11. The stations with the highest diversity were Stations 6 and 1, with 30 and 20 taxa respectively, both located on located on the main entrance channel. Intermediate numbers of species were at Station 3, in West Loch's Walker Bay, at Station 7 along the main channel, and at Station 12, northeast of Ford Island.

The micromollusc analysis (Appendix E) concluded that the composition of this community in 1996 was similar to that found in Pearl Harbor in 1972, except that both species and numbers of individuals were fewer in 1996. Micromolluscs were more abundant at stations located on the channels, with few to no organisms occurring at the heads of the lochs. The total sediment dwelling community represented in Table 4 shows the same pattern as micromolluscs, suggesting that the sediment organisms became more depauperate in the fine grained silt to clay sized sediments that make up the bottom at the heads of the lochs.

E. Comparison with Previous Pearl Harbor Reports of Marine Organisms

The present surveys collected and identified a total of 434 (36 algae, 1 spermatophyte, 338 invertebrate and 59 fish) species and higher taxa among the 15 stations sampled in 1996. Three hundred ninety four of these taxa were from fouling, sediment samples or fish observations and the remaining 40 taxa exclusively from sediments. By comparison, the largest and most comprehensive previous survey in Pearl Harbor (Evans et al. 1974) listed 388 taxa (23 algae, 278 invertebrate and 87 fish) collected or observed in 1971-73. Another study in 1978 (Grovhoug, 1979) reported 130 taxa (79 invertebrate and 51 fish). Other studies in the 1970s all recorded less than 100 taxa, and the surveys by Brock (1994, 1995) determined 96 taxa in 1993 and 99 in 1994. All studies previous to the 1970s reported ten or fewer taxa or were single species reports.

The total cumulative number of taxa and the number of new taxa added by decade for Pearl Harbor which have been reported in the literature or are in Bishop Museum collections (listed in Appendix C) are shown in Figure 14. A total of 1096 taxa that are datable have been reported for

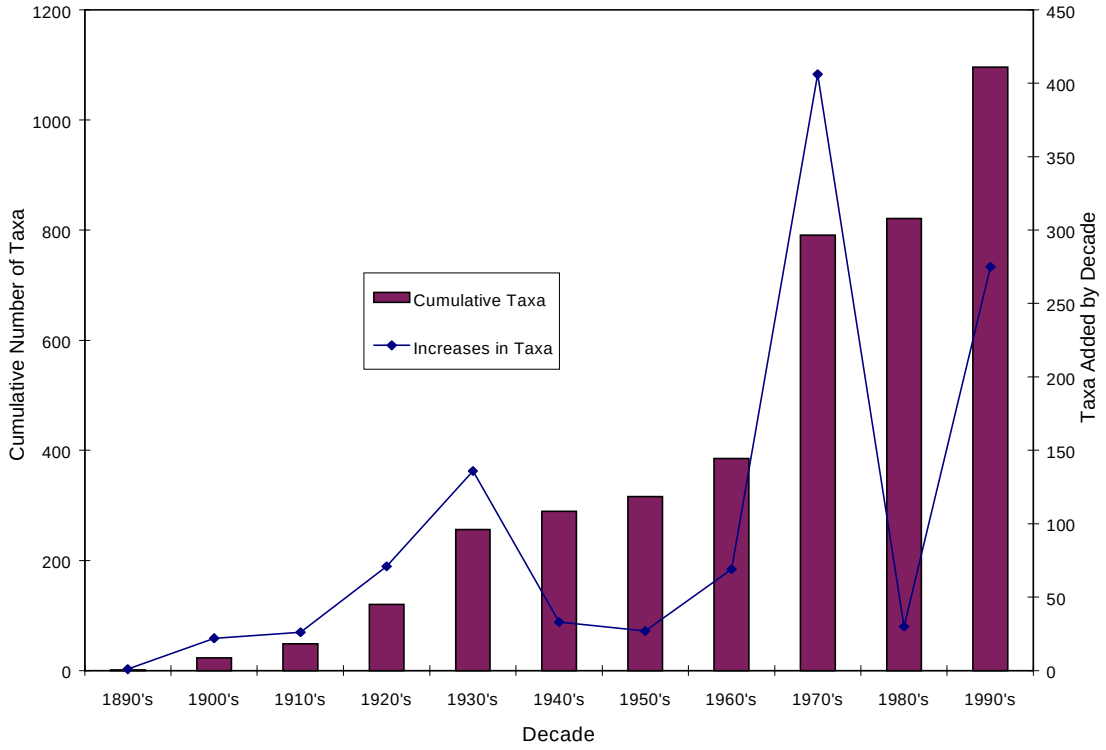

Figure 14. Cumulative numbers of total taxa (bars) and taxa added by decade (line) for Pearl Harbor.

Pearl Harbor by all sources. (An additional 45 records in the BPBM collections are undated, bringing the total reports to 1141). Prior to 1899 only two reports were made, which were newspaper references (see Kay 1979) to oysters (*Crassostrea* sp.) imported to be grown and harvested in Pearl Harbor. Collections and new reports of organisms in Pearl Harbor began in 1899 but increased only slightly from 1900 to 1920. Three periods of substantial increments are indicated for the rest of the century. The first was in the 1920s and 1930s when total taxa reported approximately doubled in each decade. In the 1970s over 400 new taxa were reported, more than doubling the total to 791 total taxa, and in the 1990s 275 new taxa were recorded, increasing the total dated reports for the harbor to 1096. These decades of new reports represented times of markedly increased sampling activity in the Harbor, and therefore are probably based more on effort than on actual new species having been introduced to the harbor during those periods. The 1920s and 30s were a period of pronounced shell collecting in the harbor by P. Bartsch, L. A. Thurston, T. T. Dranga and H. E. Alexander, and fouling studies by C. H. Edmondson and W. M. Ingram. During the 1970s seven environmental studies were conducted in the harbor, most notably the comprehensive Naval Undersea Center study of 1971-73 (Evans, et al., 1974). The 1990s included the two surveys by Brock in East Loch in 1993 and 1994, and the 166 new species reports determined for the harbor from the present study.

F. Introduced Species in Pearl Harbor

The taxa identified from Pearl Harbor in this survey were evaluated in terms of their status as endemic, indigenous, cryptogenic, or introduced. The assignment of individual taxa to a particular status was, in part, based on a decision making process similar to the flow chart depicted in Figure 15. Initially, the status of an individual identified to specific level is *unknown* pending further investigation. If this species is known only from Hawaii, it is tentatively categorized as *endemic*. If the species is known to occur elsewhere, a decision is made regarding its presence in Hawaii. If the species can be shown to occur in Hawaii naturally (e.g., fossil evidence of prehistoric distribution including Hawaii), it is considered to be *indigenous*. If no evidence exists regarding the natural occurrence of a species in Hawaii, there is a possibility the species may be introduced. A species can be shown to be introduced on the basis of several criteria (Chapman 1988, Chapman and Carlton 1991). These include appearance in local regions where not found previously, association with human mechanisms of dispersal (e.g., as fouling on ship bottoms), association with other introduced species, restriction to artificial (or disturbed) habitats (e.g., harbors), and widespread, disjunct geographic distributions. Species with these and other associated attributes are categorized as *introduced*. Species that are not demonstrably introduced or native are here considered to be *cryptogenic* (Carlton, 1996). Pending further study and additional evidence, a species may move from one status category to another (Figure 15 - dashed lines). A review of previously recorded cryptogenic and introduced marine and brackish invertebrates of Hawaii can be found in Carlton and Eldredge (ms., in prep). Other authorities for status of species collected in Pearl Harbor include Brock (1960), Maciolek (1984) and Randall (1987) for fishes, Paulay, (1996 and pers. comm.) for bivalves, Kelly-Borges, et al., (ms. in prep.) for sponges, Lambert, (pers. comm.) for ascidians, Newman, (pers. comm.) for barnacles and Child (pers. comm.) for pycnogonids.

Of the total 434 species and higher taxa found for Pearl Harbor in this study, 96 or about 22% are considered to be introduced or cryptogenic (Appendix F). Fifty five of these are species previously reported in Hawaii and considered introduced, 19 are previously reported and considered cryptogenic, 14 species are new reports for Hawaii considered cryptogenic and eight are new reports considered introduced. The pattern of first occurrences by decade of the introduced or cryptogenic species found in the present study is shown in Figure 16, along with the total new taxa added in each decade from Figure 14. Both patterns are quite similar, with first reports of introduced or cryptogenic species generally increasing during decades of high collecting

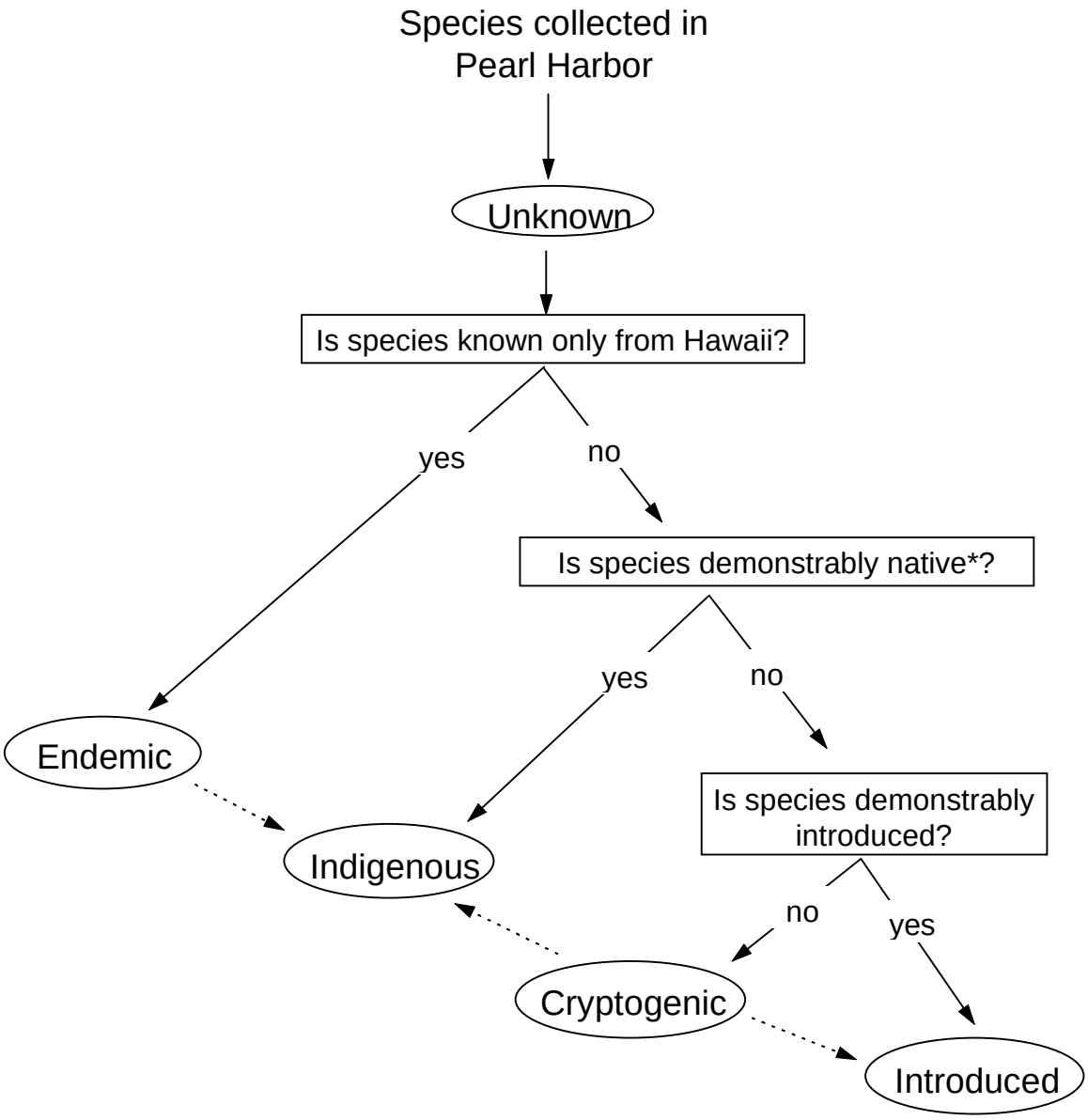

Figure 15. A flow chart for determining the status of individual taxa collected and identified from Pearl Harbor. * “Native” refers to a species that includes Hawaii as part of its natural (i.e. prehistoric) distribution. Dashed lines indicate the possible reassignment of taxa in light of additional evidence.

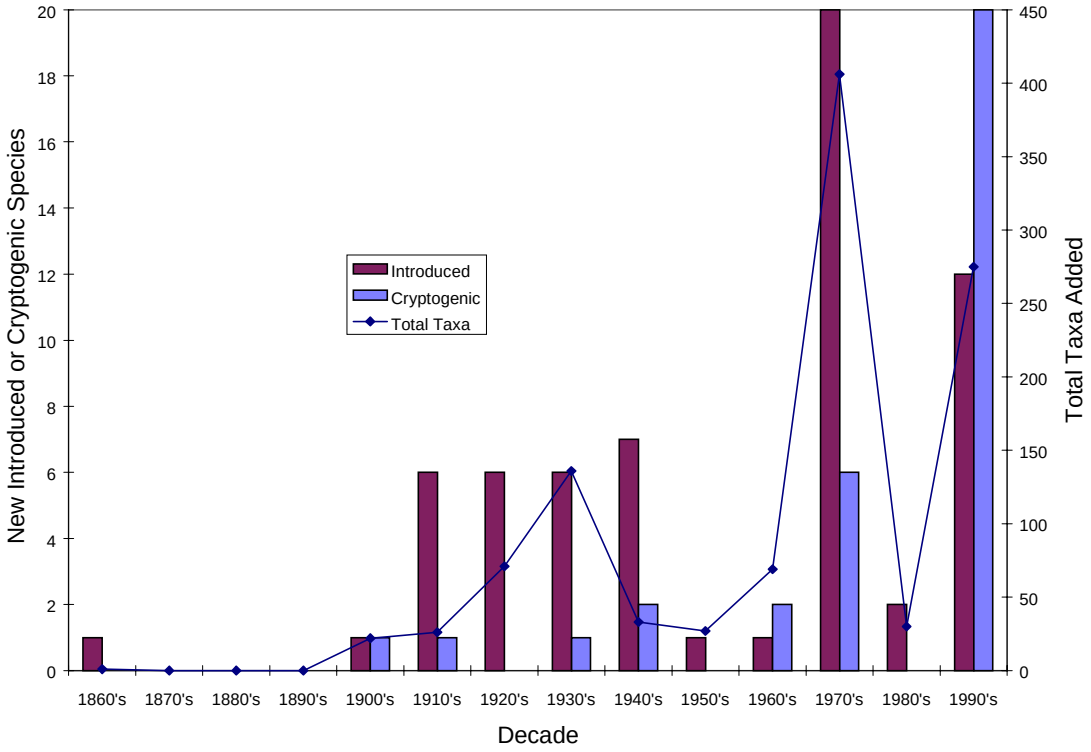

Figure 16. First occurrences of introduced or cryptogenic species present in 1996 (bars) and total taxa added by decade (line) in Pearl Harbor.

activity. However, the first period of numerous reports of introductions occurred in the 1910s and 1920s, preceding the first decade of high total taxa reports in the 1930s. This could have been due to a combination of two factors: 1) introduced and cryptogenic species had been in the harbor for many years and were only discovered when collection activity increased after the turn of the century, or 2) the dredging of the Pearl Harbor entrance channel and frequent entry of ocean-going ships that occurred only after 1910 provided a means for a genuine increase in species introductions.

The other period of relative high frequencies of reports of introduced or cryptogenic species occurred from 1941 to 1950. Despite relatively low collecting activity indicated by total taxa reports of less than 50 during that decade, nine newly introduced or cryptogenic species were reported in the 1940s, compared to a total of only two introduced and two cryptogenic species in the 1950s and the 1960s. This suggests that increased shipping activity during the World War II and early Korean War periods promoted increases in species introductions, and this was a time when many on site reports were made of non-indigenous species being collected from ships and barges recently transported to Pearl Harbor (Edmondson 1951, 1952, 1954; Doty, 1961).

The maximum numbers of introduced and cryptogenic species were reported in the 1970s. Introduced species totaled 20, more than twice the number of any preceding decade, and this may represent a delayed response to increased shipping activity during the Vietnam War. However, this possibility is masked by the fact that collecting effort, as indicated by total new taxa reported and the number and extent of surveys that were conducted, were substantially greater during this decade than in any other.

The introduced species first detected in Pearl Harbor in the 1990s include four previously reported in Hawaii and the eight species new to Hawaii found by the present study. This is a relatively high number, considering that they came from a single survey of 15 stations throughout the harbor. Twenty cryptogenic species, including the 14 from the present study, were also detected in the 1990s, the highest of any decade. This number of cryptogenic species may decrease as further information becomes available that will allow reclassification of their status to introduced or indigenous.

The new reports of introduced species for the present study include four bivalves (*Saccostrea cucullata, Chama elatensis*, *Abra* sp. and *Sphenia* sp. A), one pycnogonid (*Pigrogromitus timsanus*), one barnacle (*Chthamalus proteus*), one grapsid crab (*Nanosesarma minutum)* and one ascidian *(Symplegma reptans)*. Distributions of these species are shown in Figures 17 through 19.

The bivalves were identified by G. Paulay, who has previously examined Hawaiian material in the Bishop and U. S. National Museums. This is the first report in Pearl Harbor for the oyster *Saccostrea cucullata,* which was found throughout the harbor (Figure 17). According to Edmondson and Wilson (1940) and Brock (1952), Australian oysters (*Ostrea cucullata*) were planted in Kalihi and Kaneohe in 1928 and 1929 but did not survive. If the present *S. cucullata* are the same species they may represent a surviving population of those introductions which has not been observed elsewhere. The unidentified species of *Sphenia* is a new record for Hawaii and was abundant at many stations (Figure 17). It resembles *Hiatella arctica*, which was reported in the harbor in the 1980s. However, *Hiatella* normally occurs on wave-exposed reefs, suggesting that the *H. arctica* reports were misidentifications of this species (Paulay, pers. comm.). Of the four species of *Chama* that were found in this study (Figure 18), three are considered to be introduced and one to be cryptogenic. Two introduced Indo-Pacific species, *C. lazarus* and *Chama pacifica*, probably were brought into Pearl Harbor on ship bottoms in the 1950s (Paulay,

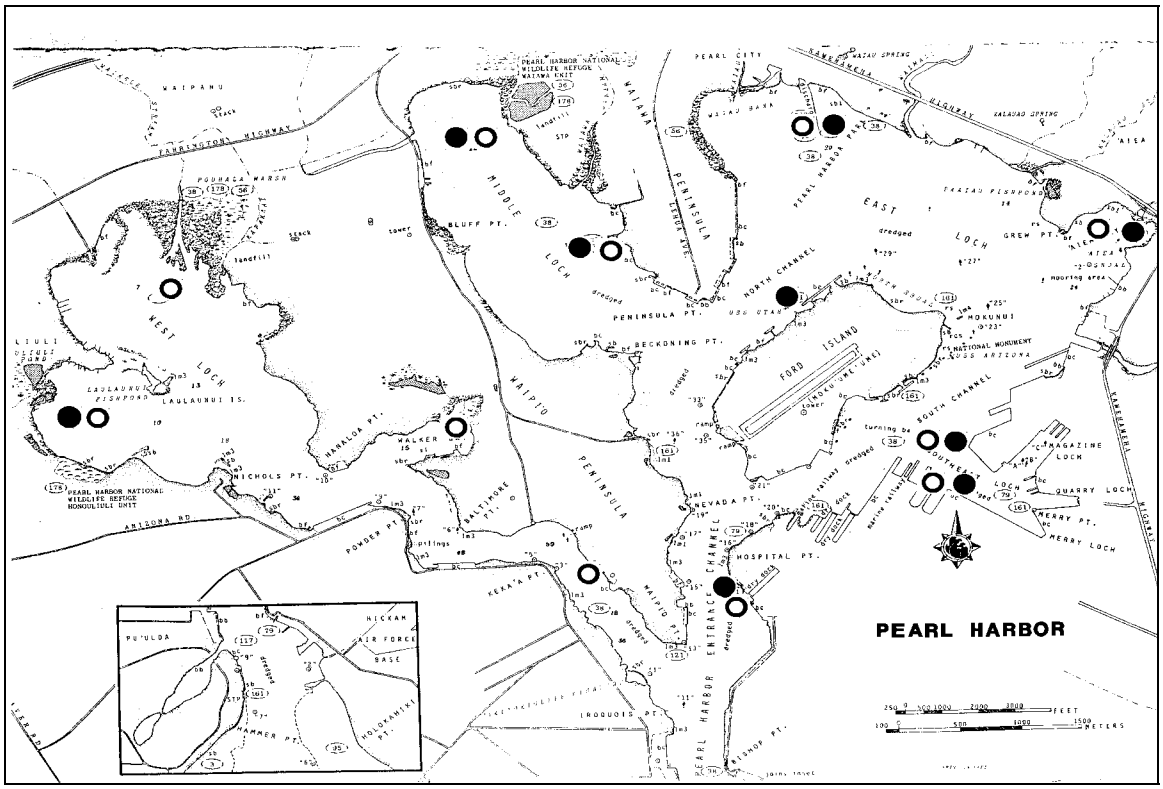

Figure 17 . Distribution of *Saccostrea cucullata* (solid circles) and *Sphenia* sp. (open circles) in Pearl Harbor, 1996.

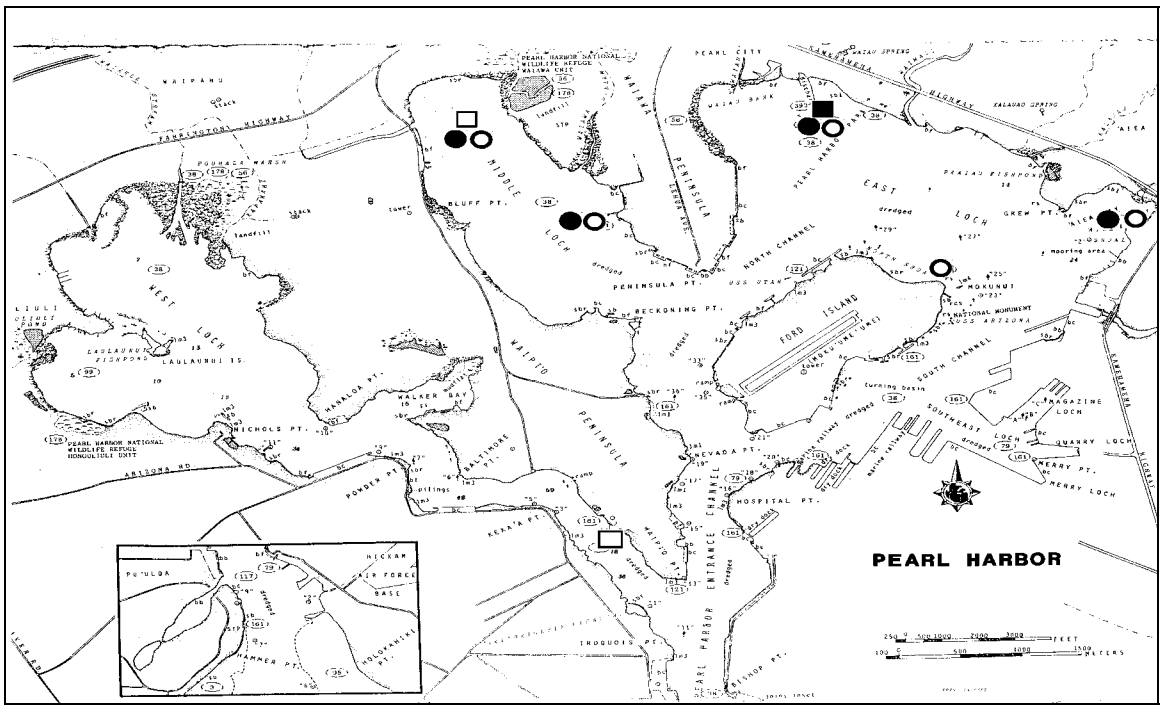

Figure 18. Distribution of *Chama elatensis* (solid circles), *C. fibula* (open circles), *C. lazarus* (solid squares) and *C. pacifica* (open squares) in Pearl Harbor, 1996.

1996). The third, newly introduced, *Chama* species has been identified as *Chama elatensis*. This species was previously unknown outside of the Red Sea (Paulay, pers. comm.) and in densities up to $0.6 \cdot ft^{-2}$ ($5 \cdot m^{-2}$) on the hull of the *USS Machinist* floating drydock in Middle Loch and as a single specimen at the entrance of West Loch. The fourth species, *Chama fibula,* was reported in Pearl Harbor early in this century (Bryan, 1915; Dall, Bartsch and Rehder, 1938) but is at least cryptogenic (Carlton and Eldredge, ms. in prep.) based on its distribution, which ranges to the Philippines and Australia (Kay, 1979). Only one specimen was found of the unidentified species of *Abra*, the remaining newly introduced mollusc.

The barnacle *Chthamalus proteus* (identified using DNA analysis, W. Newman, pers. comm.) is perhaps the most surprising new introduction detected by this study. This origin of this species the Caribbean, and this is the first report for it in the Pacific. The chthamalid species *Chthamalus hemblii* and *C. intertextus* have been reported from Hawaii since the 1920s, but barnacles previously placed in the genus *Chthamalus* in Hawaiian waters are now placed in other genera (*Euraphia* and *Nesochthamalus*). Thus this is the first confirmed report of true *Chthamalus* in the Hawaiian Islands. Brock (1994, 1995) reported *Chthamalus hemblii* from mangrove roots near the HECO discharge in East Loch, which was probably a misidentification of the *Chthamalus proteus* of the present study. This species occurs throughout Pearl Harbor (Figure 19) and is very abundant on smooth hard surfaces in Kaneohe Bay and Honolulu Harbor (Coles, pers. obs.), and therefore is probably widely distributed around Oahu. It was also observed in abundance in Nawiliwili and Kahului Harbors in 1996 (Defelice, pers. obs.). No *Chthamalus* were reported by the extensive biological surveys in Pearl Harbor in 1971-1973 (Evans, et al., 1974), by Matsuda (1973) or by the many other studies in the harbor in the 1970s. Therefore, it is likely that this species has been introduced and proliferated throughout the Hawaiian Islands in the last 20 years.

The other newly introduced crustacean detected in the present study is *Nanosesarma minutum,* a small grapsid crab previously reported from East Africa to Japan. This species was moderately abundant at stations near the shorelines of Middle and East Loch and at the station at the channel entrance to Middle Loch (Figure 19). The newly reported ascidian *Symplegma reptans,* which is a Japanese species (G. Lambert, pers. comm.), occurred only on the hull of the *Machinist,* and the introduced pantropical pycnogonid *Pigrogromitus timsanus* occurred as a single juvenile only at Station 14 in the HECO discharge area.

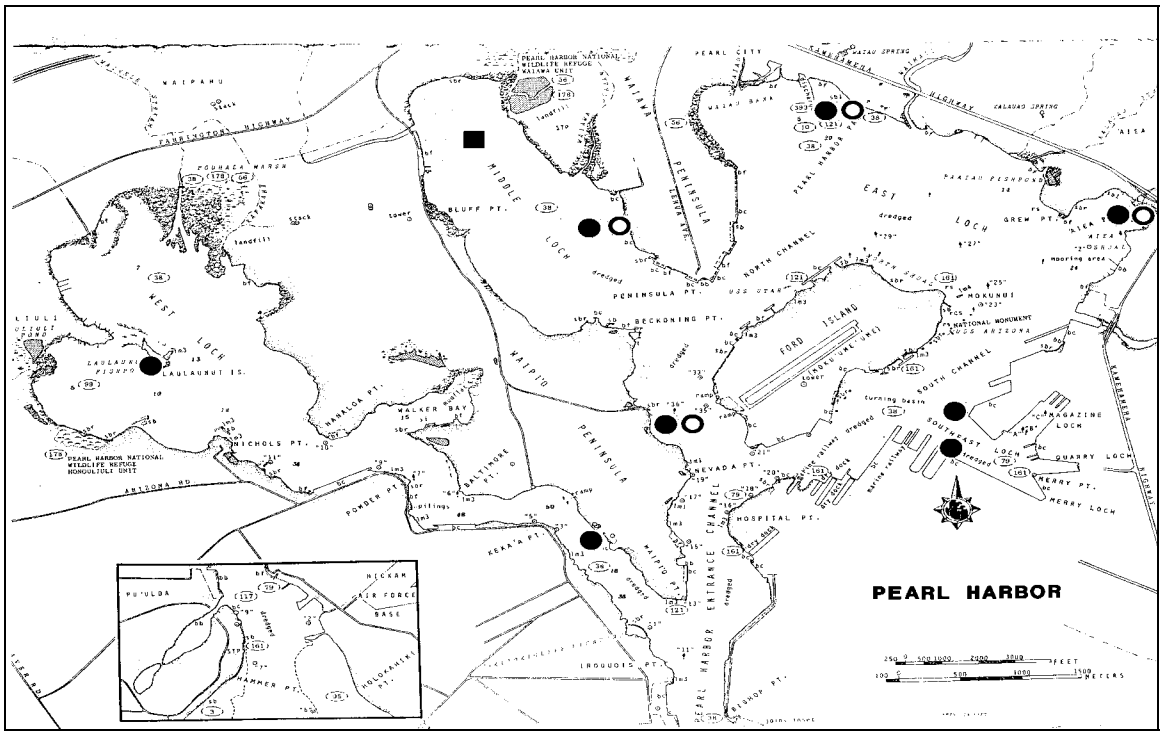

Figure 19. Distributions of barnacle *Chthamalus proteus*.(solid circles), grapsid *Nanosesarma minutum* (open circles) and ascidian *Symplegma reptans* (solid squares).

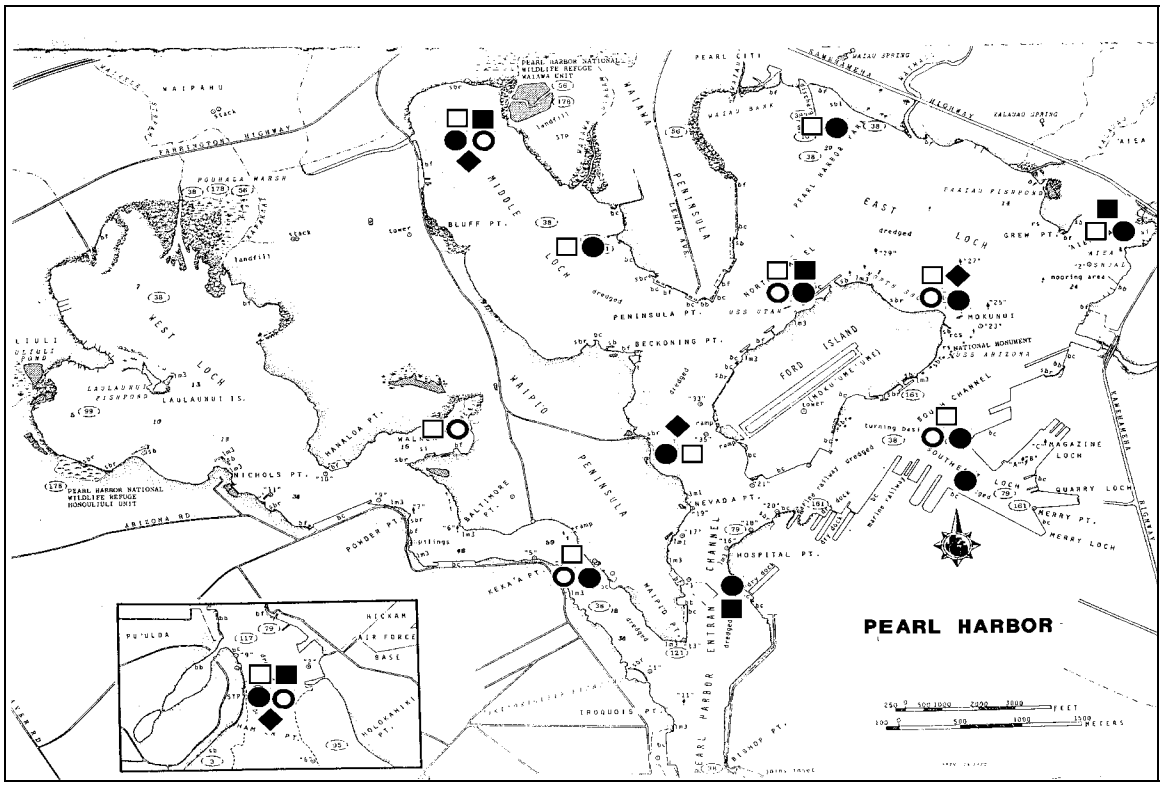

Figure 20. Distributions of sponges *Mycale (Aegogropila) armata* (solid circles), *Gelliodes fibrosa* (open circles), *Sigmadocia* cf. *caerulea* (open squares), *Echinodictyum asperum* (solid squares) and *Biemna fistulosa* (solid diamonds).

G. Persistence of Introduced Species

The 63 introduced species that were collected in Pearl Harbor in 1996 (Appendix F) represent 64% of a total of 99 introduced species that have been sampled from Pearl Harbor since collecting began. The introduced species still present in 1996 are listed in Table 5 and those not found in 1996 are listed in Table 6. The percentages of the total species introduced by decade still present in 1996 are shown as the line graph in Figure 21. Percent persistence by decade ranged from 100% for the ten species introduced in the 1910s to a low of 30% for species introduced in the 1960s, with no indication of decreasing presence with time of species that have been introduced.

This indicates a high level of persistence by nonindigenous species in the harbor once they have been introduced. Moreover, these estimates of species persistence are probably conservative, since our sampling methods probably missed some previously reported nonindigenous species which still occur in the harbor. For example, three small species of previously reported introduced fishes *(Fundulis grandis, Gambusia affinis* and *Mugilogobius parvus*) would have been more likely to be sampled by seining, and four species of wood boring molluscs (*Lyrodus affinis, L. affinis, Teredo clappi* and *T. furcifera*) may have occurred further within wood structures than we were able to penetrate in our sampling.

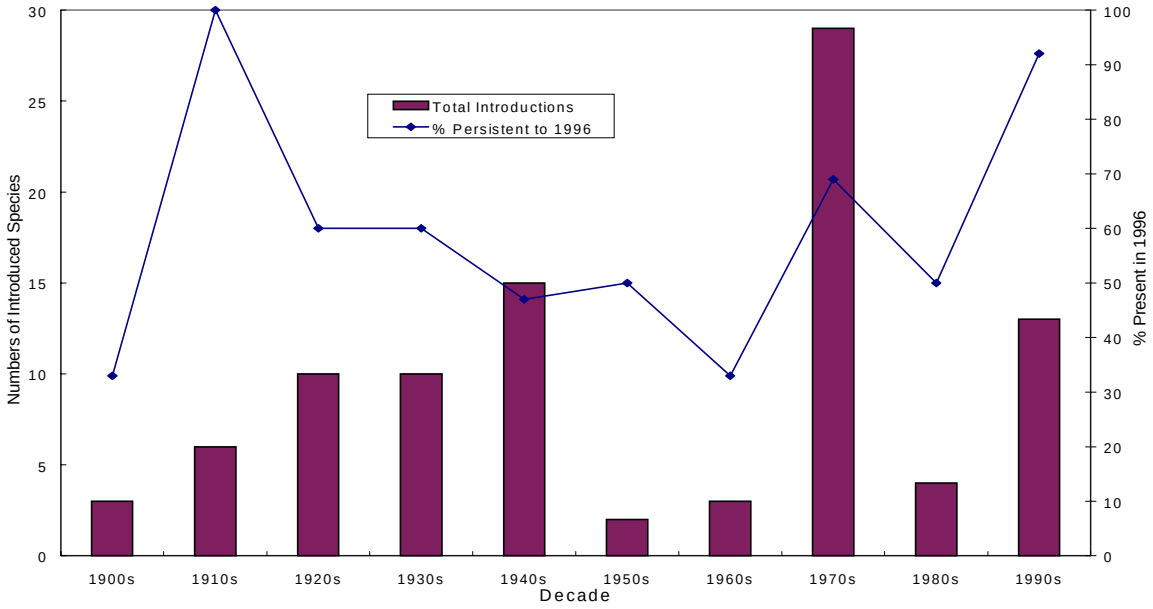

Figure 21. Percent of nonindigenous species introduced by decade which were collected in the present study.

Table 5. Total reports by decade of introduced species collected or observed in Pearl Harbor in 1996.

Phylum	Genus and Species	1st Rept.	1900s	1910s	1920s	1930s	1940s	1950s	1960s	1970s	1980s	1990s	Total
RHODOPHYTA	*Acanthophora spicifera*	1952						1		2		2	5
PORIFERA	*Halochondria melanodocia*	1993										2	2
PORIFERA	*Mycale (Carmia) cecilia*	1973								1		1	2
PORIFERA	*Zygomycale parishii*	1947					1			1		2	4
PORIFERA	*Suberites cf. zeteki*	1948					1			1		2	4
CNIDARIA	*Halocordyle disticha*	1929			1		3			3	1	2	10
CNIDARIA	*Carijoa (=Telesto) riisei*	1972								4	1	2	7
ANNELIDA	*Hydroides dirampha*	1929			2	8				5		1	16
ANNELIDA	*Hydroides elegans*	1929			2	9	6			6	2	1	26
ANNELIDA	*Pomatoleios kraussii*	1976								1		2	3
ANNELIDA	*Salmacina dysteri*	1972								1	1	2	4
MOLLUSCA	*Diodora ruppelli*	1962							1			1	2
MOLLUSCA	*Crepidula aculeata*	1915		1	1	3		1		5	1	2	14
MOLLUSCA	*Crucibulum spinosum*	1950					2			2		2	6
MOLLUSCA	*Vermetus alii*	1973								2	1	2	5
MOLLUSCA	*Crassostrea virginica*	1866	1		1				1	2	2	1	8
MOLLUSCA	***Saccostrea cucullata***	1996										1	1
MOLLUSCA	***Chama* cf. elatensis**	1996										1	1
MOLLUSCA	*Chama fibula*	1920		2		1				1		1	
MOLLUSCA	*Chama lazarus*	1950					4					1	5
MOLLUSCA	*Chama pacifica*	1950					1					1	2
MOLLUSCA	***Abra* sp.**	1996										1	1
MOLLUSCA	*Venerupis (Ruditapes) philippinarum*	1918		2	4	1						1	8
MOLLUSCA	***Sphenia* sp. A**	1996										1	1
MOLLUSCA	*Martesia striata*	1920		4		2				1	1	1	9
MOLLUSCA	*Teredo bartschi*	1935				1				1		1	3
PYCNOGONIDA	***Pigrogromitus timsanus***	1996										1	1
ARTHROPODA	*Balanus amphitrite amphitrite*	1913		2	2	5	9			4	1	2	25
ARTHROPODA	*Balanus eburneus*	1929			1		3	1		6		2	13
ARTHROPODA	*Balanus reticulatus*	1915		1			1			2		1	5
ARTHROPODA	***Chthamalus proteus***	1996										1	1
ARTHROPODA	*Limnoria tripunctata*	1973								1		1	2
ARTHROPODA	*Corophium ascherusicum*	1973								1		1	2
ARTHROPODA	*Corophium baconi*	1973								2		1	3
ARTHROPODA	*Corophium insidiosum*	1978								1		1	2
ARTHROPODA	*Ericthonius brasiliensis*	1938				2				2		1	5
ARTHROPODA	*Grandidierella japonica*	1996										1	1
ARTHROPODA	*Elasmopus rapax*	1948					4	1			2	1	8
ARTHROPODA	*Podocerus brasiliensis*	1938				2	3	2			2	1	10
ARTHROPODA	*Stenothoe gallensis*	1937				1	2	2			2	1	8
ARTHROPODA	*Scylla serrata*	1972								1	1	1	3
ARTHROPODA	***Nanosesarma minutum***	1996										1	1
ARTHROPODA	*Panopeus pacificus*	1929			3	2	6			3		1	15
ARTHROPODA	*Gonodactylus falcatus*	1973								1	1	2	4
BRYOZOA	*Amathia distans*	1948					2			2		1	5
BRYOZOA	*Aetea truncata*	1972								2		1	3
BRYOZOA	*Bugula neritina*	1921			2	4	8	3		4		2	23
BRYOZOA	*Bugula stolonifera*	1940				7		2		3		2	14
BRYOZOA	*Savignyella lafontii*	1972								1		1	2
BRYOZOA	*Schizoporella errata*	1973								1	2	1	4
BRYOZOA	*Schizoporella unicornis*	1935				2				2		2	6
BRYOZOA	*Watersipora edmondsoni*	1972								3		1	4
CHORDATA	*Ascidia sydneiensis*	1976								1		1	2
CHORDATA	*Ascidia* sp. B	1996										1	1
CHORDATA	*Herdmania momus*	1972								2		2	4
CHORDATA	*Microcosmus exasperatus*	1996										1	1
CHORDATA	*Phallusia nigra*	1985									1	2	3
CHORDATA	*Symplegma oceania*	1975								2		1	3
CHORDATA	***Symplegma reptans***	1996										1	1
CHORDATA	*Poecilia* cf. *latipinna*	1905	1								1	1	3
CHORDATA	*Oreochromis mossambicus*	1973								2	1	2	5
CHORDATA	*Sarotherodon melanotheron*	1987									1	1	2
CHORDATA	*Lutjanus fulvus*	1973								2		3	5

Table 6. Total reports by decade of introduced species not collected or observed in Pearl Harbor in 1996.

Phylum	Genus and Species	1st Rept.	1900s	1910s	1920s	1930s	1940s	1950s	1960s	1970s	1980s	1990s	Total
CNIDARIA	*Clytia hemispherica*	1978								1			1
CNIDARIA	*Obelia bidentata*	1978								1			1
CNIDARIA	*Obelia dichotoma*	1975								2			2
CNIDARIA	*Cassiopea medusa*	1941					1						1
CNIDARIA	*Phyllorhiza punctata*	1941					1			2			3
CNIDARIA	*Diadumene leucolena*	1977								1			1
ANNELIDA	*Ficopomatus enigmaticus*	1937				1				1			2
ANNELIDA	*Hydroides crucigera*	1937				2				2			4
ANNELIDA	*Neodexiospira foraminosa*	1993										1	1
ANNELIDA	*Nereis areanaceodonta*	1973								1			1
ANNELIDA	*Polydora websteri*	1966							1				1
MOLLUSCA	*Hyotissa hyotis*	1950					1						1
MOLLUSCA	*Crassostrea gigas*	1938				1						1	2
MOLLUSCA	*Sphenia luticola*	1972								1			1
MOLLUSCA	*Lopha cristigalli*	1951						1					1
MOLLUSCA	*Lyrodis affinis*	1973								2			2
MOLLUSCA	*Lyrodis pedicillatus*	1935				2				1			3
MOLLUSCA	*Teredo clappi*	1923			2					1			3
MOLLUSCA	*Teredo furcifera*	1921			4	1				1			6
ARTHROPODA	*Paracerceis sculpta*	1968							1	3			4
ARTHROPODA	*Sphaeroma walkeri*	1973								2			2
ARTHROPODA	*Caprella scaura*	1929			2		1			1			4
ARTHROPODA	*Shyzophrys aspera*	1950					1						1
ARTHROPODA	*Charybdis helleri*	1950					1						1
ARTHROPODA	*Glabropilumnus seminudus*	1950					1		1	1			3
ARTHROPODA	*Neoliomera immigrans*	1950					1		1				2
ARTHROPODA	*Panopeus herbstii*	1947					1						1
BRYOZOA	*Zoobotryon verticillatum*	1921			1		4			1			6
CHORDATA	*Didemnum candidum*	1985									1	1	2
CHORDATA	*Ciona intestinalis*	1975								2			2
CHORDATA	*Fundulus grandis*	1905	1								1		2
CHORDATA	*Gambusia affinis*	1905	1								1		2
CHORDATA	*Mugilogobius parvus*	1987									1		1
	Total Reports		2	0	9	7	13	1	4	27	4	3	70

H. Origins and Distributions of Introduced Species

The probable origins or previously known geographic ranges of the introduced species still present in 1996 are listed in Table 6, and the totals and percentages of the species by origin or range are shown in Figure 22. Most of the species (42%) were of indeterminate origin, occurring in temperate or tropical waters worldwide. Most of those for which an origin or previous range can be designated can be traced to the Western Indo-Pacific (24%) and the general Indo-Pacific (12%), with a additional fraction (3%) from the Eastern Pacific and the Red Sea, totaling 45% for the Pacific basin. The Atlantic basin accounted for a total of only 15% of the introduced species, with over half of these coming from the western Atlantic region.

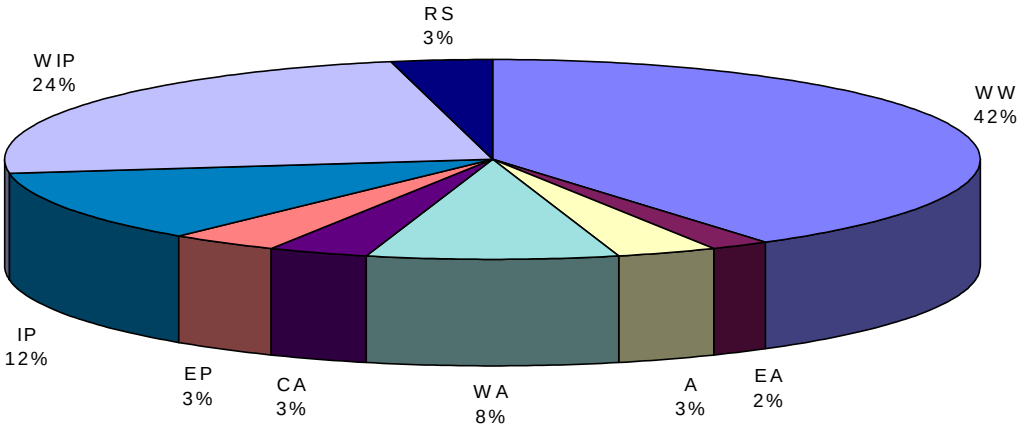

Figure 22. Origin or geographic distribution of the introduced species collected in 1996. WW: Temperate or Tropical Worldwide; RS: Red Sea; WIP: Western Indo-Pacific; IP: Indo-Pacific; EP: Eastern pacific; CA: Caribbean; WA: Western Atlantic; A: Atlantic; EA: Eastern Atlantic, including Mediterranean

Table 6. Origins or previously known distributions of introduced species collected in Pearl Harbor in 1996 (listed phylogenetically within geographic category).

Phylum	Genus and Species	1st P. H. Rept.	Origin and/or Previous Range	ID
ARTHROPODA	*Corophium insidiosum*	1978	North Atlantic (Carlton & Eldredge, ms)	A
BRYOZOA	*Savignyella lafontii*	1972	Tropical Atlantic (Carlton & Eldredge, ms)	A
CNIDARIA	*Carijoa (=Telesto) riisei*	1972	Florida-Brazil (Bayer, 1961)	CA
ARTHROPODA	***Chthamalus proteus***	1996	Caribbean (Newman. pers. comm.)	CA
CNIDARIA	*Halocordyle disticha*	1929	European Atlantic, Worldwide (Cooke, 1977)	EA
ARTHROPODA	*Corophium baconi*	1973	Bering Sea- Peru (Barnard, 1970)	EP
BRYOZOA	*Schizoporella unicornis*	1935	Northwest Pacific (Carlton & Eldredge, ms)	EP
PORIFERA	*Mycale (Carmia) cecilia*	1973	Panama-Palau (Kelly-Borges et al., ms.)	IP
MOLLUSCA	*Chama lazarus*	1950	East Afica-Tonga (Paulay, 1996)	IP
MOLLUSCA	*Chama pacifica*	1950	Thailand-Line Islands (Paulay, 1996)	IP
ARTHROPODA	*Scylla serrata*	1972	Guam, Red Sea-Tahiti (Brock, 1960)	IP
BRYOZOA	*Watersipora edmondsoni*	1972	Tropical-Subtropical Pacific (Carlton & Eldredge, ms)	IP
CHORDATA	*Symplegma oceania*	1975	Temperate and Tropical Pacific (Abbot et al. 1997)	IP
CHORDATA	*Lutjanus fulvus*	1973	Tropical Indo-Pacific (Randall, 1987)	IP
MOLLUSCA	***Chama* cf. *elatensis***	1996	Red Sea (Paulay, pers. comm.)	RS
ARTHROPODA	*Balanus amphitrite amphitrite*	1913	Red Sea, Worldwide (Carlton & Eldredge, ms)	RS
PORIFERA	*Halochondria melanodocia*	1993	Tropical West Atlantic (Bergquist, 1967)	WA
MOLLUSCA	*Vermetus alii*	1973	Florida (Hadfield, pers. comm. in Carlton & Eldredge, ms)	WA
MOLLUSCA	*Crassostrea virginica*	1866	Eastern N. America, Worldwide	WA
ARTHROPODA	*Balanus eburneus*	1929	Western N. Atlantic, Worldwide (Carlton & Eldredge, ms)	WA
CHORDATA	*Poecilia* cf. *latipinna*	1905	Eastern North America (Randall, 1987)	WA
RHODOPHYTA	*Acanthophora spicifera*	1952	Guam-Australia (Doty, 1961)	WIP
PORIFERA	*Suberites cf. zeteki*	1948	Philippines-Palau (Kelly-Borges et al., ms.)	WIP
ANNELIDA	*Pomatoleios kraussii*	1976	Tropical Indo-West Pacific (Bailey-Brock, 1987)	WIP
ANNELIDA	*Salmacina dysteri*	1972	Tropical Worldwide (Bailey-Brock, 1987)	WIP
MOLLUSCA	*Diodora ruppelli*	1962	Tropical Indo-West Pacific -Red Sea (Kay, 1979)	WIP
MOLLUSCA	***Saccostrea cucullata***	1996	Australia (Edmondson & Wilson, 1940)	WIP
MOLLUSCA	*Chama fibula*	1920	Philippines-Australia	WIP
MOLLUSCA	*Venerupis (Ruditapes) philippinarum*	1918	Japan, Indo-West to East Pacific	WIP
ARTHROPODA	*Grandidierella japonica*	1996	Japan (Carlton & Eldredge, ms)	WIP
ARTHROPODA	***Nanosesarma minutum***	1996	East Afica-Thailand (Carlton & Eldredge, ms)	WIP
ARTHROPODA	*Gonodactylus falcatus*	1973	Eastern Pacific- Phillipines (Kinsey, 1968)	WIP
CHORDATA	***Symplegma reptans***	1996	Japan (Lambert, pers. comm.)	WIP
CHORDATA	*Oreochromis mossambicus*	1973	East Africa, Tropical Worldwide (Randall, 1987)	WIP
CHORDATA	*Sarotherodon melanotheron*	1987	West Africa, Tropical Worldwide (Randall, 1987)	WIP
PORIFERA	*Zygomycale parishii*	1947	Tropical Worldwide (Kelly-Borges et al., ms.)	WW
ANNELIDA	*Hydroides dirampha*	1929	Tropical and Temperate Worldwide (Bailey-Brock, 1987)	WW
ANNELIDA	*Hydroides elegans*	1929	Worldwide (Bailey-Brock, 1987)	WW
MOLLUSCA	*Crepidula aculeata*	1915	Worldwide (Kay, 1979)	WW
MOLLUSCA	*Crucibulum spinosum*	1950	Worldwide (Kay, 1979)	WW
MOLLUSCA	*Martesia striata*	1920	Throughout Atlantic and Pacific (Kay, 1979)	WW
MOLLUSCA	*Teredo bartschi*	1935	Worldwide (Kay, 1979)	WW
PYCNOGONIDA	***Pigrogromitus timsanus***	1996	Suez Canal, Tropical Worldwide	WW
ARTHROPODA	*Balanus reticulatus*	1915	Worldwide (Carlton & Eldredge, ms)	WW
ARTHROPODA	*Limnoria tripunctata*	1973	Worldwide (Muir, pers. comm.)	WW
ARTHROPODA	*Corophium ascherusicum*	1973	Tropical and Temperate Worldwide (Barnard, 1971)	WW
ARTHROPODA	*Ericthonius brasiliensis*	1938	Tropical and Temperate Worldwide (Muir, pers. comm.)	WW
ARTHROPODA	*Elasmopus rapax*	1948	Tropical Worldwide (Bernard, 1970)	WW
ARTHROPODA	*Podocerus brasiliensis*	1938	Tropical and Temperate Worldwide (Muir, pers. comm.)	WW
ARTHROPODA	*Stenothoe gallensis*	1937	Tropical Worldwide (Carlton & Eldredge, ms)	WW
BRYOZOA	*Amathia distans*	1948	Tropical Worldwide (Carlton & Eldredge, ms)	WW
BRYOZOA	*Bugula neritina*	1921	Tropical Worldwide (Soule &Soule, 1967)	WW
BRYOZOA	*Bugula stolonifera*	1940	Tropical Worldwide (Gordon & Maatvatari, 1992))	WW
BRYOZOA	*Schizoporella errata*	1973	Worldwide (Carlton & Eldredge, ms)	WW
CHORDATA	*Ascidia sydneiensis*	1976	Tropical Worldwide (Abbot et al. 1997)	WW
CHORDATA	*Ascidia* sp. B	1996	Tropical Western Pacific (Abbot et al. 1997)	WW
CHORDATA	*Herdmania momus*	1972	Tropical Worldwide (Abbot et al. 1997)	WW
CHORDATA	*Microcosmus exasperatus*	1996	Tropical Worldwide (Abbot et al. 1997)	WW
CHORDATA	*Phallusia nigra*	1985	Worldwide (Abbot et al. 1997)	WW
MOLLUSCA	***Abra* sp.**	1996	Unknown	
MOLLUSCA	***Sphenia* sp. A**	1996	Unknown	
ARTHROPODA	*Panopeus pacificus*	1929	Unknown	
BRYOZOA	*Aetea truncata*	1972	Unknown (Carlton & Eldredge, ms)	

I. New Species Reports and Changes in Biota

One hundred sixty six of the 434 total taxa reported for this study were species or genera never previously reported in Pearl Harbor (Appendix F). Of these new reports nine were sampled from sediments and the remaining 157 were fouling community organisms or fishes. New reports for these non-sediment organisms ranged from 16% of the total taxa at Station 5 to 47% of total taxa at Station 1, with new reports more than 35% of total taxa at 7 of the 15 of the stations. Approximately the same proportions of the total number of new reports for the harbor were accounted for by each phylum as applied for the total community, except that algae comprised 14.6% sponges 17.2% and fishes only 7.6% of the new reports, compared to 9.1%, 8.4% and 15% for those groups respectively in the total taxa (Table 2).

Nineteen of the 32 sponges (~60%) collected in Pearl Harbor are new species reports for the Hawaiian Islands. Eleven of these may represent undescribed species unique to Hawaii, and three are considered to be introduced species (Kelly-Borges, et al, unpublished ms. and Carlton and Eldredge, unpub. ms.). Of the 23 species previously recorded from Pearl Harbor, only five were verified by the present study to occur in the harbor in 1996. Because few specimens exist from previous collections in Pearl Harbor, it is not possible to compare our species identifications with previous reports (De Laubenfels, 1950; McCain, 1974,1975; Brock 1994, 1995). It is highly probable that many of the species identified as new reports in the present study have occurred in Pearl Harbor for some time. It is also possible that some species previously reported in Pearl Harbor do occur there but were not collected by this survey. The lack of information regarding the historical presence of sponges in Pearl Harbor makes it difficult to designate the status (i. e. native or introduced) of many of the species identified by this study. As a result many species of sponges are herein categorized as cryptogenic, pending further study. Several specimens that have been assigned specific names with some certainty and are presently considered cryptogenic are discussed below.

Mycale (Aegogropila) armata is perhaps the most abundant and conspicuous sponge in Pearl Harbor, found at all sampling stations except those of upper West Loch (Figure 20). As abundant as it is, it is not likely that this sponge was overlooked by previous collectors in the harbor. It has probably been previously misidentified as *Zygomycale parishii,* a species with a similar complement of spicules and an orange color. The known distribution of *M. (A.) armata* is the Great Barrier Reef, Indo-Malaysian region (including the Philippines) and the west-central Pacific. An ongoing survey of the fouling communities in commercial harbors throughout Hawaii did not encounter this species in Nawiliwili or Kahului Harbors (DeFelice, pers. obs.), suggesting that this species may be introduced.

Gelliodes fibrosa, a black sponge that forms a thick fibrous mat, occurred at seven sampling stations, including the *USS Machinist* hull (Figure 20). This sponge may have been overlooked or misidentified by previous researchers, but it is important to note that this species has not been recorded elsewhere to date except in the Philippines. *Sigmadocia* cf. *caerulea* may eventually be regarded as an introduced sponge. This species was originally described from the Caribbean, and nothing similar has been recorded anywhere in the Indo-Pacific, including Japan. If the Pearl Harbor specimens are confirmed to be *S. caerulea*, it is highly improbable that the resulting distribution of this species (i. e. the Caribbean and Hawaii) is natural.

Echinodictylum asperum is very common and widely distributed from the Arabian Gulf through the Indo-Pacific, including the western coast of Australia, the Palau marine lakes, Guam, Likiep, Pohnpei, northern and southern Papua New Guinea and Zanzibar. This sponge may have been overlooked by previous researchers since it is covered with sediment, but it could not have been mistaken for any other sponge known from Hawaii. If the distribution of this species in Hawaii proves to be restricted to Pearl Harbor, this sponge may be considered an introduced species. If it is found to be widely distributed throughout the state, it would be difficult to determined whether it is introduced or the Hawaiian Islands are part of this sponge's normal distribution.

Biemna fistulosa is another species that may have been overlooked by previous researchers. This sponge is known from Zanzibar, Chuuk, and the Palau marine lakes, which have similar environments to Pearl Harbor. A human-mediated transport between Pearl Harbor and these remote locations is unlikely; therefore, it is possible that Hawaii may be part of this species' natural distribution.

The locations where reef corals were found in Pearl Harbor during the present study are shown Figure 23 Four coral species occurred, and two of them penetrated well into East Loch. *Leptastrea purpurea,* a recognized hardy species, occurred at six stations, extending to the shoreline at Rainbow Bay and even to the sheet piling in the path of the HECO warm water effluent. Colonies of this species were all small, but their survival in these environments was surprising. A single small colony of *Pocillopora damicornis* (Plate 4) occurred at Station 11 at the entrance to Southeast Loch, and a few medium size colonies were near the Hospital Point drydock. However, this species was relatively abundant at Station 2 in West Loch channel, where colony sizes ranged from 1-2 cm up to ca 15 cm, and an incipient new reef appears to be forming.

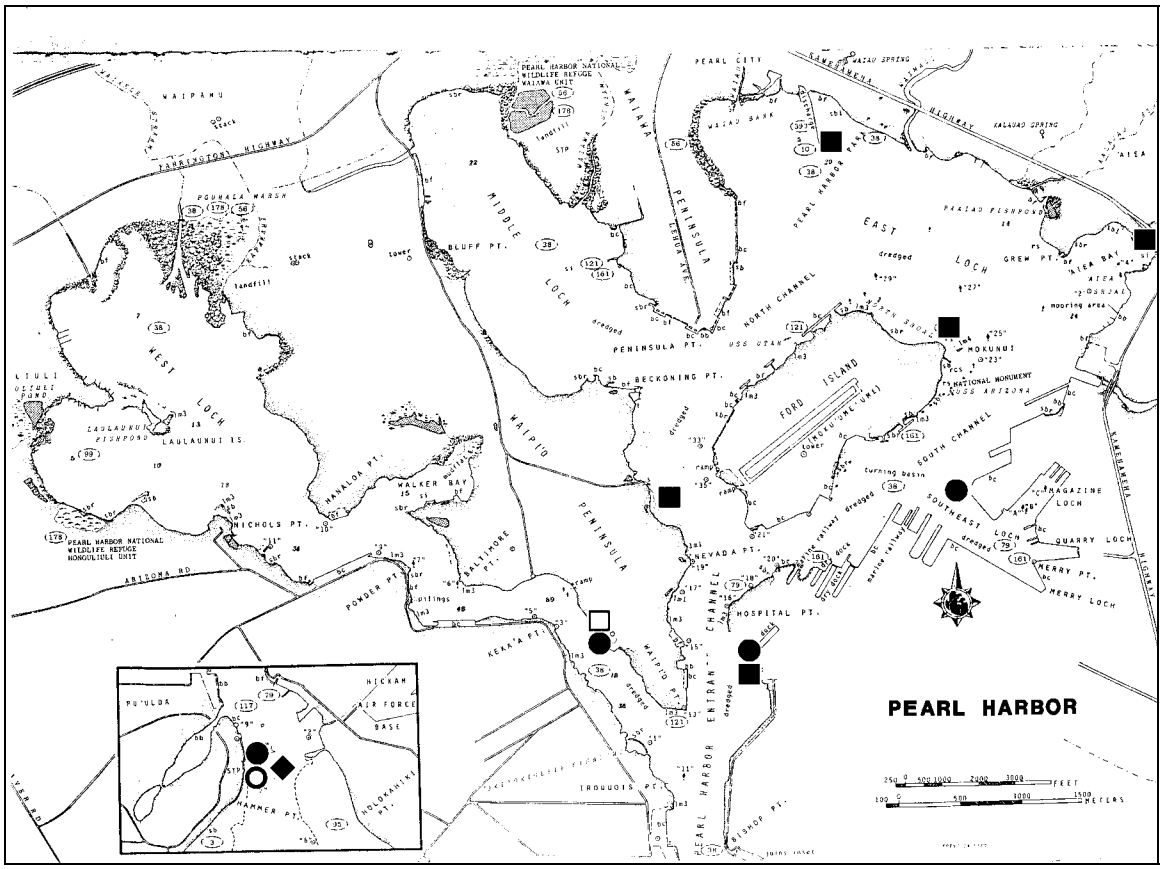

Figure 23. Distribution of reef corals found in Pearl Harbor in 1996: *Pocillopora damicornis* (solid circles), *Pocillopora meandrina* (open circles). *Leptastrea purpurea* (solid squares), *Porites compressa* (open square), *Montipora patula* (solid diamond).

This was also the location of the only colony of *Porites compressa* found in this study (Plate 5), which was about 15 cm in diameter. Small, scoured colonies of *Pocillopora meandrina, P. damicornis* and *Montipora patula* occurred at the main channel entrance, which is the location most exposed to wave turbulence and the site most similar to a normal coral reef environment.

This is the first report of widespread occurrence of reef corals in Pearl Harbor. No corals were found by the extensive 1971-73 NUC study (Evans et al., 1974) or any of the other studies conducted in the harbor in the 1970s. Since most of the stations of the present study were established as close as possible to many of the original NUC stations, it is not likely that corals found in 1996 were missed by the previous study. Brock (1994) was the first to report occurrence of coral in Pearl Harbor, which were several small colonies of *Leptastrea purpurea* on the west shore of Ford Island in December 1993. All coral colonies in the present study were small to medium in size, suggesting the conditions in the harbor have only become amenable to coral settlement and growth in recent years.

Fifty four species or higher taxa of polychaetes were tentatively identified, and 12 of these were not previously reported from Pearl Harbor. Four species of introduced Serpulidae previously reported in the harbor were re-collected in this study. Five species previously reported as cryptogenic were also collected. Twelve species of polychaetes are tentatively listed as new reports to Pearl Harbor and one eunicid species may be a new report for Hawaii. Polychaetes listed in Appendix C as unidentified will require further examination before their status can be determined.

One of the cryptogenic species, the large tube building worm *Chaetopterus variopedatus,* occurred throughout the harbor and was extraordinarily abundant at the Hospital Point Drydock. *C. variopedatus* is one of the few species observed in the harbor to have monopolized a habitat. It is likely that, with further taxonomic and biogeographical investigation, this species will be categorized as introduced.

Eighteen of the total 166 genera and species newly found in Pearl Harbor by this study were molluscs, including four species considered introduced or cryptogenic. Of the remaining 14, six occurred only at Stations 1 or 2, where conditions most resemble an oceanic reef environment. This may also reflect a change in water quality in the last twenty years that has favored the settlement and survival of reef corals.

All four pyconogonids that were identified to species in the present study are new reports for Pearl Harbor, and one, *Pigrogromitus timsanus*, was a new report and introduction for Hawaii. Two isopods and one amphipod species were collected in the present study that are considered to be new Hawaiian records. The isopod, *Mesanthura* sp., has not yet been identified to the specific level. It is somewhat similar to *Mesanthura hieroglyphica*, a species considered native, but differs substantially from that species (Muir, pers. comm.). *M. hieroglyphica* was reported in the harbor in 1973 (Evans et al. 1974), but none were collected in this survey. Several *Mesanthura* sp. were collected from Station 6, 7, 9, and 15, and specimens are also present in Kahului Harbor, Maui (DeFelice, pers. obs.). Another isopod, *Exospheroma* sp., is not identified to species. This is a new record for this genus in Hawaii and, once identified, will probably be considered an introduction. Three individuals were collected from Station 10. The amphipod, *Grandidierella bispinosa*, was found only at Station 14. This amphipod is known from Indonesia and Fiji and may also be classified as an introduced species pending verification of the identification.

Twenty one species of decapod crustacea never previously reported in Pearl Harbor were collected or observed in this study, including the newly introduced species *Nanosesarma minutum*. Ten of these species occurred only at Stations 1 or 2, and five are species symbiotically associated with the corals *Pocillopora meandrina* and *P. damicornis.* This provides further

indication of a transition of the environment at the mouth of the harbor toward coral reef conditions which is being reflected in the benthic fauna species composition.

The present study identified a total of 19 taxa of ascidians, seven of which were not previously reported in Pearl Harbor, and one, *Symplegma reptans,* which is a new introduction to Hawaii. Most of these ascidians were widely distributed in the harbor, and two, *Phallusia nigra* and *Herdmania momus,* occurred at virtually every station except those furthest into West Loch. The most taxa of ascidians reported by a previous study in Pearl Harbor was nine (Grovhoug, 1976) and most studies, e. g. Evans, et al (1974), reported four or less. This is surprising, considering that this group is well adapted to live in the organically rich, high turbidity environment that has historically existed in Pearl Harbor. The relatively high number of new reports of ascidians for this study may represent a real increase in species richness in the harbor for this group. However, it is equally or more likely that previous studies did not fully identify the ascidians that may have been sampled.

Of the 59 taxa of fishes reported in the present study, only 12 were not previously recorded in the harbor. Four of these occurred only at Station 1, at the channel entrance, and can be considered coral reef associated species. The visual observations and trapping methods used in this study were limited in their capability for detecting the fishes resident in the harbor, and many species were undoubtedly missed. However, by comparison, the 1971-1973 NUC study used a variety of techniques including seines, gill nets, traps and diving observations, and detected a total of 88 taxa of fishes, only about 1.5 the total number determined in the present study.

All shore areas of West Loch which provide a hard surface for settlement are dominated by large edible oysters (*Crassostrea ?virginica*). These oysters, possibly descended from the first eastern oysters reported introduced into the harbor in the 1860s or more probably from oysters planted in West Loch in the 1920s, suggest that a full recovery has been made from the nearly complete oyster mortality that occurred in 1972 (Kawamoto and Sakuda, 1973).

IV. DISCUSSION

As a result of geographic and evolutionary isolation, island ecosystems are generally thought to be more sensitive to biological invasions than are continental areas (Moulton and Pimm, 1986; Vitousek and Walker 1989). Yet, despite the potential for detrimental effects to the nearshore environment, fundamental information regarding the occurrence and distribution of introduced marine species in Hawaii is limited (Eldredge, 1987). Most information regarding introduced marine and brackish-water species in Hawaii comes from past research conducted on Oahu (Carlton and Eldredge, ms. in prep.).

Even after allowance for a bias in data collection effort, Pearl Harbor appears to have been a major receptacle and incubation ground for introduced species. It is clear that Pearl Harbor has received both intentional and accidental species introductions since at least 1866 when the first attempts at culturing eastern oysters (*Crassostrea* sp.) in the harbor were made. Earlier undocumented introductions almost certainly occurred from the fouling communities of the first European ships or even from earlier Polynesian migrations to Hawaii. The majority of invasive species have probably been introduced accidentally to Pearl Harbor. In most cases, the dispersal mechanism of unintentionally introduced species is assumed to be ships. These undocumented introductions could have originated from fouling on the hulls of the first European ships to reach the islands or, more recently, from ballast water. Some species may have been released along with intentionally introduced species (e.g. oysters).

The rate of introductions in the harbor apparently increased substantially in this century after the completion of the ship channel in 1911 enabled entry of ocean going vessels into the harbor and provided the opportunity for release of marine organisms from ballast water or fouling. However, all six introduced species that were first detected from 1911 to 1920 were still present in the harbor in 1996. This suggests that these species were well established in Pearl Harbor before sampling activity increased, and that they have persisted as a normal component of the harbor community. Rates of new species introductions appear to have increased during periods of high shipping activity during and after war time in the 1920s, 1940s and 1970s, although this effect is difficult to separate from variations in sampling effort.

Our sampling indicated that 96 species, or about 22% of the total number of species obtained in Pearl Harbor in 1996 could be considered introduced or cryptogenic based upon the criteria described for these categories. Of these 96 species 22, or about 5% of the total 434 species found, were introduced or cryptogenic species first detected in the present study, and these putative new introductions exceed those of any previous decade. Some of the species classified as recent introductions or cryptogenic may be reclassified to be indigenous as further taxonomic

information becomes available. However, these results suggest that introduced species comprise a substantial portion of the total biological community in Pearl Harbor and that species introduction continues to occur at a moderate and measurable rate.

A substantial portion of the Pearl Harbor biological community is comprised of inonindigenous species, and the fouling communities in many areas are dominated by introduced or cryptogenic sponges, tunicates, bryozoans and polychaetes which may cover virtually 100% of available surfaces. West Loch areas receiving highly turbid runoff and sedimentation were dominated by *Crassostrea* ?*virginica* oysters wherever hard substrata were available for oyster settlement and growth. The filter feeding cryptogenic polychaete *Cheatopterus variopedatus* was very abundant under Drydock 4 at Station 6. Two species of introduced sponges *Mycale (Carmia) cecilia* and *Suberites* cf. *zeteki* were so abundant in the vicinity of the heated discharge water at the HECO outfall that they form a virtual sponge reef that is unique in Hawaii. Both the elevated water temperature and the high particulate levels in the discharged effluent may promote the growth of these and other sponges in this area.

However, we saw little evidence of dominance of the sublittoral community or monopolization of resources by any recently introduced cryptogenic species such has been reported for San Francisco Bay (Cohen and Carlton, 1995) and the Great Lakes (Mills, et al., 1993). With one exception these organisms occurred in Pearl Harbor in low abundance, and many were single reports. The only recently introduced species that has achieved high numbers or densities throughout the harbor is the small barnacle *Chthamalus proteus*, which was unreported in the harbor or elsewhere in Hawaii before 1993. This organism now occurs in high densities in the upper intertidal in Pearl Harbor, Honolulu Harbor and Kaneohe Bay and has been observed in Nawiliwili and Kahului Harbors (DeFelice, pers. obs.). It is surprising that this organism, which could have easily been transported as fouling or in its larval stages in ballast water at any time, would be so late in reaching Hawaii and then so rapidly disseminated and propagated to become a dominant intertidal organism. However, distribution charts of barnacle species prepared by Matsuda (1973) for surveys made in Pearl Harbor and Kaneohe Bay show no *Chthamalus* species present, indicating that introduction and explosive proliferation of this species within the past 20 years has been a real occurrence (Newman, pers. comm.). Although *C. proteus* occurs in the upper intertidal where few other marine organisms reside, it may represent serious competition to native species in this zone. Its high densities and rapid growth rate potentially may act to dominate or exclude competing organisms, and it can completely cover the shells of intertidal limpets with its growth.

As noted in the Results, at least eight newly introduced species have been identified in this 1996 survey of Pearl Harbor. Given that the major previous surveys of the Harbor were more than 20

years ago, this number may appear to be relatively low when compared to the number of new invasions over the past two decades in other active ports on the Pacific Rim (such as San Francisco Bay, San Diego Bay, and Hong Kong (Cohen and Carlton, 1995; J. T. Carlton, unpublished summaries)). However, a number of factors hamper clear interpretation of the actual number of invasions that have occurred in Pearl Harbor over the past 20 years: 1) it is difficult to clarify in the 1990s the biogeographic status and history of many tropical and subtropical marine invertebrates, thus at least 14 of the newly recorded species in this survey must tentatively be regarded as cryptogenic, 2) numerous smaller taxa (such as bryozoans, hydroids, micropolychaetes, turbellarian flatworms, small nemerteans, benthic copepods, and so forth), that are common in ballast water and/or ship fouling, are often not adequately sampled or resolved taxonomically in broad scale macroinvertebrate surveys, 3) previous studies in the 1970s differed considerably in their foci, techniques, and level of taxonomic resolution, making the appearance (or, indeed, disappearance) of certain taxa somewhat uncertain.

Notably, Pearl Harbor may have sustained a fairly large number of ascidian invasions since World War II. However, earlier biological collections in Pearl Harbor may not have completely sampled habitats (such as float fouling communities) where sea squirts may dominate, nor were ascidian taxonomic characteristics examined in detail. In the meantime, taxonomists have systematically recorded many species of ascidians from the Hawaiian Islands (Abbott et al., in press) that were not seen in the 1940s. Our survey found many of these same species (by default not here recorded as "new records for Hawaii"), many of which may in fact have arrived since the 1960s or 1970s. Other studies (Carlton and Eldredge, ms in prep.) are attempting to assemble the first dates of collection of these ascidians, as well as of other taxa, in order to more clearly understand if a pulse of invasions occurred in Pearl Harbor during and since the 1970s as seen elsewhere in the world.

Some of the more vigorous vectors promoting species introductions in other world ports to may operate at a relatively lower scale in Pearl Harbor. Most ballast water, for example, is transported in large bulk cargo carriers that arrive "empty" (but in fact often with 25,000 or more metric tons of ballast water) to pick up cargo. The majority of traffic in and out of Pearl Harbor is military traffic, which generally carries far less ballast water than commercial traffic. The majority of traffic for the Hawaiian Islands in general are container ships and inbound petroleum tanker vessels, neither of which carry the quantities of ballast water utilized by bulk carriers. (In the case of container ships, ballast water is usually measured in the hundreds of tons, or in the single-digit thousands of tons, whereas in the case of loaded petroleum tankers, ballast water may be virtually absent or used for trim purposes only). There have been no studies, however, on the amounts of ballast water actually released annually in Pearl Harbor or anywhere else in Hawaii, nor on their biological contents.

Because of the nature of vessel traffic coming into Pearl Harbor with a speculated relatively low "ballast signature", ship fouling (in the form of both hull fouling communities and sea chest fouling communities) may play a role equal or exceeding that of ballast water, depending on vessel type, length of service out of the drydock, and source region. As with ballast water, however, there are no modern-day studies on what organisms are arriving in Pearl Harbor via ship fouling. The probable post-1970s appearance of various new fouling bivalves, at least one new ascidian, at least several new sponges, and of a new barnacle (*Chthamalus proteus*) may implicate either the modern day role of ballast water or fouling communities.

No recent imports of commercial shellfish (such as oysters, clams, mussels, or abalones) are known to have occurred in Pearl Harbor in the last two decades that would have released either the target species in question or associated unintentional introductions. This lack of mariculture activity, increasingly active in many other parts of the world, has spared the harbor from new marine invasions by this vector, although introductions of commercial shrimp (*Macrobrachium*) in streams and rivers in Hawaii have occurred (Eldredge, 1994).

Along with the introduction of new species that may have been occurring in the last two decades, the results indicate that the environment in Pearl Harbor has been changing to conditions that may be considered more pristine and favorable to organisms formerly excluded from the harbor. Five species of corals were found in this study, some of them occurring well within the harbor and removed from oceanic conditions normally considered necessary for coral survival. Grovhoug (Appendix F in Evans, et al., 1974) noted that “stony corals were conspicuously absent from all biostations in Pearl Harbor (including BC-11 located at the harbors mouth in the entrance channel)”. BC-11 was the site of Station 1 where the present study found three coral species, and two more coral species occurred further into the harbor, with the distribution of one extending to shoreline at the head of East Loch.

Few data are available to verify the general improvement of water quality in the harbor since comprehensive surveys were made in the early 1970’s. However, the above observations of coral occurrence within the harbor, subjective observations of water clarity over a 20-year period (Coles, pers. obs.) and the abatement of many sources of pollution to the harbor since the 1970s (Grovhoug, 1992) combine to indicate that water conditions have improved considerably over the last twenty years. Organisms more sensitive to sedimentation, turbidity and other pollution stresses appear to be establishing themselves within the harbor. Given that harbor water quality conditions continue to improve, it will be interesting to determine if these conditions favor futher establishment of nonindigenous species or the continuation of the relatively stable conditions that now apparently prevail for the biological community.

This study constitutes the first comprehensive study of a bay or harbor in Hawaii conducted with the objective of detecting the introduction of nonindigenous marine or brackish water species. Although Pearl Harbor provides one of the best opportunities for such a study because of the amount of sampling that has been conducted there, it is a relatively unusual environment that has only been open to oceanic ship traffic for the last 85 years. Since that time there has been ample opportunity for introductions of species from areas throughout the world, especially from other regions of the Pacific during war time. However, other ports of call in Hawaii, especially Honolulu and Hilo Harbors, have received trans-oceanic shipping for a much longer time than has Pearl Harbor. The marine biological communities of these and other harbors in Hawaii have never been systematically surveyed, and they would act as strategic distribution points for dissemination of introduced species to other areas in Hawaii. Studies such as the present one are needed to determine the present composition of the marine communities of other Hawaiian harbors and to determine the history of species introductions in these areas.

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APPENDIX A

Chronology of Important Events in Pearl Harbor

Undated "...an enterprising Ewa Chief, Keaunui, son of Mawaeke, about twenty-six generations ago, accomplished the task of deepening and widening the channel of the harbor… The writer is inclined, however, to surmise the date as about thirteen generations ago, when the building of walled fish ponds must have been sufficiently novel to the native chronicler to be recorded" (Stokes, 1909).

Undated "But to Keanui, the head of the powerful and celebrated Ewa chiefs, is attributed the honour of having cut a navigable channel near the present Puuloa saltworks, by which the great estuary, now known as the "Pearl River," was in all subsequent ages rendered accessible to navigation….the estuary doubtless had an outlet for its waters where the present gap is; but the legend is probably correct in giving Keanui the credit of having widened it and deepened it, so as to admit the passage of canoes, and even larger vessels, in and out of the Pearl River estuary" (Fornander, quoted in Sterling and Summers, 1978)

1792 Entrance to Pearl Harbor noted by officers and crew of the *HMS Discovery*, under command of Capt. George Vancouver. Ships naturalist Archibald Menzies comments on small pearls brought for trade from the harbor, considering them "badly shaped and ill colored, so consequently of little value"(Menzies 1920)

1796 "To the westward of Fair Haven (Honolulu) is another (harbor) which is formed in a large bason [sic] when the reefs are passed. Pearls of good quality are collected in this bason". (Broughton, 1804)

1798 "On the Island is a pearl oyster. It is in a river about three or four miles from where we anchored. We got some pearls and some of the pearl oyster shells…" (Townsend, 1888)

1810 "Pearls and mother-of-pearl shells are found in considerable quantity. Since the King [Kamehameha I] has learned their value, he has kept the fishing to himself, and employs divers for that purpose" (Campbell, 1822)

1819 "About six miles to the westward of this harbour is Wy Momi, or Pearl Water….There is not more than about fifteen feet of water on the bar or reef at high water, and inside about six to eighteen fathoms mud and sand….At the head of the inlet is a run of very fine fresh water, and provisions are here cheap and plentiful. There are many divers employed here, diving for Pearl Oysters, which are found in great plenty". (Corney, 1896).

1821-22 "We…reached the Pearl River, so called from the pearls which are found in small quantities in its bed. The specimens I saw appeared to be of a very inferior quality. The sea here forms a small bay, which has the appearance of a salt-water lake, being landlocked on every side except at the narrow entrance….on every estate the is a fishpond surrounded by a stone wall, where the fish are strictly preserved for the use of their rightful owners,…"(Mathison, 1925)

1824-25 First surveys of the entrance and Lochs of Pearl Harbor by Lt. C. R. Malden and J. Frembly of the *HMS Blonde* under command of Capt. Lord Byron (Figure 2). Minimum depths at harbor entrance charted as 2 ½ fathoms and at entrance to Middle Loch as 3 ¼ fathoms. Pearl Harbor was described by the ships botanist. "Pearl River is about seven miles west of Hanaruru, [sic] and is improperly called a river, being rather inlets from the sea, branching in different directions….The entrance to Pearl River is very narrow and shallow,…it is fit for very small vessels to enter, but over the bar there is deep water, and in the channels leading to the lochs there are from 7 to 20 fathoms. The lochs themselves are rather shallow….The oysters that are found in Pearl River are small and insipid and of no value or consequence." (Macrae, 1922).

1838-40 "Pearl-River Harbour affords an abundant supply of fine fish. Two species of clams are procured here, called by the natives okupe and olepe. Mr. Drayton, who went to Pearl Rover for the purpose of examining its shores, and obtaining fossils, reported that he found a large bed of fossil oyster shells, extending into the bank in a bed one to four feet wide and a half a mile in length:…" (Wilkes, 1840, in Sterling and Summers, 1978).

After the mid-19th century water quality conditions in Pearl harbor apparently declined substantially, resulting in loss of the pearl oysters and decrease in other shellfish populations:

> "From that time it was much found in Ewa up to recent years, about 1850-53, the time when this race of people [Hawaiians] were being destroyed by the small pox. The oyster began to vanish from that time to the present. (Manu, 1885; quoted in Sterling and Summers, 1978)
>
> "In some unknown era of the past, the population of the whole island…might have been supplied from the banks of this inlet with excellent oysters. There are no oysters to be gathered in any of these islands now." (Bowser, 1880).
>
> "…the pearl oysters vanished from the places where they were found in great numbers as far as the shore. They were no longer found. The few found today are merely nothing." (1899 Hawaiian newspaper article, quoted in Sterling and Summers, 1978)
>
> "No where else in all Hawaii were there so many kinds of bivalves as in Pearl Harbor. There were large and small ones, thin-shelled and thick-shelled ones besides the pipi, …these too have dwindled in number (Pukui, 1944),

1845 Visit to Honolulu by the USS *Constitution* ("Old Ironsides) under command of Capt. John Percival (Judd, 1929). In 1846 ships officer Lt. I. W. Curtis prepared a secret report to the Hawaiian government which outlined and proposed a comprehensive plan to set aside and fortify Pearl Harbor as a naval base (Taylor, 1912)

1866 Planting of a barrel of imported seed oyster by Capt. John Paty (Honolulu Advertiser, 1895, cited in Kay, 1979; Eldredge, 1994)

1876 First Treaty of Reciprocity between the United States and Hawaii, in which the U. S. was granted no special privileges in Pearl Harbor, but the Hawaiian government agreed that "it will not lease or otherwise dispose of or create any lien upon any port, harbor or other territory…or grant any special privilege or right of use therein to any other government.' (Taylor, 1912).

1877 Oyster planting by James Campbell at Honouliuli (Honolulu Advertiser, 1947, cited in Kay, 1979)

1887 Granting of exclusive franchise of Pearl Harbor to the United States by King Kalakaua

1890 Introduction of seed oysters from San Francisco by S. M. Damon at Moanalua (Maclellan, 1938; Eldredge, 1994)

1893-95 Successful plantings of eastern oyster *Crassostrea virginica* at Ewa which established the species in Pearl Harbor (Brock 1960). Successful culture and marketing of eastern oysters by John Colbourn from his fishpond on Pearl City peninsula (Independent, 1895, cited in Kay, 1979)

1898 Treaty of annexation of Hawaii to the United States enables U. S. Navy to proceed with plans to develop Pearl Harbor as a coaling station and ships drydock.

1901 Contract awarded for dredging of Pearl harbor entrances to 30 feet deep by 200 feet wide to accommodate ocean-going ships. (Anon., Paradise of the Pacific, 1901, 14(1) and 1902, 15(2))

1902 Introduction of the red mangrove, *Rhizophora mangle* to southwest Molokai for soil retention on mud flats (Wagner et al, 1990). No information is available when this plant began growing in Pearl Harbor, where it has come to totally dominate and cover the shoreline at the heads of the three major lochs.

1905 Introduction of mosquito fish (*Gambusia affinis*), sailfin molly (*Mollienesia latipina*) and killifish (*Fundulis grandis*) at Moanalua, near Pearl Harbor (Brock, 1960).

1910 First two deep draft boats, four and five masted schooners, enter Pearl Harbor to deliver lumber to be used in construction of naval drydock. (Anon. Paradise of the Pacific, 1910, 23(4))

1911 Official opening of the Pearl Harbor channel for navigation on Dec. 15, 1911, first entered by the cruiser USS *California*. (Anon., Paradise of the Pacific, 1912, 25(1)).

1913 Nearly completed first Naval drydock is destroyed when "the bottom began to rise as the coffer dam was being pumped, and a nine foot hole opened in the floor. Suddenly it blew with the force of dynamite shattering heavy timbers as sections collapsed" (Scott, 1968). An engineering study (Stanford, 1915) explained this to be due to fresh water intrusion into the geological substratum below the drydock, but a more interesting explanation was provided in Hawaiian lore. "When a drydock was built at Pu'uloa about thirty years ago, the old timers shook their heads. The drydock was all right, but the location was not good, for it was directly over the home of Ka'ahupahau's (the shark goddess's) son. When the crash came and the dock, well built as it was, fell shattered and broken, it was no surprise to the old timers" (Pukui, 1944). Further "When the water was once again pumped from the cofferdam…the backbone and ribs of a fourteen foot hammerhead shark were found on the cofferdam floor" (Scott, 1968).

1919 Completion of first drydock and beginning of major ship repair operations. Commissioning of Naval Ammunition Depot at Magazine Island (Grovhoug, 1992).

1920 Introduction of Japanese clam *Venerupis (=Tapes) phippinarum* into Pearl Harbor (Edmondson and Wilson, 1940; Brock, 1960; Eldredge, 1994).

1921-22 Introduction of five barrels of the eastern oyster *Ostrea elongata* (*Crassostrea virginica*) into Pearl Harbor by the Hawaiian Fish and Game Commission (Coleman, 1923). Oysters from this planting reported in 1940 as "scattered…but not enough for commercial purposes" (Anon., Paradise of the Pacific, 1940, 52(12); Kay, 1979; Eldredge, 1994).

1920-40 Acquisition of Ford Island and construction of Naval Air Station and "Battleship Row". Acceleration of development of Pearl harbor Naval Complex and alteration of shoreline in East and Southeast Lochs by dredging and filling (Grovhoug, 1992).

1926-35 Introduction of the Samoan Crab *Scylla serrata* to various localities on Oahu, probably including Pearl Harbor (Brock, 1960).

1938 Beginning of operation of Waiau Electrical Generating Station at the head of East Loch. The first two units utilized fresh water from wells for cooling condensers, while Units 3 to 8 (completed from 1947 to 1968) use salt water from East Loch that is taken from one side of a 365 m long sheet piling and discharged on the other side at 5-7^{o}C above ambient. A maximum of 2.07 million m^{3} per day of cooling water has been cycled and heated by the station since it reached maximum capacity in 1968 (McCain, 1975).

1938 Attempted introduction of Japanese oyster (*Crassostrea gigas*) into Pearl Harbor (Eldredge, 1994), considered by Brock (1960) not to have survived.

1941 Japanese attack on Pearl Harbor forces U. S. entry into WWII, and Pearl Harbor ship activity escalates. Massive expansion Pearl Harbor Naval facilities and activities. Between 1940 and 1945, 6 ½ miles of piers and wharves were constructed and a new marine railway was completed (Scott, 1968). Thomas drydock was completed and opened in Sept. 1943. Large areas of the Waipio Peninsula in West Loch were filled and converted to dry land by depositing dredged material (Grovhoug, 1992). As a result of this and other dredge and fill operations most of the Hawaiian fishponds existing early in the century were destroyed. A map compiled from information available from 1873 to 1915 shows 30 fishponds along Pearl Harbor's shoreline, including the two largest, Loko Hanoloa and Loko Eo, on Waipio Peninsula. Over half still remained after intitial development of the Pearl Harbor naval Base (Figure 4), but only four fishponds existed by 1974 (Apple and Kikuchi, 1975).

1940-50 Massive increase in ship traffic to Pearl Harbor from Pacific and America increases probability of species introductions. A heavily fouled barge which had been towed to Pearl Harbor from Guam in 1950 was examined and found to have numerous crustacean species new to Hawaii, and latter proposed to have been the source of introductions of exotic species of algae and cnidarians (Doty, 1961)

1950-70 Increasing usage of Pearl Harbor for receiving sewage effluent and sugar mill wastes. In 1957 69 outfalls were counted and over 100 outfalls estimated to release treated or untreated effluents into the harbor. Water quality was highly degraded with coliform bacteria counts reaching as high as 130,000 MPN/100 ml at mouths of streams in East Loch and 2.4 billion(!) MPN/100 ml in the vicinity of oyster beds in West Loch (Cox and Gordon, 1970).

1962 Population of eastern oysters in West Loch, Pearl Harbor, had grown to 19 major beds containing approximately 36 million oysters equivalent to about 56 thousand bushels (Kawamoto and Sakuda, 1973).

1971-73 First comprehensive biological survey of Pearl Harbor conducted by the Naval Undersea Center (NUC). The report published from this study defined the characteristics and condition of the Pearl Harbor marine and estuarine communities and related these to ongoing studies of physical and chemical parameters (Evans et al. 1974). Other studies of the environmental impacts of the thermal outfalls from the Waiau Power Station (McCain 1974, 1975, 1977) and three smaller power plants operated by the Navy (Grovhoug 1979) provided further information on Pearl Harbor biological communities during this period.

1972 Drastic 99% mortality of the 35 million oysters previously estimated in 1972 to occur in West Loch, Pearl Harbor. Cause of mortality not specified but suggested to be similar to fungal infection which caused massive oyster kills that previously occurred on the eastern and gulf coast U. S. mainland (Kawamoto and Sakuda, 1973). About on month before this event, researchers conducting the NUC Pearl Harbor Biological Survey observed an extensive fish and invertebrates mortality that affected organisms throughout most of Middle Loch, apparently due to anoxic conditions that were

generated by an oxygen scavenging substance that was released into the Loch by a sewage diffuser. Red tides were observed periodically in all lochs throughout the study (Evans, et al., 1974).

Ca. 1975 Navy completed installation of shipboard wastewater collection, holding and transfer tank systems and stops release of wastewater effluents into Pearl Harbor (Grovhoug, 1992).

1982-84 End of sewage effluent discharge into Pearl Harbor from all major treatment plants except the Fort Kamehameha plant which still releases an average 6.5 mgd at the Harbor entrance. Within the Harbor or its tributaries, effluents totaling over 14 mgd were diverted from outfalls at Pearl City, Waipahu, Mililani, Pacific Palisades, Halawa and Iroquois Point. (Grovhoug, 1992).

1987 Spill of ca. 100,000 gallons of aviation fuel from a pipeline near the mouth of Waiawa Spring at the head of Middle Loch. This produced leaf yellowing on about 10 acres of mangroves of the total 46 acres of forest along the shore of Middle loch, but appeared to have little toxic effect on the subtidal organisms near the affected mangrove swamp (AECOS, 1987).

1990 Resampling of nine NUC stations previously sampled in 1971-73 indicated improving conditions in the East and Southeast Lochs of Pearl Harbor. With the exception of light extinction at two stations, water quality parameters were within state standards. Metal concentrations in the water were far below state acute standards at all stations and were below state chronic standards for all but two stations, in the shipyard area of Southeast Loch. Sediment metal concentrations showed significant decreases from 1972 values for most metals. Only silver showed elevated concentrations in the entrance channel area, probably from sewage effluent release from the Fort Kamehameha sewage outfall. Polychlorinated biphenyl concentrations were substantially elevated in sediments in the area of the Southeast Loch shipyard (Grovhoug, 1992).

1992 Transport of the floating drydock, the *Machinist* to Pearl Harbor from the Philippines aroused concern by the Hawaii Department of Agriculture, Department of Aquatic Resources, the National Marine Fisheries Service, the Army Corps of Engineers and interested scientists about the danger of introduction of exotic marine species or diseases living within ballast water or as fouling organisms on the hull. The Navy assured all concerned that the drydock would be thoroughly cleaned of fouling organisms and inspected, deballasted while still at sea and ballast water samples tested for cholera and coliform bacteria. However, the Navy declined access to non-navy observers who wish to confirm the report that the hull is free of fouling organisms and did not provide other items requested by the Hawaii Department of Agriculture that would help to confirm absence of introduced organisms.

1996 Spill of ca. 39,000 gallons of bunker fuel oil from Chevron oil pipeline at head of East Loch where it supplies the Waiau Generating Station. The intertidal and subtidal mud flats and mangroves in the area of the spill point of discharge were heavily oiled, and heavy oiling occurred on the shores of Ford Island Waipio Peninsula that were in the direct path of the oil slick. The Arizona Memorial on Ford Island was closed for four days for cleaning operations. Short term mortality to marine organisms or wildlife caused by the spill was limited to four pufferfishes and two prawns, but other organisms in the intertidal zone may have been impacted by heavy oil deposits, which stuck to hard surfaces or were retained within intertidal and subtidal sediments.

APPENDIX B

Annotated Bibliography of Pearl Harbor Published and Unpublished Literature

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AECOS (1979). “Oahu Coral Reef Inventory. Part A , Atlas, and Part B, Sectional Map Descriptions,” Rep. No. 0072. U. S. Army Corps of Engineers, Honolulu.
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Descriptions of biota at disposal sites off Pearl Harbor and Honolulu dumping sites.

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.Fish and Game conducted surveys of oyster abundance in 1971 and feasibility studies for commercial development and aquaculture of American oysters (*Crassostrea viginica*) in Pearl Harbor West Loch and in intake and discharge zones of HECO Waiau power plant. Oysters in West Loch grew to commercial size in three weeks utilizing artificial feeding and could be dupurated in clean sea water in one week to be suitable for direct marketing. Oyster transplanted to power plant zone showed lower condition indexes and lower growth in warm water discharge than in cooler intake water, which stimulated growth by water movement. Oysters in West Loch were drastically depleted in 1972 by undetermined cause.

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Survey of biofouling organisms growing on USS Arizona conducted in 1986

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Power Plant

Marine Research Consultants (1990). “Marine environmental assessment of Pearl Harbor in the vicinity of Foxtrot 5 pier.,”. Belt,Collins and Assoc, Honolulu.
Superficial analysis of impact of dredging and construction of pier and landing at Ford Island. Environmental data taken from 1972 NUC study.

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Description of Pearl Harbor and pearls obtained inn 1821-22.

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Results of barnacle surveys conducted on shoreline of Pearl harbor and elsewhere on Oahu in 1973.

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Results of one year study of environmental effects of operation and discharge of cooling water effluent from Waiau Power Plant.

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Summary of HECO's Waiau plant operations and effects on local receiving waters, including fouling study in intake and discharge area of East Loch

McCain, J. C. (1977). “A benthic survey in the vicinity of the Waiu Generating Station,” Rep. No. NV99. Hawaiian Electric Co. Inc., Honolulu.
Soft bottom benthos near Waiau Generating Station intake composed of two communities of organisms with high density and diversity relative to adjacent areas. However, number of species not as high as other areas of Pearl Harbor except where most polluted.

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Menzies, A. (1920). “Hawaii Nei 128 Years Ago,”, Honolulu.
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Description of *Teredo trulliformis* collected from Pearl Harbor

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Miller, M. A. (1968). Isopoda and Tanaidacea from buoys in coastal waters of the continental United States, Hawaii, and the Bahamas (Crustacea). *Proc. U. S. Nat. Mus.* **125**, 1-53.
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Description of sampling schedule and methods for Youngberg (1973) study of Pearl Harbor sediments.

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Summary of findings of various Navy water quality studies in Pearl Harbor in 1970's.

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Short history of dredging in Pearl Harbor and master plan for future dredging.

PacDiv (1974). “Monitoring results and evaluation of the receiving water quality of Pearl Harbor, Hawaii,”. PacDiv Nav. Fac. Eng. Com., Honolulu.
Water quality data taken in support of NUC 1971-74 biological study with significant findings and recommendations.

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Summary of environment of Pearl Harbor mostly based on 1971-74 NUC study

PacDiv (1990). “Final EIS for proposed developments at Naval Base Pearl Harbor Oahu, Hawaii,”. Department of Navy, Honolulu.
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New state records for four species of bivalves originally found on barge in Pearl Harbor in 1950.

Peeling, T. J., Grovhoug, J. G., and Evans, E. C., III (1972). “Pearl Harbor biological survey: Report for first survey cycle (August 1972),” Rep. No. NUC TN 801. Naval Undersea Center, San Diego.
First summary report for Navy Pearl Harbor study describing initial findings on sediment infauna, micromolluscs, fouling communities and fishes.

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in tests from 1963 to 1966. However, search for an environmentally more acceptable substitute suggested basic zinc sulfate to be promising for prevention of *Teredo, Martesia* and *Limnoria*. Tributyl tin oxide (TBO) and copper naphenate found to be ineffective in preventing wood borers.

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Taxonomic descriptions of Hawaiian bivalves found in Pearl Harbor.

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Taxonomic descriptions of Hawaiian bivalves found in Pearl Harbor.

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Report of *Balanus amphitrite* found in Pearl Harbor in 1913.

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R. M. Towill Inc. (1973). "Physical oceanography study - Waiau Power Plant biological support data," Rep. No. NV-45. Hawaiian Electric Co. Inc., Honolulu.
Measurements of temperature, salinity, dissolved oxygen and other parameters in support of biofouling study on intake and discharge sides of Waiau outfall jetty.

Randall, J. E. (1987). Introductions of marine fishes to the Hawaiian Islands. Bull. Mar. Sci. 41:490-502.

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Report of *Mugilogobius parvus* in 1987 and 1991 in Pearl Harbor near East Loch shore.

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Reid, D. G. (1986). "The Littorinid Molluscs of Mangrove Forests in the Indo-Pacific Region," 1st Ed. British Museum, London.
Taxonomic description of *Littoraria intermedia*, formerly *Littorina scabra* var *newcombi*, from Pearl Harbor.

Roe, T., Jr. (1977). "1977 inspection of experimental marine piling at Pearl Harbor, Hawaii," Rep. No. N-1505. Naval Civil Engineering Laboratory, Port Hueneme, CA.
Report of inspection of piles at Pearl Harbor treated with creosote containing toxic additive, solution with two toxic additives or a dual treatment.

S. O. Hirota Inc. (1977). "Environmental impact assessment U. S. S. Arizona Memorial,". PacDiv Nav. Fac. Com, Honolulu.
Brief description of environment in vicinity of Arizona Memorial on Ford Island, including fouling species lists.

Sakuda, H. M. (1964). "Experimental purification of Eastern Oyster (*Crassostrea virginica*) in Hawaii", Honolulu.

Experimental cleaning of oysters taken from Pearl Harbor at Honolulu Bait Station. Coliform levels in oysters reached < 2400 coliform MPN in about one week.

Sakuda, H. M. (1966). Condition of the American Oyster, Crassostrea virginica, in West Loch, Pearl Harbor, Hawaii. *Trans. Am. Fish. Soc.* **95**, 426-429.Condition of oysters in West Loch determined through two year period indicated better growth in lower than upper or middle West Loch, due to excessive siltation in latter areas.

Scott, E. B. (1968). "The Saga of the Sandwich Islands," 4th Ed. Sierra-Tahoe Publishing, Honolulu.
Anecdotes and photographs of Pearl Harbor area through WWII.

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Highest concentrations of TBT have been found in yacht harbors and near vessel repair centers. 75% of sites measured had no detectable TBT. Pearl harbor among the lowest concentrations found for TBT.

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Follow up study to 1984 baseline assessment confirmed low levels of TBT in Pearl Harbor, from undetectable to max of 21 ppb in SE Loch water. By contrast, Honolulu Harbor ranged 4.8 to 580 ppb . Sediment samples from near Drydock No. 2 had TBT concentrations 10X the harbor average, up to 420 ppb (dry wt.). Oyster tissue burdens ranged from non-detectable in W. Loch to 360 ppb (wet wt.) at Rainbow Bay.

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Spawning biomass of nehu in Pearl Harbor was estimated weekly over two year period and varied from 0.5 to 5 metric tons in response to fishing and seasonal cyclicity in reproduction.

Sparks, A. K. (1963). "Survey of the oyster potential of Hawaii,". Hawaii DLNR, Div. Fish and Game, Honolulu.
Report on condition of oyster fishery in Pearl Harbor.

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Extensive engineering description of construction of first Pearl Harbor dry dock and reasons for collapse.

Stephenson, W. (1976). Notes on Indo-Pacific portunids (Decapoda, Portunidae) in the Smithsonian collection. *Crustaceana* **31**, 11-26.
Describes a specimen of *Callinectes* sp. collected by Bartsch in 1920 from Pearl Harbor which could not be identified to species (see Eldredge, 1995).

Sterling, E. P., and Summers, C. C. (1978). "Sites of Oahu," Bishop Museum Press, Honolulu.
General information on early appearance and history of Pearl Harbor (Puuloa) area with Hawaiian legends. Historical descriptions of abundances of pearl oysters, reasons of disappearance and opening of main channel by ancient chief. 1959 map of Pearl Harbor compiled from 1873-1915 data included.

Stickney, H. L. (1945). Colossus of the Pacific. *Paradise of the Pacific* **57**, 10-12.
Description of first drydock opening in 1919 and recent opening in 1943 of one of the

worlds largest drydocks. Massive alteration of shoreline occurred after 1940 with 6 1/2 miles of 10 total miles of piers and wharves and massive dredge and fill operations.

Stokes, J. F. G. (1909). Walled fish traps of Pearl Harbor. *Occ. Pap. Bernice P. Bishop Museum* **4**, 199-36.
Description of shapes and locations of walled fish traps in Pearl Harbor main channel in 1909, just before they were destroyed by Naval dredging and widening of channel. Principal species of fish caught are named.

Straughan, D. (1969). Serpulidae (Annelida: Polychaeta) from Oahu, Hawaii. *Bull. South. Calif. Acad. Sci.* **68**, 229-40.
Reports of various species of polychaetes from Pearl Harbor sampled 1929-1940.

Sun, Low, Tom, and Hara (1967). "Dispersion study of effluent from the proposed Pearl Harbor sewage treatment plant outfall," Rep. No. NBy 82365. U. S. Public Works Center, Pearl Harbor, Honolulu.
Dye studies of current movements in Pearl Harbor channel entrance by Fort Kam relative to sewage effluent disposal.

Takahashi, C. E. (1986). Tales of Honolulu's Fort Kam reef. *In* "Hawaii Shell news", Vol. 33, pp. 5.Reports findings of exotic species *Cyprea arabica* Linn. and *C. staphylea* Linn. on ledges at entrance channel to Pearl Harbor.
Attributes to blowing of ballast water by submarines that they have taken on at Apra Harbor, Guam. (However, see Byron, 1826).

Taylor, A. P. (1912). Pearl Harbor. *Paradise of the Pacific* **25**, 69-71.
Detailed history of development of idea of use of Pearl Harbor for a naval base, beginning with Lt. I. W. Curtis on USS Constitution in 1846 and culminating with construction of 1000 ft drydock to be completed in 1914.

Thaanaum, D. (1921). *Tapes philippinarum* in the Hawaiian Islands. *Nautilus* **34**, 107.
Describes planting of this introduced species on mud flats twice pre-1920 at Moanalua and states they are frequently imported from Japan for sale by the barrel.

Tokioka, T. (1967). Pacific tunicata of the United States National Museum. *Smithsonian Institution Bull.* **251**, 1-247.
Report and description of tunicate *Polyclinum vasculosum* from Pearl Harbor.

Townsend, J. K. (1839). "Narrative of a Journey Across the Rocky Mountains to the Columbia River, and a visit to the Sandwich Islands, Chile, etc., with a Scientific Appendix.,", Philadelphia.
Description of pearls obtained from Pearl Harbor in 1798.

Turner, B. W. (1975). Mineral distribution with the sediments of Pearl Harbor. M.S. Thesis, Hawaii, Honolulu.
Study of mineralogy , organic content and metal content of Pearl Harbor sediments and inter-relationships of these parameters.

Visscher, J. P. (1928). Nature and the extent of fouling of ships' bottoms. *Bull. U. S. Bur. Fish.* **43**, 193-252.
General description of fouling organisms occurring on ships throughout the world, mechanisms of organism settlement and fouling and attempts to prevent using the technology of the time.

Visscher, J. P. (1937). "Fouling of ships' bottoms, Pearl Harbor, 1935-1936. Section II. Ships examined in dry dock.," Bureau of Ships Library.

Wagner, W. L., Herbst, D. R., and Sohmer, S. H. (1990). “Manual of Flowering Plants of Hawaii,” Bishop Museum Press, Honolulu.
Date of introduction of red mangrove to Hawaii

Walter Lum & Assoc. (1969). “Investigation of pollution of harbor waters, Pearl Harbor, Hawaii,” Rep. No. N62471-69-C-0585. Nav. Fac. Eng. Com., Honolulu.
Study to locate and determine source of oil contamination in vicinity of Oscar-1 pier using soil borings.

Ward, L. A. (1987). Family Spionidae. *In* “Reef and Shore Fauna of Hawaii. Section 2: Platyhelminthes through Phoronida and Section 3: Sipuncula through Annelida” (D. M. Devaney and L. G. Eldredge, eds.), Vol. Special Publ. 64 (2&3), pp. 461. Bishop Museum Press, Honolulu.

Water Resources Engineers (1973). “Data report for the Pearl Harbor system of Hawaii,” Rep. No. Contr. No. 68-01-1800. EPA Systems Development Agency, Washington D. C.
Effects of Waikele Stream runoff on water quality and circulation of West Loch and Pearl Harbor.

Water Resources Engineers (1974). “Validation and sensitivity analyses of stream and estuary models applied to Pearl Harbor, Hawaii,” Rep. No. Contract No. 68-01-1800. EPA Systems Development Branch, Washington D. C.
Calculation and validation of stream and estuarine circulation in Pearl Harbor.

Wentworth (1951). “Geology and ground-water resources of the Honolulu-Pearl Harbor area, Oahu, Hawaii,”. Board of Water Supply, Honolulu.
Description of hydrology and groundwater resources of the Pearl Harbor area, including surface and artesian spring sources.

Wilson Okimoto & Assoc. (197?). “Aiea Bay State Recreation Area Conceptual Master Plan and DEIS,”. Hawaii Dept. Land and Nat Resources, Honolulu.
Superficial description of near shore waters of Aiea bay with limited hydrographic data.

Wyrtki, K., Graefe, V., and Patzert, P. (1969). “Current observations in the Hawaiian Archipelago,” Rep. No. HIG-69-15. Hawaii Inst. Geophysics, Honolulu.
Results of current meter studies conducted 1965-69, including waters seaward off Honolulu Harbor and Barbers Point

Yap, W. G. (1978). Population biology of the Japanese Little-neck clam, *Tapes philppinarum*, in Kaneohe Bay, Oahu, Hawaiian Islands. *Pac. Sci.* **31**, 223-244.
This clam was first introduced to Hawaii from Japan in 1920 and planted in Kalihi Basin, Pearl Harbor and Kaneohe Bay, had disappeared from Pearl Harbor and Kalihi, but was still thriving at time of study in Kaneohe Bay on a 1.35 hectare mudflat after depletion in six other beds in the Bay.

Youngberg, A. D. (1973). “A study of sediments and soil samples from Pearl Harbor area,” Rep. No. ETDB 73-004 LIMDIST. Naval Civil Engineering Lab., Port Hueneme, CA.
Description of sediment characteristics and heavy metal content of Pearl Harbor sediments and effects of Navy operations on sediment metals, primarily restricted to SE Loch and S Channel. Middle and West Loch strongly affected by urban development and agriculture. Stations with highest metal content had lowest number of species.

Youngberg, A. D. (1973.). “A study of groundwater contamination beneath landfills at Pearl Harbor,” Rep. No. EPDB 73-004 LIMDIST. Nat. Fac. Eng. Com., Honolulu.

APPENDIX C

Listing of Occurrences of Marine or Estuarine Organisms
Collected or Observed in Pearl Harbor
from all Available Sources

Legacy Project - Species Report

KINGDOM: MONERA

Phylum: CYANOPHYCOTA
Class: CYANOPHYCEAE
Order: NOSTOCALES
Family: OSCILLATORIACEAE
Genus: *Lyngbya*
Lyngbya sp.
1996 This Project

Genus: *Phormidium*
Phormidium crosbyamum ***Tilden***
1982 Spec - BPBM-AL 523155 E shore of entrance; reef at Fort Kamehameha.

KINGDOM: PROTISTA

Phylum: CHRYSOPHYTA
Class: CHRYSOPHYCEAE
Genus: *Chrysonephos*
Chrysonephos lewisii ***(Taylor, 1951)***
1972 Ref - Long, 1974

Order: DICTYOCHALES
Family: DICTYOCHACEAE
Genus: *Dictyocha*
Dictyocha sp.?
1978 Ref - Grovhoug, 1979

Phylum: BACILLARIOPHYTA
Class: BACILLARIOPHYCEAE
Order: CENTRALES
Family: CHAETOCERACEAE
Genus: *Chaetoceros*
Chaetoceros sp.
1978 Ref - Grovhoug, 1979

Family: COSCINODISCACEAE
Genus: *Coscinodiscus*
Coscinodiscus sp.
1973 Ref - Evans et al., 1974

Family: MELOSIRACEAE
Genus: *Melosira*
Melosira sp.
1978 Ref - Grovhoug, 1979

Family: THALASSIOSIRACEAE
Genus: *Skeletonema*
Skeletonema sp.
1978 Ref - Grovhoug, 1979

Order: PENNALES
Unidentified Pennales
1978 Ref - Grovhoug, 1979

Family: DIATOMACEAE
Genus: *Thalassionema*
Thalassionema sp.
1978 Ref - Grovhoug, 1979

Legacy Project - Species Report (Cont.)

Family: NAVICULACEAE

Genus: *Navicula*

Navicula sp.

1978 Ref - Grovhoug, 1979

Family: NITZSCHIACEAE

Genus: *Nitzschia*

Nitzschia sp.

1978 Ref - Grovhoug, 1979

Phylum: CHLOROPHYCOTA

Class: CHLOROPHYCEAE

Order: ULOTRICHALES

Family: ULVACEAE

Genus: *Enteromorpha*

Enteromorpha intestinalis ***(Linnaeus)***

1972 Ref - Long, 1974 Off Pearl Harbor.

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Genus: *Ulva*

Ulva sp.

1943 Ref - Hutchins, 1949

Ulva fasciata ***Delile, 1813***

1973 Ref - Evans et al., 1974

1978 Ref - Grovhoug, 1979

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Ulva lactuca ***Linnaeus, 1753***

1973 Ref - Evans et al., 1974

Ulva reticulata ***Forsskal, 1775***

1973 Ref - Evans et al., 1974

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Order: CLADOPHORALES

Family: CLADOPHORACEAE

Genus: *Chaetomorpha*

Chaetomorpha indica ***Kutzing***

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Genus: *Cladophora*

Cladophora sp.

1973 Ref - Evans et al., 1974

1996 This Project

Cladophora fascicularis ***(Mertens)***

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Order: CAULERPALES

Family: CAULERPACEAE

Genus: *Caulerpa*

Caulerpa racemosa ***Forsskal***

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Caulerpa sertularioides ***(Gmelin) Howe, 1905***

Unknown Spec - BPBM-AL 515478 Middle Loch.

1973 Ref - Evans et al., 1974

1996 This Project

Caulerpa verticillata ***J. Agardh***

1973 Ref - Evans et al., 1974

Legacy Project - Species Report (Cont.)

Family: CODIACEAE

Genus: *Chlorodesmis*

Chlorodesmis caespitosa ***J. Agardh*** ***New record for Pearl Harbor.***

1996 This Project

Genus: *Codium*

Codium arabicum ***Kutzing***

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Codium dichotomum ***(Hudson, 1762)***

1972 Ref - Long, 1974 Off Pearl Harbor.

Codium edule ***Silva***

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

Codium reediae ***Silva***

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Genus: *Halimeda*

Halimeda discoidea ***Decaisne***

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Order: SIPHONOCLADALES

Family: SIPHONOCLADACEAE

Genus: *Cladophoropsis*

Cladophoropsis luxurians ***Gilbert***

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Family: VALONIACEAE

Genus: *Boodlea*

Boodlea composita ***(Harvey, 1905)***

Unknown Spec - BPBM-AL 92645

1996 This Project

Boodlea hiloense ***(Pilsbry & Vanatta, 1908)***

1973 Ref - Evans et al., 1974

Genus: *Dictyosphaeria*

Dictyosphaeria versluysii ***Weber-Van Bosse, 1905*** ***New record for Pearl Harbor.***

1996 This Project

Phylum: PYRROPHYCOPHYTA

Class: DINOPHYCEAE

Order: PROROCENTRALES

Family: PROROCENTRACEAE

Genus: *Prorocentrum*

Prorocentrum gracile ***Schott***

1973 Ref - Evans et al., 1974

Order: DINOPHYSIALES

Family: DINOPHYSIACEAE

Genus: *Dinophysis*

Dinophysis sp.?

1978 Ref - Grovhoug, 1979

Dinophysis caudatum ***(Kent)***

1973 Ref - Evans et al., 1974

Order: PERIDINIALES

Family: CERATIACEAE

Genus: *Ceratium*

Ceratium ferka ***(Ehrenberg)***

1973 Ref - Evans et al., 1974

Legacy Project - Species Report (Cont.)

Family: GONYAULACEAE
Genus: *Gonyaulax*
Gonyaulax minutum ***Michener***
1973 Ref - Evans et al., 1974

Family: GYMNODINIACEAE
Genus: *Cochlodinium*
Cochlodinium catenatum ***Okamura***
1973 Ref - Evans et al., 1974

Family: NOCTILUCACEAE
Genus: *Noctiluca*
Noctiluca minuta ***(McCartney & Kofoid)***
1973 Ref - Evans et al., 1974

Family: PERIDINIACEAE
Genus: *Peridinium*
Peridinium crassipes ***(Kofoid)***
1973 Ref - Evans et al., 1974

Family: POLYKRIKACEAE
Genus: *Polykrikos*
Polykrikos schwartzi ***(Butschli)***
1973 Ref - Evans et al., 1974

Phylum: PHAEOPHYCOPHYTA
Class: PHAEOPHYCEAE
Order: ECTOCARPALES
Family: RALFSIACEAE
Genus: *Ralfsia*
Ralfsia occidentalis ***Hollenberg***
1979 Ref - AECOS, 1979 Off Pearl Harbor.

Order: DICTYOTALES
Family: DICTYOTACEAE
Genus: *Dictyota*
Dictyota acutiloba ***J. Agardh***
1979 Ref - AECOS, 1979 Off Pearl Harbor.

Dictyota divaricata ***Lamouroux, 1809***
1972 Ref - Long, 1974 Off Pearl Harbor.
1979 Ref - AECOS, 1979 Off Pearl Harbor.

Genus: *Lobophora*
Lobophora variegata ***(Lamouroux)*** ***New record for Pearl Harbor.***
1979 Ref - AECOS, 1979 Off Pearl Harbor.
1996 This Project

Genus: *Padina*
Padina japonica ***Boergesen***
1979 Ref - AECOS, 1979 Off Pearl Harbor.

Padina pavonica ***(Linnaeus, 1753)***
1972 Ref - Long, 1974 Off Pearl Harbor.

Order: FUCALES
Family: SARGASSACEAE
Genus: *Sargassum*
Sargassum echinocarpum ***J. Agardh***
1979 Ref - AECOS, 1979 Off Pearl Harbor.

Sargassum obtusifolium ***J. Agardh***
1979 Ref - AECOS, 1979 Off Pearl Harbor.

Sargassum polyphyllum ***J. Agardh***
1979 Ref - AECOS, 1979 Off Pearl Harbor.

Order: SCYTOSIPHONALES
Family: SCYTOSIPHONACEAE
Genus: *Colpomenia*
Colpomenia sinuosa ***(Roth)***
1979 Ref - AECOS, 1979 Off Pearl Harbor.

Genus: *Hydroclathrus*
Hydroclathrus clathratus ***(C. Agardh)***
1979 Ref - AECOS, 1979 Off Pearl Harbor.

Phylum: RHODOPHYCOTA
Family: GELIDIACEAE
Genus: *Gelidium*
Gelidium sp.
1996 This Project

Gelidium arenaria ***Kylin New record for Pearl Harbor.***
1996 This Project

Gelidium pusillum ***(Stackhouse) Lejolis, 1863 New record for Pearl Harbor.***
1996 This Project

Family: PEYSONNELIACEAE
Genus: *Peysonnelia*
Peysonnelia sp.
1996 This Project

Class: RHODOPHYCEAE
Order: NEMALIALES
Family: BONNEMAISONIACEAE
Genus: *Asparagopsis*
Asparagopsis taxiformis ***(Delile)***
1979 Ref - AECOS, 1979 Off Pearl Harbor.

Family: GELIDIELLACEAE
Genus: *Gelidiella*
Gelidiella sp.
1982 Spec - BPBM-AL 585470 E shore of entrance; reef at Fort Kamehameha.

Gelidiella sp. 1 ***New record for Pearl Harbor.***
1996 This Project

Gelidiella sp. 2 ***New record for Pearl Harbor.***
1996 This Project

Gelidiella myrocladia ***(Borgesen) Feldmann & Hamel, 1934 New record for Pearl Harbor.***
1996 This Project

Order: GIGARTINALES
Family: GRACILARIACEAE
Genus: *Gracilaria*
Gracilaria bursapastoris ***(Gmelin)***
1979 Ref - AECOS, 1979 Off Pearl Harbor.

Gracilaria coronopifolia ***J. Agardh, 1852***
1978 Spec - BPBM-AL 561794 Reef flat between W end of the Reef Runway & entrance to Pearl Harbor; opposite the National Guard hanger area.
1978 Spec - BPBM-AL 561795 Reef flat between W end of the Reef Runway & entrance to Pearl Harbor; opposite the National Guard hanger area.
1979 Ref - AECOS, 1979 Off Pearl Harbor.

Gracilaria lichenoides ***Linnaeus***
1973 Ref - Evans et al., 1974

Legacy Project - Species Report (Cont.)

Gracilaria parvispora ***Abbott, 1985***

1978 Spec - BPBM-AL 562094 Reef flat between W end of the Reef Runway & entrance to Pearl Harbor; opposite the National Guard hanger area. Identified by fide.I.A.Abbott 1994.

Gracilaria salicornia ***(Agardh) Dawson*** ***New record for Pearl Harbor.***

1996 This Project

Family: HYPNEACEAE

Genus: *Hypnea*

Hypnea cervicornis ***J. Agardh***

1973 Ref - Evans et al., 1974

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Hypnea spinella ***(C. Agardh) Kutzing, 1849*** ***New record for Pearl Harbor.***

1996 This Project

Hypnea valentiae ***(Turner) Montagne, 1841*** ***New record for Pearl Harbor.***

1996 This Project

Family: PLOCAMIACEAE

Genus: *Plocamium*

Plocamium sandvicense ***J. Agardh***

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Order: CRYPTONEMIALES

Family: CORALLINACEAE

Genus: *Amphiroa*

Amphiroa fragilissima ***(Linnaeus)***

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Genus: *Corallina*

Corallina sp.

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Genus: *Jania*

Jania sp.

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Genus: *Lithothamnium*

Lithothamnium byssoides

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Genus: *Porolithon*

Porolithon onkodes ***(Heydrich) Foslie, 1909*** ***New record for Pearl Harbor.***

1979 Ref - AECOS, 1979 Off Pearl Harbor.

1996 This Project

Family: CRYPTONEMIACEAE

Genus: *Halymenia*

Halymenia formosa ***Harvey***

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Family: RHIZOPHYLLIDACEAE

Genus: *Chondrococus*

Chondrococus hornemannii ***(Harvey)***

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Order: RHODYMENIALES

Family: CHAMPIACEAE

Genus: *Champia*

Champia parvula ***(C. Agardh)*** ***New record for Pearl Harbor.***

1979 Ref - AECOS, 1979 Off Pearl Harbor.

1996 This Project

Legacy Project - Species Report (Cont.)

Family: RHODYMENIACEAE

Genus: *Coelothrix*

Coelothrix irregularis ***(Harvey)***

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Order: CERAMIALES

Family: CERAMIACEAE

Genus: *Aglaothamnion*

Aglaothamnion sp. 1 ***New record for Pearl Harbor.***

1996 This Project

Aglaothamnion sp. 2 ***New record for Pearl Harbor.***

1996 This Project

Genus: *Anotricium*

Anotricium sp.

1996 This Project

Anotricium secundum ***Caormaci, Funari & Pizzuto*** ***New record for Pearl Harbor.***

1996 This Project

Genus: *Centroceras*

Centroceras clavulatum ***(C. Agardh)***

1973 Ref - Evans et al., 1974

1979 Ref - AECOS, 1979 Off Pearl Harbor.

1996 This Project

Genus: *Centrocerus*

Centrocerus sp.

1996 This Project

Genus: *Ceramium*

Ceramium sp.

1979 Ref - AECOS, 1979 Off Pearl Harbor.

1996 This Project

Ceramium sp. 1 ***New record for Pearl Harbor.***

1996 This Project

Ceramium sp. 2 ***New record for Pearl Harbor.***

1996 This Project

Ceramium clarionense ***Setchell and Gardner, 1930*** ***New record for Pearl Harbor.***

1996 This Project

Genus: *Griffithsia*

Griffithsia sp.

1973 Ref - Evans et al., 1974 Recorded as Griffitsia.

1979 Ref - AECOS, 1979 Off Pearl Harbor. Recorded as Griffitsia.

Griffithsia heteromorpha ***Kutzing, 1863*** ***New record for Pearl Harbor.***

1996 This Project

Genus: *Spyridia*

Spyridia filamentosa ***(Wulfen)***

1973 Ref - Evans et al., 1974

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Genus: *Tolypiocladia*

Tolypiocladia sp.

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

1996 This Project

Tolypiocladia glomerulata ***(C. Agardh) Schmitz, 1897*** ***New record for Pearl Harbor.***

1996 This Project

Legacy Project - Species Report (Cont.)

Family: RHODOMELACEAE

Genus: *Acanthophora*

Acanthophora spicifera ***(Vahl, 1802) Introduced.***

1961	Ref - Doty, 1961	
1973	Ref - Evans et al., 1974	
1979	Ref - AECOS, 1979	Off Pearl Harbor.
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
1996	This Project	

Genus: *Laurencia*

Laurencia brachyclados ***Pilger New record for Pearl Harbor.***

1996	This Project	

Laurencia nidifica ***J. Agardh***

1979	Ref - AECOS, 1979	Off Pearl Harbor.

Genus: *Polysiphonia*

Polysiphonia sp.

1979	Ref - AECOS, 1979	Off Pearl Harbor.
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
1996	This Project	

Polysiphonia mollis ***J. Hooker & Harvey in Harvey, 1847***

Unknown	Spec - BPBM-AL 189658	
Unknown	Spec - BPBM-AL 189659	West Loch.

Polysiphonia scopulorum ***(Harvey) Hollenberg, 1968 New record for Pearl Harbor.***

1996	This Project	

Polysiphonia subtilissima ***Montagne***

1973	Ref - Evans et al., 1974	

Phylum: PROTOZOA

Class: GRANULORETICULOSEA

Order: FORAMINIFERIDA

Unidentified Foraminiferida

1978	Ref - Grovhoug, 1979	
1982	Spec - BPBM-A 174	Pearl Harbor dredge spoil dumping site.

Family: AMPHISTEGINIDAE

Genus: *Amphistegina*

Amphistegina lessonii ***d'Orbigny, 1826***

1977	Spec - BPBM-A 160	Off Pearl Harbor. Identified by Philip Papish, 1980.

Amphistegina lobifera ***Larsen, 1976***

1977	Spec - BPBM-A 161	Off Pearl Harbor. Identified by Philip Papish, 1980.

Class: CILIATEA

Family: FOLLICULINIDAE

Genus: *Parafolliculina*

Parafolliculina violaceae ***Giard, 1888***

1975	Ref - Grovhoug, 1976	

Legacy Project - Species Report (Cont.)

KINGDOM: PLANTAE

Phylum: BRYOPHYTA
Class: HEPATICOPSIDA
Order: JUNGERMANNIALES
Family: MASTIGOPHORACEAE
Genus: *Mastigophora*
Mastigophora sp.

1972	Ref - Long, 1974	Off Pearl Harbor.

Phylum: MAGNOLIOPHYTA
Class: MAGNOLIOPSIDA
Order: ROSALES
Family: LEGUMINOSAE
Genus: *Lathyrus*
Lathyrus sp.

1933	Spec - BPBM-MO 205313	Ford Island. Catalogue XIV.

Order: CORNALES
Family: RHIZOPHORACEAE
Genus: *Rhizophora*
Rhizophora mangel ***Linnaeus*** ***New record for Pearl Harbor.***

1996	This Project	

KINGDOM: ANIMALIA

Phylum: PORIFERA
Unidentified Porifera

1979	Ref - AECOS, 1979	light-purple.
1979	Ref - AECOS, 1979	orange.
1979	Ref - AECOS, 1979	blue-green.
1982	Spec - BPBM-C 437	Off Pearl Harbor dredge spoil dumping site.
1987	Ref - Brewer & Assoc., 1987	encrust. red.
1987	Ref - Brewer & Assoc., 1987	blue-green.
1987	Ref - Brewer & Assoc., 1987	branch. brown.

Class: CALCAREA
Order: LEUCOSOLENIIDA
Family: LEUCOSOLENIIDAE
Genus: *Leuconia*
Leuconia n. sp. ***New record for Hawaii. Known only from Hawaii.***

1996	This Project	

Order: SYCETTIDA
Family: HETEROPIIDAE
Genus: *Heteropia*
Heteropia glomerosa ***(Bowerbank, 1873)*** ***New record for Hawaii. Cryptogenic.***

1996	This Project	

Family: SYCETTIDAE
Genus: *Sycon*
Sycon sp.

1972	Ref - Long, 1974	Off Pearl Harbor.

Class: DEMOSPONGIAE
Order: DICTYOCERATIDA
Family: SPONGIIDAE
Genus: *Hyatella*
Hyatella intestinalis ***Lamarck, 1814*** ***New record for Hawaii. Cryptogenic.***

1996	This Project	

Legacy Project - Species Report (Cont.)

Genus: ***Spongia***

Spongia oceania ***de Laubenfels, 1950***

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

Order: DENDROCERATIDA

Family: APLYSELLIDAE

Genus: ***Aplysilla***

Aplysilla cf. rosea ***Barrois, 1876 New record for Pearl Harbor.***

1996 This Project

Genus: ***Chelonaplysilla***

Chelonaplysilla violacea ***Lendenfeld, 1883 New record for Pearl Harbor.***

1996 This Project

Family: DICTYODEDRILLIDAE

Genus: ***Dictyodendrilla***

Dictyodendrilla n. sp. ***New record for Hawaii. Known only from Hawaii.***

1996 This Project

Family: DYSIDEIDAE

Genus: ***Dendrilla***

Dendrilla cactus ***(Selenka, 1867)***

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

Genus: ***Dysidea***

Dysidea n. sp. 1 ***New record for Hawaii. Known only from Hawaii.***

1996 This Project

Dysidea n. sp. 2 ***New record for Hawaii. Known only from Hawaii.***

1996 This Project

Dysidea n. sp. 3 ***New record for Hawaii. Cryptogenic.***

1996 This Project

Dysidea avara ***sensu de Laubenfels 1950 New record for Pearl Harbor.***

1996 This Project

Dysidea cf. arenaria ***Bergquist, 1965 New record for Hawaii. Cryptogenic.***

1996 This Project

Dysidea herbacea ***(Keller, 1889)***

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

Genus: ***Euryspongia***

Euryspongia lobata

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

Order: HAPLOSCLERIDA

Family: CALLYSPONGIIDAE

Genus: ***Callyspongia***

Callyspongia diffusa ***(Ridley, 1884)***

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

1996 This Project

Family: CHALINIDAE

Genus: ***Toxiclona***

Toxiclona n. sp. ***New record for Hawaii. Known only from Hawaii.***

1996 This Project

Legacy Project - Species Report (Cont.)

Family: HALICLONIDAE

Genus: *Gellius*

Gellius n. sp. ***New record for Pearl Harbor.***

1996 This Project

Genus: *Haliclona*

Haliclona aquaeducta ***Schmidt, 1862***

1993 Ref - Brock, 1994 Recorded as H. aquaedactyla.

1994 Ref - Brock, 1995 Recorded as H. aquaedactyla.

Family: NIPHATIDAE

Genus: *Gelliodes*

Gelliodes fibrosa ***(Wilson) New record for Hawaii. Cryptogenic.***

1996 This Project

Order: POECILOSCLERIDA

Family: ADOCIIDAE

Unidentified Adociidae n. gen. n. sp.

1996 This Project

Genus: *Pellina*

Pellina eusiphonia ***Ridley, 1884***

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

Genus: *Sigmadocia*

Sigmadocia cf. caerulea ***Hechtel, 1965 New record for Hawaii. Introduced.***

1996 This Project

Genus: *Toxadocia*

Toxadocia violacea ***de Laubenfels, 1950***

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

Family: AMPHILECTIDAE

Genus: *Biemna*

Biemna fistulosa ***Topsent, 1897 New record for Hawaii. Cryptogenic.***

1996 This Project

Family: MICROCIONIDAE

Genus: *Clathria*

Clathria (Microciona) n. sp. ***New record for Hawaii. Known only from Hawaii.***

1996 This Project

Clathria (Microciona) maunaloa ***de Laubenfels, 1951***

1993 Ref - Brock, 1994 Recorded as Microciona maunaloa.

1994 Ref - Brock, 1995 Recorded as Microciona maunaloa.

Family: MYCALIDAE

Genus: *Mycale*

Mycale sp. ***Cryptogenic.***

1973 Ref - McCain, 1974

1973 Ref - McCain, 1975

Mycale (Aegogropila) armata ***Thiele, 1903 New record for Hawaii. Cryptogenic.***

1996 This Project

Mycale (Carmia) cecilia ***(de Laubenfels, 1936) Introduced.***

1973 Ref - Evans et al., 1974 Recorded as Mycale sp..

1973 Ref - McCain, 1974 Recorded as Mycale cecilia.

1973 Ref - McCain, 1975 Recorded as Mycale cecilia.

1993 Ref - Brock, 1994 Recorded as Mycale cecilia.

1994 Ref - Brock, 1995 Recorded as Mycale cecilia.

1996 This Project

Mycale (Carmia) contarenii ***sensu de Laubenfels, 1951 New record for Pearl Harbor.***

1996 This Project

Mycale (Carmia) maunakea ***de Laubenfels, 1936 New record for Pearl Harbor. Known only from Hawaii.***

1996 This Project

Genus: *Zygomycale*

Zygomycale parishii ***(Bowerbank, 1875) Introduced.***

1947	Ref - de Laubenfels, 1950	Recorded as Zygomycale parishi.
1973	Ref - McCain, 1974	Recorded as Zygomycale parishi.
1973	Ref - McCain, 1975	Recorded as Zygomycale parishi.
1993	Ref - Brock, 1994	Recorded as Zygomycale parishi.
1994	Ref - Brock, 1995	Recorded as Zygomycale parishi.
1996	This Project	

Family: MYXILLIDAE

Genus: *Tedania*

Tedania ignis ***(Duchassaing & Michelotti, 1864) Cryptogenic.***

1973 Ref - McCain, 1974
1973 Ref - McCain, 1975
1993 Ref - Brock, 1994
1994 Ref - Brock, 1995

Tedania macrodactyla ***(Lamarck, 1814) Cryptogenic.***

1993 Ref - Brock, 1994
1994 Ref - Brock, 1995

Tedania reticulata ***Thiele, 1903 New record for Pearl Harbor.***

1996 This Project

Family: PHORBASIDAE

Genus: *Damiriana*

Damiriana hawaiiana ***de Laubenfels, 1951***

1993 Ref - Brock, 1994
1994 Ref - Brock, 1995

Family: RASPAILIIDAE

Genus: *Echinodictyum*

Echinodictyum asperum ***Ridley and Dendy, 1886 New record for Hawaii. Cryptogenic.***

1996 This Project

Genus: *Phycopsis*

Phycopsis aculeata ***(Wilson)***

1973 Ref - Evans et al., 1974

Order: HALICHONDRIDA

Family: HALICHONDRIIDAE

Genus: *Amorphinopsis*

Amorphinopsis n. sp. ***New record for Hawaii. Known only from Hawaii.***

1996 This Project

Genus: *Ciocalypta*

Ciocalypta sp.

1963	Spec - BPBM-C 196	Waiau; Hawaiian Electric Company condensers and tunnel outlets 3, 4, 5, 6.

Genus: *Halichondria*

Halichondria sp.

1963	Spec - BPBM-C 195	Waiau; Hawaiian Electric Company condensers and tunnel outlets 3, 4, 5, 6.
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	

Halichondria coerulea ***Bergquist, 1967 Cryptogenic.***

1993 Ref - Brock, 1994
1994 Ref - Brock, 1995

Halichondria dura ***Lundgren, 1897***

1993 Ref - Brock, 1994
1994 Ref - Brock, 1995

Halichondria melanadocia ***de Laubenfels, 1936 Introduced.***

1993 Ref - Brock, 1994
1994 Ref - Brock, 1995
1996 This Project

Genus: *Topsentia*

Topsentia cf. halichondrioides ***Dendy, 1905 New record for Hawaii. Cryptogenic.***

1996 This Project

Family: HYMENIACIDONIDAE

Genus: *Hymeniacidon*

Hymeniacidon sp.

1973 Ref - Evans et al., 1974

Order: HADROMERIDA

Family: CLIONIDAE

Genus: *Cliona*

Cliona sp. ***Introduced.***

1996 This Project

Cliona vastifica ***Hancock, 1849***

1993 Ref - Brock, 1994
1994 Ref - Brock, 1995

Family: SPIRASTRELLIDAE

Genus: *Spirastrella*

Spirastrella coccinea ***(Duchassaing & Michelotti, 1864)***

1993 Ref - Brock, 1994
1994 Ref - Brock, 1995

Family: SUBERITIDAE

Genus: *Prosuberites*

Prosuberites oleteira ***de Laubenfels, 1957 New record for Pearl Harbor. Known only from Hawaii.***

1996 This Project

Genus: *Suberites*

Suberites cf. zeteki ***de Laubenfels Introduced.***

1948 Spec - BPBM-C 201
1978 Ref - Grovhoug, 1979 Recorded as Terpios zeteki.
1993 Ref - Brock, 1994 Recorded as Terpios zeteki.
1994 Ref - Brock, 1995 Recorded as Terpios zeteki.
1996 This Project

Genus: *Terpios*

Terpios granulosa ***Bergquist, 1967***

1993 Ref - Brock, 1994 Recorded as Terpios granuloma.
1994 Ref - Brock, 1995 Recorded as Terpios granuloma.

Order: CHORISTIDA

Family: CHONDROSIIDAE

Genus: *Chondrosia*

Chondrosia chucalla ***de Laubenfels, 1936***

1993 Ref - Brock, 1994
1994 Ref - Brock, 1995

Family: STELLETTIDAE

Genus: *Stelletta*

Stelletta n. sp. (cf. purpurea) ***Ridley New record for Hawaii. Known only from Hawaii.***

1996 This Project

Legacy Project - Species Report (Cont.)

Phylum: CNIDARIA

Unidentified Cnidaria

1996	This Project	

Class: HYDROZOA

Unidentified Hydrozoa

1982	Spec - BPBM-D 753	Off Pearl Harbor.
1983	Spec - BPBM-D 971	Mamala Bay; Pearl Harbor disposal site.
1987	Ref - Brewer & Assoc., 1987	
1996	This Project	

Order: HYDROIDA

Unidentified Hydroida

1948	Spec - BPBM-D 283	
1950	Spec - BPBM-D 307	
1950	Spec - BPBM-D 308	

Family: BOUGAINVILLIIDAE

Genus: *Garveia*

Garveia humilis ***(McCrady, 1856) Cryptogenic.***

1975	Ref - Grovhoug, 1976	

Family: CAMPANULARIIDAE

Genus: *Clytia*

Clytia hemisphaerica ***(Linnaeus, 1767) Introduced.***

1978	Ref - Grovhoug, 1979	

Genus: *Obelia*

Obelia sp.

1972	Ref - Long, 1974	Off Pearl Harbor.

Obelia bidentata? ***Introduced.***

1978	Ref - Grovhoug, 1979	

Obelia dichotoma ***(Linnaeus, 1758) Introduced.***

1975	Ref - Grovhoug, 1976	
1978	Ref - Grovhoug, 1979	

Family: CLAVIDAE

Genus: *Turritopsis*

Turritopsis nutricula ***(McCrady, 1856) Introduced.***

1975	Ref - Grovhoug, 1976	

Family: HALECIIDAE

Genus: *Halecium*

Halecium sp.?

1948	Spec - BPBM-D 288	Drydock #2.

Family: HALOCORDYLIDAE

Genus: *Halocordyle*

Halocordyle disticha ***(Goldfuss, 1820) Introduced.***

1929	Spec - BPBM-D 183	
1943	Ref - Hutchins, 1949	Recorded as Pennaria sp..
1944	Spec - BPBM-D 250	Off Pearl Harbor.
1948	Spec - BPBM-D 289	Drydock #4.
1972	Ref - Long, 1974	Recorded as Pennaria tiarella McCrady.
1973	Ref - Evans et al., 1974	Recorded as Pennaria tiarella McCrady.
1978	Ref - Grovhoug, 1979	
1986	Ref - Lenihan, 1990	Recorded as Pennaria tiarella.
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
1996	This Project	

Family: PLUMULARIIDAE

Unidentified Plumulariidae

1948	Spec - BPBM-D 290	Drydock #4.

Genus: *Plumularia*

Plumularia goodei? ***Nutting, 1900***

1972	Ref - Long, 1974	Off Pearl Harbor.

Family: TUBULARIIDAE

Genus: *Tubularia*

Tubularia sp.

1978	Ref - Grovhoug, 1979	

Class: SCYPHOZOA

Unidentified Scyphozoa

1929	Spec - BPBM-D 240	
1982	Spec - BPBM-D 751	Off Pearl Harbor.

Order: SEMAEOSTOMEAE

Family: ULMARIDAE

Genus: *Aurelia*

Aurelia labiata? ***Chamisso & Eysenhardt, 1820***

1973	Ref - Evans et al., 1974	Recorded as Balanus labiata.

Order: RHIZOSTOMEAE

Family: CASSIOPEIDAE

Genus: *Cassiopea*

Cassiopea medusa ***Light, 1914 Introduced.***

1941	Ref - Doty, 1961	

Family: MASTIGIIDAE

Genus: *Phyllorhiza*

Phyllorhiza punctata ***von Ledenfeld, 1884 Introduced.***

1941	Ref - Doty, 1961	Recorded as Cotylorhizoides pacificus.
1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	

Class: ANTHOZOA

Unidentified Anthozoa

1937	Spec - BPBM-D 227	
1948	Spec - BPBM-D 291	Drydock #4.

Order: TELESTACEA

Family: TELESTIDAE

Genus: *Carijoa*

Carijoa (Telestea) riisei ***Duchassaing & Michelotti, 1860 Introduced.***

1972	Spec - BPBM-D 454	Near channel buoy #11. Identified by Rees.
1973	Ref - Evans et al., 1974	Recorded as Telesto riisei.
1974	Ref - Cuttress, 1977	Recorded as Telesto riisei.
1978	Ref - Grovhoug, 1979	Recorded as Telesto riisei.
1986	Ref - Lenihan, 1990	Recorded as Telesto riisei.
1993	Ref - Brock, 1994	Recorded as Telesto riisei.
1994	Ref - Brock, 1995	Recorded as Telesto riisei.
1996	This Project	

Order: ALCYONACEA

Family: ALCYONIIDAE

Genus: *Anthomastus*

Anthomastus sp.

1982	Spec - BPBM-D 637	Off Pearl Harbor. Identified by D.M. Devaney, 21 April 1982.

Anthomastus fisheri ***Bayer***

1982	Spec - BPBM-D 750	Off Pearl Harbor. Identified by D.M. Devaney.

Order: GORGONACEA

Unidentified Gorgonacea

1950	Spec - BPBM-D 309	
1950	Spec - BPBM-D 310	
1982	Spec - BPBM-D 752	Off Pearl Harbor.

Order: ZOANTHIDEA

Family: ZOANTHIDAE

Genus: *Zoanthus*

Zoanthus pacificus ***Walsh & Bowers, 1971***

1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	

Order: ACTINIARIA

Family: ACTINIIDAE

Genus: *Cladactella*

Cladactella sp.

1973	Ref - Evans et al., 1974	

Cladactella manni? ***(Verrill, 1899)***

1979	Ref - AECOS, 1979	Off Pearl Harbor.

Family: AIPTASIIDAE

Genus: *Aiptasia*

Aiptasia pulchella ***Carlgren, 1943***

1978	Ref - Grovhoug, 1979	
1986	Ref - Lenihan, 1990	
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
1996	This Project	

Family: DIADUMENIDAE

Genus: *Diadumene*

Diadumene leucolena ***(Verrill, 1866) Introduced.***

1977	Ref - Cuttress, 1977	

Family: HORMATHIIDAE

Genus: *Calliactis*

Calliactis polypus? ***(Forsskal, 1775)***

1973	Ref - Evans et al., 1974	

Family: ISOPHELLIIDAE

Genus: *Epiphellia*

Epiphellia humilis ***(Verrill, 1928)***

1973	Ref - Evans et al., 1974	

Family: STOICHACTINIDAE

Genus: *Antheopsis*

Antheopsis papillosa ***(Kwietniewski, 1898)***

1973	Ref - Evans et al., 1974	Recorded as Radianthus cookei (Verrill 1928).

Order: SCLERACTINIA

Family: ACROPORIDAE

Genus: *Montipora*

Montipora sp.

1973	Ref - Evans et al., 1974	Off Pearl Harbor.

Montipora patula ***Verrill, 1864 New record for Pearl Harbor.***

1996	This Project	

Family: DENDROPHYLLIIDAE

Genus: *Tubastraea*

Tubastraea sp.

1950	Spec - BPBM-SC 340	Pearl Harbor drydock.

Legacy Project - Species Report (Cont.)

Family: FAVIIDAE

Genus: *Leptastrea*

Leptastrea purpurea ***Dana, 1846***

1993 Ref - Brock, 1994
1994 Ref - Brock, 1995
1996 This Project

Family: FUNGIIDAE

Genus: *Fungia* ***Common name(s): mushroom coral; Hawaiian name(s): ko`akohe; hu`ahu`a akai.***

Fungia sp.

Unknown Spec - BPBM-SC 399

Family: POCILLOPORIDAE

Genus: *Pocillopora*

Pocillopora damicornis ***Linnaeus, 1758 New record for Pearl Harbor. Hawaiian name(s): `ako`ako`a.***

1972 Ref - Long, 1974 Off Pearl Harbor. Recorded as Pocillopora cespitosa laysanensis Vaughan.
1996 This Project

Pocillopora ligulata

1904 Spec - BPBM-SC 142

Pocillopora meandrina ***Dana, 1846 New record for Pearl Harbor.***

1972 Ref - Long, 1974 Off Pearl Harbor.
1973 Ref - Evans et al., 1974 Off Pearl Harbor.
1996 This Project

Family: PORITIDAE

Genus: *Porites* ***Hawaiian name(s): pokahu puna.***

Porites compressa ***Dana, 1846 New record for Pearl Harbor. Hawaiian name(s): `ako`ako`a.***

1996 This Project

Porites compressa f. fragilis

1904 Spec - BPBM-SC 456 Outside Pearl Harbor.

Phylum: CTENOPHORA

Class: TENTACULATA

Order: CYDIPPIDA

Family: PLEUROBRACHIIDAE

Genus: *Pleurobrachia*

Pleurobrachia sp.

1973 Ref - Evans et al., 1974

Phylum: PLATYHELMINTHES

Unidentified Platyhelminthes

1979 Ref - AECOS, 1979 Off Pearl Harbor. Black polyclad.
1996 This Project

Class: TURBELLARIA

Order: POLYCLADIDA

Family: PLANOCERIDAE

Genus: *Planocera*

Planocera sp.

1973 Ref - Evans et al., 1974

Class: CESTODA

Genus: *Tylocephalum*

Tylocephalum sp.

1965 Ref - Rifkin & Cheng, 1968

Phylum: NEMATODA

Unidentified Nematoda

1996 This Project

Legacy Project - Species Report (Cont.)

Phylum: ANNELIDA

Class: POLYCHAETA

Unidentified Polychaeta

1982	Spec - BPBM-R 1584	Pearl Harbor dredge spoil dumping site.
1982	Spec - BPBM-R 1585	Off Pearl Harbor; dredge spoil dumping site.
1982	Spec - BPBM-R 1586	Off Pearl Harbor; dredge spoil dumping site.

Family: AMPHINOMIDAE

Unidentified Amphinomidae

1978	Ref - Grovhoug, 1979	

Genus: *Eurythoe*

Eurythoe complanata ***(Pallas, 1776)***

1973	Ref - Evans et al., 1974	
1979	Ref - AECOS, 1979	Off Pearl Harbor.
1996	This Project	

Family: APHRODITIDAE

Unidentified Aphroditidae

1978	Ref - Grovhoug, 1979	

Family: ARABELLIDAE

Genus: *Arabella*

Arabella sp.

1973	Ref - Evans et al., 1974	
1996	This Project	

Arabella iridescens ***Treadwell, 1906***

1973	Ref - Evans et al., 1974	

Family: CAPITELLIDAE

Unidentified Capitellidae

1978	Ref - Grovhoug, 1979	
1996	This Project	

Genus: *Dasybranchus*

Dasybranchus lumbricoides ***Grube, 1878***

1973	Ref - Evans et al., 1974	

Family: CHAETOPTERIDAE

Unidentified Chaetopteridae

1978	Ref - Grovhoug, 1979	
1996	This Project	

Genus: *Chaetopterus*

Chaetopterus variopedatus ***(Renier, 1804)*** ***Cryptogenic.***

1976	Ref - Grovhoug & Rastetter, 1980	Recorded as Chaetopterus variodoptecus.
1993	Ref - Brock, 1994	Recorded as C. variopedus.
1994	Ref - Brock, 1995	Recorded as C. variopedus.
1996	This Project	

Genus: *Phyllochaetopterus*

Phyllochaetopterus verrilli ***Treadwell, 1943***

1973	Ref - Evans et al., 1974	
1979	Ref - AECOS, 1979	Off Pearl Harbor.

Family: CIRRATULIDAE

Unidentified Cirratulidae

1978	Ref - Grovhoug, 1979	

Genus: *Cirratulus*

Cirratulus sp.

1929	Spec - BPBM-R 1451	
1973	Ref - Evans et al., 1974	

Genus: ***Cirriformia***

Cirriformia sp.

1973 Ref - Evans et al., 1974

Cirriformia hawaiensis ***Hartman, 1956***

1966 Ref - Hartman, 1966

1973 Ref - Evans et al., 1974

Cirriformia punctata ***(Grube, 1856)***

1973 Ref - McCain, 1974

1973 Ref - McCain, 1975

1996 This Project

Family: COSSURIDAE

Unidentified Cossuridae

1978 Ref - Grovhoug, 1979

Family: DORVILLEIDAE

Unidentified Dorvilleidae

1996 This Project

Genus: ***Dorvillea***

Dorvillea sp.

1973 Ref - Evans et al., 1974

1973 Ref - McCain, 1974

1973 Ref - McCain, 1975

Family: EUNICIDAE

Unidentified Eunicidae

1978 Ref - Grovhoug, 1979

Genus: ***Eunice***

Eunice sp.

1973 Ref - Evans et al., 1974

1996 This Project

Eunice antennata ***(Savigny, 1820)***

1973 Ref - Evans et al., 1974

Eunice australis ***Quatrefages, 1865***

1973 Ref - Evans et al., 1974

1996 This Project

Eunice cariboea ***New record for Pearl Harbor.***

1996 This Project

Eunice filamentosa ***Grube, 1856***

1973 Ref - Evans et al., 1974

1996 This Project

Eunice vittata ***(Delle Chiaje, 1828)***

1973 Ref - Evans et al., 1974

Genus: ***Lysidice***

Lysidice ninetta ***Audoin & Milne Edwards, 1833***

1973 Ref - Evans et al., 1974 Recorded as Lysidice collaris Grube, 1870.

1996 This Project

Genus: ***Marphysa***

Marphysa sp.

1931 Spec - BPBM-R 1504 Identified by G. Tien.

1931 Spec - BPBM-R 1505 Identified by G. Tien.

1931 Spec - BPBM-R 1508 Identified by G. Tien.

Marphysa sanguinea ***(Montagu, 1815)***

1938 Spec - BPBM-R 1364 Identified by G. Tien.

1973 Ref - Evans et al., 1974
1996 This Project

Genus: *Nematonereis*

Nematonereis unicornis ***Schmarda, 1861***

1973 Ref - Evans et al., 1974
1973 Ref - McCain, 1974
1973 Ref - McCain, 1975
1996 This Project

Genus: *Palola*

Palola siciliensis

1973 Ref - Evans et al., 1974 Recorded as Eunice siciliensis.
1996 This Project

Genus: *Paramarphysa*

Paramarphysa sp.

1973 Ref - Evans et al., 1974

Family: GLYCERIDAE

Genus: *Glycera*

Glycera tesselata ***New record for Pearl Harbor.***

1996 This Project

Family: HESIONIDAE

Unidentified Hesionidae

1978 Ref - Grovhoug, 1979

Genus: *Syllidia*

Syllidia armata ***New record for Pearl Harbor.***

1996 This Project

Family: LUMBRINERIDAE

Unidentified Lumbrineridae

1973 Ref - Evans et al., 1974
1973 Ref - McCain, 1974
1973 Ref - McCain, 1975

Genus: *Lumbrineris*

Lumbrineris sp.

1996 This Project

Family: LYSARETIDAE

Genus: *Oenone*

Oenone fulgida ***(Savigny)***

1973 Ref - Evans et al., 1974

Family: NEREIDAE

Unidentified Nereidae

1931 Spec - BPBM-R 1488
1978 Ref - Grovhoug, 1979
1996 This Project

Genus: *Ceratonereis*

Ceratonereis sp.

1973 Ref - Evans et al., 1974

Genus: *Laeonereis*

Laeonereis sp.

1973 Ref - Evans et al., 1974
1973 Ref - McCain, 1974
1973 Ref - McCain, 1975

Genus: *Leonnates*

Leonnates sp.

1973 Ref - McCain, 1974

1973 Ref - McCain, 1975

Genus: *Micronereis*

Micronereis sp.

1973 Ref - Evans et al., 1974

Genus: *Nereis*

Nereis sp.

1973 Ref - Evans et al., 1974

1987 Ref - Brewer & Assoc., 1987

Nereis sp. 1

1973 Ref - McCain, 1974 Recorded as Nereis sp. 1.

1973 Ref - McCain, 1975 Recorded as Nereis sp. 1.

Nereis sp. 2

1973 Ref - McCain, 1974 Recorded as Nereis sp. 2.

1973 Ref - McCain, 1975 Recorded as Nereis sp. 2.

Nereis areanacoedonta Moore, 1903 Introduced.

1973 Ref - Evans et al., 1974 Recorded as Nereis (Neanthes) caudata (Delle Chiaje).

Nereis corallina Kinberg, 1866

1966 Ref - Hartman, 1966

Genus: *Perinereis*

Perinereis sp.

1929 Spec - BPBM-R 1502 Identified by G. Tien.

1973 Ref - Evans et al., 1974

1987 Ref - Brewer & Assoc., 1987

Perinereis cultifera floridana Iwajima, 1972

1973 Ref - Evans et al., 1974 Recorded as Perinereis cultrifera.

Genus: *Platynereis*

Platynereis sp.

1973 Ref - Evans et al., 1974

Family: ONUPHIDAE

Genus: *Diopatra*

Diopatra sp.

1973 Ref - Evans et al., 1974

Family: OPHELIIDAE

Unidentified Opheliidae

1978 Ref - Grovhoug, 1979

Genus: *Armandia*

Armandia sp.

1996 This Project

Family: ORBINIIDAE

Unidentified Orbiniidae

1973 Ref - Evans et al., 1974

1978 Ref - Grovhoug, 1979

Family: PARAONIDAE

Unidentified Paraonidae

1978 Ref - Grovhoug, 1979

Family: PHYLLODOCIDAE

Unidentified Phyllodocidae

1978 Ref - Grovhoug, 1979

Legacy Project - Species Report (Cont.)

Genus: *Eulalia*

Eulalia sp.

1996 This Project

Eulalia sanguinea

1966 Ref - Hartman, 1966

1996 This Project

Genus: *Eumida*

Eumida sanguinea ***(Oested, 1843)***

1966 Ref - Hartman, 1966

Unidentified Eumida

1996 This Project

Genus: *Phyllodoce*

Phyllodoce sp.

1996 This Project

Family: POLYNOIDAE

Unidentified Polynoidae

1996 This Project

Genus: *Hololepidella*

Hololepidella nigropunctata

1972 Spec - BPBM-R 563 Harbor entrance, from buoy "1". Identified by D.M. Devaney.

Genus: *Iphione*

Iphione muricata ***(Savigny, 1818)***

1973 Ref - Evans et al., 1974

Genus: *Paralepidonotus*

Paralepidonotus ampulliferus ***(Grube, 1878)***

1973 Ref - Evans et al., 1974

1996 This Project

Family: SABELLARIIDAE

Unidentified Sabellariidae

1978 Ref - Grovhoug, 1979

Family: SABELLIDAE

Unidentified Sabellidae

1972 Ref - Long, 1974 Off Pearl Harbor.

1978 Ref - Grovhoug, 1979

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Genus: *Branchiomma*

Branchiomma nigromaculata ***(Baird, 1865)*** ***Cryptogenic.***

1966 Ref - Hartman, 1966:235

1975 Ref - Grovhoug, 1976 Recorded as Branchiomma cingulata.

1976 Ref - Cooke et al., 1980 Recorded as B. cingulata.

1976 Ref - Grovhoug & Rastetter, 1980 Recorded as Branchiomma cingulata.

1986 Ref - Henderson, 1990 Arizona Memorial.

1986 Ref - Lenihan, 1990 Recorded as B. cingualata.

1996 This Project

Genus: *Demonax*

Demonax leucaspis ***Kinberg, 1867***

1975 Ref - Grovhoug, 1976

1976 Ref - Cooke et al., 1980

Genus: *Potamilla*

Potamilla sp.

1996 This Project

Legacy Project - Species Report (Cont.)

Genus: *Sabella*

Sabella sp.

1973	Ref - Evans et al., 1974	

Genus: *Sabellastarte*

Sabellastarte sanctijosephi ***Gravier, 1906*** ***Cryptogenic.***

1976	Ref - Grovhoug & Rastetter, 1980	
1979	Ref - AECOS, 1979	Off Pearl Harbor.
1980	Ref - Grovhoug & Rastetter, 1980	
1986	Ref - Lenihan, 1990	
1987	Ref - AECOS, 1987	
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
1996	This Project	

Family: SERPULIDAE

Unidentified Serpulidae

1978	Ref - Grovhoug, 1979	
1979	Ref - AECOS, 1979	Off Pearl Harbor.
1996	This Project	

Genus: *Ficopomatus*

Ficopomatus enigmaticus ***(Fauvel, 1923)*** ***Introduced.***

1937	Spec - BPBM-R 1330	
1937	Ref - Straughan, 1969	Recorded as Mercierella sp..
1973	Ref - Evans et al., 1974	Recorded as Mercierella sp..
1976	Ref - Bailey-Brock, 1976	

Genus: *Hydroides*

Hydroides sp.

1937	Spec - BPBM-R 1235	Identified by D. Straughan.
1938	Spec - BPBM-R 1238	Identified by D. Straughan.
1978	Ref - Grovhoug, 1979	
1986	Ref - Lenihan, 1990	
1987	Ref - Brewer & Assoc., 1987	

Hydroides crucigera ***(Morch, 1863)*** ***Introduced.***

1937	Ref - Straughan, 1969	
1938	Ref - Straughan, 1969	
1972	Ref - Long, 1974	
1973	Ref - Evans et al., 1974	

Hydroides dirampha ***(Morch, 1863)*** ***Introduced.***

1929	Spec - BPBM-R 1083	
1929	Ref - Straughan, 1969	Recorded as H. lunulifera (Claparede, 1868).
1935	Ref - Edmondson, 1944	Recorded as H. lunulifera (Claparede, 1868).
1935	Ref - Ingram, 1937	Recorded as H. lunulifera.
1937	Spec - BPBM-R 1089	
1937	Spec - BPBM-R 1090	
1937	Spec - BPBM-R 1093	
1937	Spec - BPBM-R 1231	Identified by D. Straughan.
1937	Ref - Straughan, 1969	Recorded as H. lunulifera (Claparede, 1868).
1938	Spec - BPBM-R 1094	
1938	Spec - BPBM-R 1095	
1972	Ref - Long, 1974	
1973	Ref - Evans et al., 1974	Recorded as H. lunulifera (Claparede, 1868).
1973	Ref - McCain, 1974	Recorded as H. lunilifera.
1973	Ref - McCain, 1975	Recorded as H. lunilifera.
1975	Ref - Grovhoug, 1976	Recorded as Hydroides norvegica Gunnerus, 1768.
1976	Ref - Cooke et al., 1980	Recorded as H. lunulifera (Claparede, 1868).
1996	This Project	

Hydroides elegans ***(Haswell, 1883)*** ***Introduced.***

1929	Spec - BPBM-R 1101	Identified by D. Straughan.
1929	Ref - Straughan, 1969	Recorded as H. norvegica Gunnerus, 1768.
1935	Ref - Edmondson, 1944	Recorded as H. norvegica Gunnerus, 1768.
1935	Ref - Ingram, 1937	Recorded as H. norvegica Gunnerus, 1768.
1937	Spec - BPBM-R 1108	
1937	Spec - BPBM-R 1120	Identified by D. Straughan.
1938	Spec - BPBM-R 1109	
1938	Spec - BPBM-R 1110	
1938	Spec - BPBM-R 1111	
1938	Spec - BPBM-R 1113	
1938	Spec - BPBM-R 1114	
1940	Spec - BPBM-R 1115	
1940	Spec - BPBM-R 1366	Identified by D. Straughan.
1941	Spec - BPBM-R 1122	Identified by D. Straughan.
1947	Spec - BPBM-R 1123	Identified by D. Straughan.
1948	Spec - BPBM-R 1118	
1948	Spec - BPBM-R 1121	Identified by D. Straughan.
1972	Ref - Long, 1974	Recorded as H. norvegica Gunnerus, 1768.
1973	Ref - Evans et al., 1974	Recorded as H. norvegica Gunnerus, 1768.
1973	Ref - McCain, 1974	Recorded as H. norvegica.
1973	Ref - McCain, 1975	Recorded as H. norvegica.
1975	Ref - Grovhoug, 1976	Recorded as Hydroides norvegica Gunnerus, 1768.
1976	Ref - Cooke et al., 1980	
1978	Ref - Grovhoug, 1979	
1985	Ref - Hurlbut, 1990	
1987	Ref - Brewer & Assoc., 1987	
1996	This Project	

Hydroides sanctaecrucis ***Morch, 1863***

1972	Ref - Long, 1974	Off Pearl Harbor.

Hydroides uncinata ***Phillipe, 1844***

1972	Ref - Long, 1974

Genus: ***Neodexiospira***

Neodexiospira foraminosa ***(Moore & Bush, 1904)*** ***Introduced.***

1993	Ref - Brock, 1994
1994	Ref - Brock, 1995

Genus: ***Pileolaria***

Pileolaria semimilitaris ***Vine, 1972***

1975	Ref - Grovhoug, 1976

Genus: ***Pomatoleios***

Pomatoleios kraussii ***(Baird, 1865)*** ***Introduced.***

1976	Ref - Grovhoug & Rastetter, 1980
1993	Ref - Brock, 1994
1994	Ref - Brock, 1995
1996	This Project

Genus: ***Salmacina***

Salmacina dysteri ***Huxley, 1855*** ***Introduced.***

1972	Ref - Long, 1974
1986	Ref - Lenihan, 1990
1993	Ref - Brock, 1994
1994	Ref - Brock, 1995
1996	This Project

Genus: *Serpula*

Serpula vermicularis ***Linnaeus, 1767 Cryptogenic.***

1938 Ref - Straughan, 1969
1940 Ref - Straughan, 1969
1948 Ref - Straughan, 1969
1996 This Project

Genus: *Simplicaria*

Simplicaria pseudomilitaris ***New record for Pearl Harbor.***

1996 This Project

Genus: *Spirobranchus*

Spirobranchus tricornis ***Morch, 1863***

1972 Ref - Long, 1974 Off Pearl Harbor.

Genus: *Spirorbis*

Spirorbis sp.

1973 Ref - Evans et al., 1974
1993 Ref - Brock, 1994
1994 Ref - Brock, 1995

Genus: *Vermiliopsis*

Vermiliopsis torquata ***Treadwell, 1943***

1937 Spec - BPBM-R 1317 Identified by D. Straughan.

Family: SPINTHERIDAE

Genus: *Spinther*

Spinther japonicus ***Iwajima & Hartman, 1964 Cryptogenic.***

1976 Ref - Grovhoug & Rastetter, 1980
1987 Ref - Bailey-Brock & Hartman, 1987
1996 This Project

Family: SPIONIDAE

Unidentified Spionidae

1978 Ref - Grovhoug, 1979
1996 This Project

Genus: *Polydora*

Polydora websteri ***Hartman, 1943 Introduced.***

1966 Ref - Hartman, 1966

Genus: *Streblospio*

Streblospio benedicti ***Webster, 1879 Introduced.***

1987 Ref - Ward, 1987

Family: SPIRORBIDAE

Unidentified Spirorbidae

1996 This Project

Family: SYLLIDAE

Unidentified Syllidae

1978 Ref - Grovhoug, 1979
1996 This Project

Genus: *Autolytus*

Autolytus sp.

1996 This Project

Genus: *Branchiosyllis*

Branchiosyllis exilis ***New record for Pearl Harbor.***

1996 This Project

Genus: *Brania*

Brania rhopalophora ***New record for Pearl Harbor.***

1996 This Project

Legacy Project - Species Report (Cont.)

Genus: *Exogone*

Exogone verugera ***New record for Pearl Harbor.***

1996 This Project

Genus: *Haplosyllis*

Haplosyllis spongicola

1973 Ref - Evans et al., 1974 Recorded as Syllis spongicola.

1996 This Project

Genus: *Langerhansia*

Langerhansia cornuta

1973 Ref - Evans et al., 1974 Recorded as Syllis cornuta.

1996 This Project

Genus: *Myrianida*

Myrianida crassicirrata ***New record for Pearl Harbor.***

1996 This Project

Genus: *Opisthosyllis*

Opisthosyllis sp.

1973 Ref - Evans et al., 1974

Genus: *Syllis*

Syllis sp.

1973 Ref - Evans et al., 1974

Syllis gracilis ***New record for Pearl Harbor.***

1996 This Project

Typosyllis variegata ***(Grube, 1860)***

1973 Ref - Evans et al., 1974 Recorded as Syllis variegata.

Genus: *Trypanosyllis*

Trypanosyllis zebra ***(Grube, 1860)***

1973 Ref - Evans et al., 1974

1996 This Project

Genus: *Typosyllis*

Typosyllis sp.

1996 This Project

Typosyllis hawaiiensis ***New record for Pearl Harbor.***

1996 This Project

Typosyllis hyalina ***New record for Pearl Harbor.***

1996 This Project

Typosyllis prolifera ***New record for Pearl Harbor.***

1996 This Project

Family: TEREBELLIDAE

Unidentified Terebellidae

1978 Ref - Grovhoug, 1979

Genus: *Thelepus*

Thelepus setosus ***(Quatrefages, 1865)***

1973 Ref - Evans et al., 1974

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

1996 This Project

Class: OLIGOCHAETA

Order: RHYNCHOBDELLIDA

Family: PISCICOLIDAE

Unidentified Piscicolidae

1973 Ref - Evans et al., 1974

Legacy Project - Species Report (Cont.)

Phylum: MOLLUSCA

Unidentified Mollusca

1914	Spec - BPBM-MO 65001	Ford Island. Catalogue V.
1917	Spec - BPBM-MO 18	Off Pearl Harbor.
1922	Spec - BPBM-MO 37	
1934	Spec - BPBM-MO 205580	Dredge. Catalogue XIV.
1934	Spec - BPBM-MO 205581	Dredge. Catalogue XIV.
1934	Spec - BPBM-MO 205584	Dredge. Catalogue XIV.
1934	Spec - BPBM-MO 205585	Dredge. Catalogue XIV.
1934	Spec - BPBM-MO 205586	Dredge. Catalogue XIV.
1934	Spec - BPBM-MO 205587	Dredge. Catalogue XIV.
1934	Spec - BPBM-MO 205588	Dredge. Catalogue XIV.
1934	Spec - BPBM-MO 205591	Dredge. Catalogue XIV.
1934	Spec - BPBM-MO 205592	Dredge. Catalogue XIV.
1947	Spec - BPBM-MO 41	Bottom of ship Jacona.
1947	Spec - BPBM-MO 42	Bottom of ship Jacona.
1947	Spec - BPBM-MO 47	Bottom of ship Jacona.
1947	Spec - BPBM-MO 61	Drydock, hull of ship Jacona.
1948	Spec - BPBM-MO 44	Drydock.
1948	Spec - BPBM-MO 59	Hull of Barge YC-1024, Dry Dock #3..
1950	Spec - BPBM-MO 5	Power House intake tunnel..
1950	Spec - BPBM-MO 56	U.S.S. Deal.
1950	Spec - BPBM-MO 66	

Family: CORALLIOPHILIDAE

Genus: *Quoyula*

Quoyula madreporarum ***Sowerby***

1932	Spec - BPBM-MO 198765	Reef off Fort Kamehameha. Catalogue XIV.

Class: GASTROPODA

Family: CAECIDAE

Genus: *Caecum*

Caecum sepimentum ***de Folin, 1867 New record for Pearl Harbor.***

1996	This Project

Family: CEPHALASPIDAE

Unidentified Cephalaspidae

1996	This Project

Family: DIALIDAE

Genus: *Cerithidium*

Cerithidium perparvalum ***(Watson, 1886) New record for Pearl Harbor.***

1996	This Project

Genus: *Diala*

Diala semistriata

1973	Ref - Evans et al., 1974	Recorded as Diala varia.

Diala varia ***A. Adams, 1861 New record for Pearl Harbor.***

1996	This Project

Family: EATONIELLIDAE

Genus: *Eatoniella*

Eatoniella sp.

1996	This Project

Order: ARCHAEOGASTROPODA

Family: FISSURELLIDAE

Genus: *Diodora*

Diodora granifera ***(Pease, 1861) Hawaiian name(s): `opihi.***

Unknown	Spec - BPBM-MO 225792	Opposite Ford Island on Railroad Wharf on Peninsula. Catalogue XVI.
1973	Ref - Evans et al., 1974	

1996 This Project

Diodora octogona ***Reeve, 1850*** ***New record for Pearl Harbor.***

1996 This Project

Diodora ruppelli

1962 Ref - Kay, 1979

1996 This Project

Family: NERITIDAE

Genus: *Nerita*

Nerita sp.

1932 Spec - BPBM-MO 199261 Catalogue XIV.

Nerita picea ***Recluz, 1841*** ***Hawaiian name(s): pipipi kai; pipipi; pipipi; pipipi.***

1912 Spec - BPBM-MO 64253 Catalogue V.

1912 Spec - BPBM-MO 64264 Catalogue V.

1923 Spec - BPBM-MO 228140 Along shore near Railroad Wharf opposite Ford Island. Catalogue XVI.

1930 Spec - BPBM-MO 195621 Catalogue XIV.

1930 Spec - BPBM-MO 195622 Pearl Locks, Peninsula. Catalogue XIV.

1930 Spec - BPBM-MO 195623 Pearl Locks, Peninsula. Catalogue XIV.

1930 Spec - BPBM-MO 195624 Pearl Locks, Peninsula. Catalogue XIV.

1932 Spec - BPBM-MO 198798 Fishpond wall on Eastern side of Pearl City Peninsula. Catalogue XIV.

1932 Spec - BPBM-MO 198800 Fishpond wall on Eastern side of Pearl City Peninsula. Catalogue XIV.

1932 Spec - BPBM-MO 198801 Pearl City Peninsula, shore along Cobb's place. Catalogue XIV.

Genus: *Theodoxus*

Theodoxus cariosa ***Gray*** ***Known only from Hawaii.***

1912 Spec - BPBM-MO 64294 Catalogue V.

Theodoxus kanaka ***Pils***

1912 Spec - BPBM-MO 64313 Catalogue V.

Theodoxus neglecta ***Pease***

1932 Spec - BPBM-MO 198799 Fishpond wall on Eastern side of Pearl City Peninsula. Catalogue XIV.

1932 Spec - BPBM-MO 198802 Pearl City Peninsula, shore along Cobb's place. Catalogue XIV.

Family: PATELLIDAE

Genus: *Cellana* ***Hawaiian name(s): ka`ala; ko`ele; `opihi kapua`i lio.***

Cellana sp.

1934 Spec - BPBM-MO 205577 Dredge. Catalogue XIV.

1950 Spec - BPBM-MO 55

1973 Ref - Evans et al., 1974

Family: PHASIANELLIDAE

Genus: *Tricolia*

Tricolia variabilis ***(Pease, 1861)*** ***Hawaiian name(s): pupu kanaloa.***

1973 Ref - Evans et al., 1974 Off Pearl Harbor.

Family: PHENACOLEPADIDAE

Genus: *Phenacolepas*

Phenacolepas sp.

1973 Ref - Evans et al., 1974 Off Pearl Harbor.

Family: SCISSURELLIDAE

Genus: *Scissurella*

Scissurella sp.

1973 Ref - Evans et al., 1974

Family: SKENEIDAE

Genus: *Lophocaclias*

Lophocaclias minutissimus ***(Pilsbry, 1921)***

1973 Ref - Evans et al., 1974 Off Pearl Harbor. Recorded as Cyclostremiscus minutissimus (Pilsbry, 1921).

Legacy Project - Species Report (Cont.)

Family: STOMATELLIDAE

Genus: *Syncera*

Syncera giffardi ***Dall***

Unknown	Spec - BPBM-MO 65725	Pearl City. Catalogue V.

Family: TROCHIDAE

Genus: *Danilia*

Danilia eucheliformis

1961	Spec - BPBM-MO 217634	Off Fort Kamehameha. Catalogue XV.

Genus: *Euchelus*

Euchelus gemmatus ***Gould, 1845***

1973	Ref - Evans et al., 1974	

Genus: *Tholotia*

Tholotia subangulata ***(Pease. 1861)***

1917	Ref - Pilsbry, 1917	Recorded as Alcyna lineata Pease, 1861. MCZ 31724.

Genus: *Trochus*

Trochus sp.

1934	Spec - BPBM-MO 205576	Dredge. Catalogue XIV.

Trochus histrio ***Reeve***

1973	Ref - Evans et al., 1974	

Trochus intextus ***Kiener, 1850*** ***Hawaiian name(s): pupu o Ha`upu; ha`upu; haupu; `okole `oi `oi; pupu o Haupu.***

Unknown	Spec - BPBM-MO 200688	Catalogue XIV.
Unknown	Spec - BPBM-MO 227198	Catalogue XVI.
1918	Spec - BPBM-MO 198674	Catalogue XIV.
1918	Spec - BPBM-MO 198675	Catalogue XIV.
1923	Spec - BPBM-MO 227202	Catalogue XVI.
1924	Spec - BPBM-MO 240750	Catalogue XVII.
1930	Spec - BPBM-MO 195331	Pearl Locks Peninsula, makai face of little pier just mauka of Dr. Whitney's place.. Catalogue XIV.
1932	Spec - BPBM-MO 198940	Eastside of Pearl City Peninsula. Catalogue XIV.
1932	Spec - BPBM-MO 198941	Peninsula; Railroad Wharf. Catalogue XIV.
1932	Spec - BPBM-MO 198942	End of Waipio Peninsula. Catalogue XIV.
1932	Spec - BPBM-MO 200036	Pearl Harbor channel. Catalogue XIV.
1996	This Project	

Family: TURBINIDAE

Genus: *Leptothyra*

Leptothyra candida ***(Pease, 1861)*** ***New record for Pearl Harbor.***

1973	Ref - Evans et al., 1974	Off Pearl Harbor.
1996	This Project	

Leptothyra rubricincta ***(Mighels, 1845)*** ***Hawaiian name(s): Kahelelani eilaula; Kahelelani `okala.***

1973	Ref - Evans et al., 1974	
1996	This Project	

Genus: *Turbo*

Turbo chrysostomus

Unknown	Spec - BPBM-MO 200698	Catalogue XIV.

Turbo sandwicensis ***Menke, 1846***

Unknown	Spec - BPBM-MO 200699	Catalogue XIV.
Unknown	Spec - BPBM-MO 64380	Catalogue V.

Order: MESOGASTROPODA

Family: ARCHITECTONICIDAE

Genus: *Architectonica*

Architectonica sp.

1934	Spec - BPBM-MO 205570	Dredge. Catalogue XIV.

Architectonica perspectiva ***Common name(s): Sundial shell; Hawaiian name(s): pupu puhi.***

1906	Spec - BPBM-MO 217662	Off Fort Kamehameha. Catalogue XV.

Genus: *Heliacus*

Heliacus sp.

1973	Ref - Evans et al., 1974	

Genus: *Philippia*

Philippia sp.

Unknown	Spec - BPBM-MO 220737	Off Fort Kamehameha. Catalogue XV.

Family: BARLEEIIDAE

Genus: *Barleeia*

Barleeia sp.

Unknown	Spec - BPBM-MO 230902	Pearl City. Catalogue XVI.

Family: BURSIDAE

Genus: *Bursa*

Bursa affinis ***Brod.***

1932	Spec - BPBM-MO 199149	Reef off Fort Kamehameha. Catalogue XIV.

Bursa cruentata ***Sowerby***

1950	Spec - BPBM-MO 233988	Fort Kamehameha reef. Catalogue XVI.

Family: CALYPTRAEIDAE

Genus: *Crepidula*

Crepidula sp.

1932	Spec - BPBM-MO 200164	Waipio Peninsula, end. Catalogue XIV.
1932	Spec - BPBM-MO 200185	Peninsula; Railroad Wharf. Catalogue XIV.
1932	Spec - BPBM-MO 201516	Pearl City Peninsula, Railroad Wharf. Catalogue XIV.

Crepidula aculeata ***(Gmelin, 1791)*** ***Introduced.***

Unknown	Spec - BPBM-MO 64006	Catalogue V.
Unknown	Spec - BPBM-MO 64798	Ford Island. Catalogue V.
1915	Spec - BPBM-MO 231366	Ford Island. Catalogue XVI.
1923	Spec - BPBM-MO 231368	At Railroad Wharf, opposite Ford Island, Peninsula. Catalogue XVI.
1950	Spec - BPBM-MO 231370	Fort Kamehameha reef. Catalogue XVI.
1972	Ref - Long, 1974	
1973	Ref - Evans et al., 1974	
1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	
1975	Ref - Grovhoug, 1976	
1978	Ref - Grovhoug, 1979	
1987	Ref - Brewer & Assoc., 1987	
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
1996	This Project	

Genus: *Crucibulum*

Crucibulum spinosum ***(Sowerby, 1824)*** ***Introduced.***

1950	Spec - BPBM-MO 231372	Fort Kamehameha. Catalogue XVI.
1950	Spec - BPBM-MO 76	Reef at Fort Kamehameha.
1972	Ref - Long, 1974	
1973	Ref - Evans et al., 1974	
1993	Ref - Brock, 1994	Recorded as Calyptraea spinosum.
1994	Ref - Brock, 1995	Recorded as Calyptraea spinosum.
1996	This Project	

Family: CAPULIDAE

Genus: *Capulus*

Capulus bicarinatus ***Pease***

Unknown	Spec - BPBM-MO 65647	Catalogue V.
1922	Spec - BPBM-MO 77	

Legacy Project - Species Report (Cont.)

Family: CASSIDIDAE

Genus: *Casmaria*

Casmaria vibex

1961	Spec - BPBM-MO 218261	Off Fort Kamehameha. Catalogue XV.
1961	Spec - BPBM-MO 218262	Off Fort Kamehameha. Catalogue XV.
1961	Spec - BPBM-MO 218263	Off Fort Kamehameha. Catalogue XV.

Genus: *Cassis*

Cassis viber

1932	Spec - BPBM-MO 200430	Channel entrance, seaward. Catalogue XIV.

Genus: *Phalium*

Phalium (Semicassis) umbilica

1961	Spec - BPBM-MO 218248	Off Fort Kamehameha. Catalogue XV.
1961	Spec - BPBM-MO 218249	Off Fort Kamehameha. Catalogue XV.

Family: CERITHIIDAE

Unidentified Cerithiidae

Unknown	Spec - BPBM-MO 229571	Dredged in entrance channel to Pearl Harbor. Catalogue XVI.

Genus: *Bittium*

Bittium impendens ***(Hedley, 1899)***

1973	Ref - Evans et al., 1974	

Bittium manti ***Dall***

Unknown	Spec - BPBM-MO 65642	Catalogue V.

Bittium parcum ***(Gould, 1861)***

1973	Ref - Evans et al., 1974	
1996	This Project	

Bittium zebrum ***(Kiener, 1841)***

Unknown	Spec - BPBM-MO 229462	Catalogue XVI.
1923	Spec - BPBM-MO 229463	At Railroad Wharf on Peninsula opposite Ford Island. Catalogue XVI.
1973	Ref - Evans et al., 1974	
1996	This Project	

Genus: *Cerithiopsis*

Cerithiopsis sp. A

1973	Ref - Evans et al., 1974	Recorded as Cerithiopsis sp. A.
1996	This Project	

Cerithiopsis sp. B

1973	Ref - Evans et al., 1974	Recorded as Cerithiopsis sp. B.

Cerithiopsis acaria ***Dall***

Unknown	Spec - BPBM-MO 65649	Catalogue V.

Genus: *Cerithium*

Cerithium sp.?

1934	Spec - BPBM-MO 205561	Dredge. Catalogue XIV.

Cerithium articulatus

1961	Spec - BPBM-MO 217761	Off Fort Kamehameha?. Catalogue XV.

Cerithium diminutirum ***Phil.***

Unknown	Spec - BPBM-MO 63339	Ford Island. Catalogue V.

Cerithium locticum ***Pease***

Unknown	Spec - BPBM-MO 63176	Catalogue V.
Unknown	Spec - BPBM-MO 63229	Ford Island. Catalogue V.

Cerithium matukense ***Watson***

1961	Spec - BPBM-MO 217694	Off Pearl Harbor. Catalogue XV.
1982	Spec - BPBM-MO 207403	Catalogue XIV.

Cerithium nesioticum ***Pilsbry & Vanatta, 1905*** ***Hawaiian name(s): pupu maka`aha; maka`aha.***

1973 Ref - Evans et al., 1974

Genus: *Finella*

Finella pupoides ***A. Adams, 1860***

Unknown Spec - BPBM-MO 229372 Catalogue XVI.

1996 This Project

Genus: *Rhinoclavis*

Rhinoclavis fasciata

1961 Spec - BPBM-MO 217848 Off Fort Kamehameha. Catalogue XV.

1961 Spec - BPBM-MO 217849 Off Fort Kamehameha?. Catalogue XV.

Family: CERITHIOPSIDAE

Unidentified Cerithiopsidae

Unknown Spec - BPBM-MO 230301 Catalogue XVI.

Family: CYMATIIDAE

Genus: *Cymatium*

Cymatium sp.

1934 Spec - BPBM-MO 205568 Dredge. Catalogue XIV.

1934 Spec - BPBM-MO 205569 Dredge. Catalogue XIV.

1973 Ref - Evans et al., 1974

Cymatium aquatile ***Reeve, 1844***

1927 Spec - BPBM-MO 240863 Entrance Channel. Catalogue XVII.

1936 Spec - BPBM-MO 240862 Reef off Fort Kamehameha. Catalogue XVII.

1961 Spec - BPBM-MO 218307 Off Fort Kamehameha. Catalogue XV.

Cymatium gemmatum ***Reeve, 1844***

Unknown Spec - BPBM-MO 249233 Catalogue XVII.

1927 Spec - BPBM-MO 69 Naval Station.

1928 Spec - BPBM-MO 240865 Reef off Fort Kamehameha. Catalogue XVII.

1936 Spec - BPBM-MO 233927 Reef at Fort Kamehameha. Catalogue XVI.

1996 This Project

Cymatium intermedius ***Pease, 1869***

Unknown Spec - BPBM-MO 240869 Catalogue XVII.

Unknown Spec - BPBM-MO 240872 Catalogue XVII.

1927 Spec - BPBM-MO 240868 Entrance Channel off Fort Kamehameha. Catalogue XVII.

1936 Spec - BPBM-MO 233764 Reefs at Fort Kamehameha. Catalogue XVI.

1936 Spec - BPBM-MO 240866 Reef off Fort Kamehameha. Catalogue XVII.

1936 Spec - BPBM-MO 240867 Reef off Fort Kamehameha, under loose coral blocks. Catalogue XVII.

1996 This Project

Cymatium muricinum ***Roding, 1798*** ***Hawaiian name(s): pupu `ole kiwi; naunau; `anaunau.***

Unknown Spec - BPBM-MO 240859 Catalogue XVII.

1915 Spec - BPBM-MO 233908 Ford Island. Catalogue XVI.

1923 Spec - BPBM-MO 233913 Ewa side, near entrance. Catalogue XVI.

1927 Spec - BPBM-MO 233974 Naval Station. Catalogue XVI.

1932 Spec - BPBM-MO 198709 Naval Station, Hospital Pt.. Catalogue XIV.

1932 Spec - BPBM-MO 198710 Railroad Wharf. Catalogue XIV.

1932 Spec - BPBM-MO 198711 Watertown. Catalogue XIV.

1932 Spec - BPBM-MO 198712 Pearl Harbor channel, at Watertown. Catalogue XIV.

1936 Spec - BPBM-MO 233919 Reefs at Fort Kamehameha. Catalogue XVI.

Cymatium nicobaricum

1932 Spec - BPBM-MO 199158 Fort Kamehameha. Catalogue XIV.

1961 Spec - BPBM-MO 218320 Off Fort Kamehameha. Catalogue XV.

1996 This Project

Cymatium pileare ***Linnaeus***

1932 Spec - BPBM-MO 198718 Pearl Harbor entrance Channel, off Fort Kamehameha. Catalogue XIV.

1932	Spec - BPBM-MO 198719	Reef off Fort Kamehameha. Catalogue XIV.
1932	Spec - BPBM-MO 198726	Naval Station, Hospital Point. Catalogue XIV.
1932	Spec - BPBM-MO 198728	Watertown. Catalogue XIV.
1932	Spec - BPBM-MO 199880	Watertown, Pear Harbor Channel. Catalogue XIV.
1932	Spec - BPBM-MO 199950	Pearl City Peninsula, Railroad Wharf. Catalogue XIV.
1932	Spec - BPBM-MO 199951	Waipio Peninsula, end. Catalogue XIV.
1961	Spec - BPBM-MO 218337	Off Fort Kamehameha. Catalogue XV.

Cymatium rubeculum ***(Linnaeus, 1758)***

1932	Spec - BPBM-MO 200063	Fort Kamehameha, reef. Catalogue XIV.
1932	Spec - BPBM-MO 200065	Pearl Harbor Channel; Watertown. Catalogue XIV.
1936	Spec - BPBM-MO 240875	Reef off Fort Kamehameha, under loose coral blocks. Catalogue XVII.
1936	Spec - BPBM-MO 70	Reefs at Fort Kamahameha.
1973	Ref - Evans et al., 1974	

Genus: ***Distorsio***

Distorsio sp.

1934	Spec - BPBM-MO 205565	Dredge. Catalogue XIV.

Genus: ***Gyrineum***

Gyrineum pusillum ***Broderip***

1936	Spec - BPBM-MO 233981	E shore of entrance; reef at Fort Kamehameha. Catalogue XVI.
1936	Spec - BPBM-MO 71	Reef at Fort Kamehameha.
1961	Spec - BPBM-MO 218370	Off Fort Kamehameha. Catalogue XV.

Genus: ***Triton***

Triton tuberosus ***Lam.***

Unknown	Spec - BPBM-MO 62157	Catalogue V.

Family: CYPRAEIDAE

Genus: ***Cypraea*** ***Hawaiian name(s): leho; leholeho; leho `oma`o.***

Cypraea sp.

1934	Spec - BPBM-MO 215701	Dredgings. Catalogue XV.
1934	Spec - BPBM-MO 215704	Dredging. Catalogue XV.
1934	Spec - BPBM-MO 215705	Dredging. Catalogue XV.
1934	Spec - BPBM-MO 215706	Dredging. Catalogue XV.
1934	Spec - BPBM-MO 215707	Dredging. Catalogue XV.
1934	Spec - BPBM-MO 215708	Dredging. Catalogue XV.
1934	Spec - BPBM-MO 215709	Dredging. Catalogue XV.
1934	Spec - BPBM-MO 215710	Dredging. Catalogue XV.
1934	Spec - BPBM-MO 215711	Dredging. Catalogue XV.
1934	Spec - BPBM-MO 215712	Dredging. Catalogue XV.
1934	Spec - BPBM-MO 215713	Dredging. Catalogue XV.
1934	Spec - BPBM-MO 215714	Dredging. Catalogue XV.
1934	Spec - BPBM-MO 215715	Dredging. Catalogue XV.
1934	Spec - BPBM-MO 215716	Dredging. Catalogue XV.
1934	Spec - BPBM-MO 215717	Dredging. Catalogue XV.

Cypraea alisonae ***Burgess, 1983***

Unknown	Spec - BPBM-MO 247888	Fort Kamehameha. Catalogue XVII.
1982	Spec - BPBM-MO 9953	Fort Kamehameha, 4ft under large coral slab. Catalogue I.

Cypraea arabica ***(Linnaeus, 1758)***

1976	Ref - Burgess, 1995	Off Pearl Harbor.

Cypraea caputserpentis ***Linnaeus, 1758 Hawaiian name(s): leho kupa; leho maoli.***

1932	Spec - BPBM-MO 196399	Fort Kamehameha. Catalogue XIV.
1932	Spec - BPBM-MO 197104	Fort Kamehameha, reef off. Catalogue XIV.
1932	Spec - BPBM-MO 197112	End of Waipio Peninsula. Catalogue XIV.
1939	Spec - BPBM-MO 246606	Pearl City T.H.. Catalogue XVII.
1957	Spec - BPBM-MO 246610	Fort Kaahamaha (Fort Kamehameha). Catalogue XVII.

Legacy Project - Species Report (Cont.)

Cypraea carneola ***Linnaeus, 1758 Indigenous. Hawaiian name(s): leho pauhu.***

1932	Spec - BPBM-MO 197216	Pearl Harbor channel. Catalogue XIV.
1950	Ref - Burgess, 1959	Off Pearl Harbor.

Cypraea childreni ***New record for Pearl Harbor.***

1996	This Project	

Cypraea chinensis

1932	Spec - BPBM-MO 198042	Pearl Harbor channel, Watertown. Catalogue XIV.

Cypraea clandestina ***Linnaeus, 1767 Introduced.***

1950	Ref - Burgess, 1959	Off Pearl Harbor.

Cypraea cribaria ***Linnaeus, 1758 Introduced.***

1950	Ref - Burgess, 1959	Off Pearl Harbor.

Cypraea cylindrica ***Born Introduced.***

1950	Ref - Burgess, 1959	Off Pearl Harbor.

Cypraea depressa ***Grey, 1825 Introduced.***

1991	Ref - Burgess, 1995	Off Pearl Harbor.

Cypraea fimbriata ***Gmelin, 1791***

1932	Spec - BPBM-MO 197303	Fort Kamehameha; along edge of channel. Catalogue XIV.
1936	Spec - BPBM-MO 231689	Reefs at Fort Kamehameha. Catalogue XVI.
1957	Spec - BPBM-MO 247674	Fort Kamehameha. Catalogue XVII.

Cypraea gaskoini

Unknown	Spec - BPBM-MO 247840	Pearl City. Catalogue XVII.

Cypraea gaspardi ***Biraghi & Nicolay, 1993 Introduced.***

1993	Ref - Burgess, 1995	Off Pearl Harbor.

Cypraea helvola ***Linnaeus, 1758 Indigenous. Hawaiian name(s): leho `opule.***

Unknown	Spec - BPBM-MO 231763	Entrance. Catalogue XVI.
1932	Spec - BPBM-MO 197225	Pearl Harbor Channel; Watertown. Catalogue XIV.
1936	Spec - BPBM-MO 231768	Reefs at Fort Kamehameha. Catalogue XVI.
1939	Spec - BPBM-MO 246957	Catalogue XVII.
1958	Spec - BPBM-MO 246958	Catalogue XVII.
1960	Spec - BPBM-MO 246923	Fort Kamehameha. Catalogue XVII.

Cypraea hirundo ***Linnaeus, 1758 Introduced.***

1993	Ref - Burgess, 1995	Off Pearl Harbor.

Cypraea isabella ***Linnaeus, 1758 Hawaiian name(s): puleho; puleho holei; puleho kani`o;*** **puleholeho; puleho palaoa; puleho `ula; puleholeho; leho kupe`e lima; momi**

1932	Spec - BPBM-MO 197271	Pearl Harbor Channel; Watertown. Catalogue XIV.
1932	Spec - BPBM-MO 197272	Pearl Harbor entrance channel. Catalogue XIV.
1932	Spec - BPBM-MO 197273	Fort Kamehameha; along edge of channel. Catalogue XIV.
1936	Spec - BPBM-MO 231793	Reef at Fort Kamehameha. Catalogue XVI.
1957	Spec - BPBM-MO 246270	Fort Kamehameha. Catalogue XVII.

Cypraea labrolineata ***Gaskoin, 1849 Indigenous.***

1993	Ref - Burgess, 1995	Off Pearl Harbor.

Cypraea maculifera ***Hawaiian name(s): kuoho; leho; leho kolea.***

1957	Spec - BPBM-MO 246540	Fort Kaahamaha (Fort Kamehameha). Catalogue XVII.

Cypraea moneta ***Linnaeus, 1758 Hawaiian name(s): leho palaoa; leho puna; leho `uala; `uwala; pupu*** **leholeho.**

Unknown	Spec - BPBM-MO 231864	At Naval Station. Catalogue XVI.
Unknown	Spec - BPBM-MO 240815	Catalogue XVII.
1932	Spec - BPBM-MO 197205	Fort Kamehameha, about 150 ft. S.E. of the Ft. Kam. Wharf, 100 ft. from shore. Catalogue XIV.

Cypraea poraria ***Linnaeus, 1758 Introduced.***

1950	Ref - Burgess, 1959	Off Pearl Harbor.

Legacy Project - Species Report (Cont.)

Cypraea punctulata ***Gmelin***

1932	Spec - BPBM-MO 197286	Fort Kamehameha; along edge of channel. Catalogue XIV.
1932	Spec - BPBM-MO 198043	Pearl Harbor channel, Watertown. Catalogue XIV.
1936	Spec - BPBM-MO 68	Reef at Fort Kamehameha.

Cypraea reticulata ***Martyn***

1916	Spec - BPBM-MO 67	Reef Waikiki of entrance to Pearl Harbor.
1932	Spec - BPBM-MO 196358	Reef off Fort Kamehameha. Catalogue XIV.

Cypraea scurra ***Gmelin, 1791***

1932	Spec - BPBM-MO 198044	Keahi Point. Catalogue XIV.

Cypraea semiplota ***Mighels, 1845*** ***Hawaiian name(s): puleholeho.***

1926	Spec - BPBM-MO 231883	Fort Kamehameha reef. Catalogue XVI.
1926	Spec - BPBM-MO 231884	Fort Kamehameha reef. Catalogue XVI.
1932	Spec - BPBM-MO 198045	Fort Kamehameha. Catalogue XIV.

Cypraea shilderorum

1932	Spec - BPBM-MO 197146	Pearl Harbor Channel; Watertown. Catalogue XIV.

Cypraea staphylaea ***Linnaeus, 1758***

1939	Spec - BPBM-MO 247051	Pearl City T.H.. Catalogue XVII.
1939	Spec - BPBM-MO 247052	Pearl City T.H.. Catalogue XVII.
1950	Ref - Burgess, 1959	Off Pearl Harbor.

Cypraea sulcidentata ***Gray***

1932	Spec - BPBM-MO 197173	Fort Kamehameha, reef off. Catalogue XIV.

Cypraea talpa ***Linnaeus, 1758***

1928	Spec - BPBM-MO 240832	Reef off Fort Kamehameha, under loose coral blocks. Catalogue XVII.
1932	Spec - BPBM-MO 197277	Fort Kamehameha, off. Catalogue XIV.
1932	Spec - BPBM-MO 198046	Pearl Harbor channel. Catalogue XIV.
1936	Spec - BPBM-MO 60	Reef at Fort Kamehameha.

Cypraea teres ***Gmelin, 1791***

1954	Spec - BPBM-MO 246850	Fort Kamehamaha reef. Catalogue XVII.
1957	Spec - BPBM-MO 246865	Fort Kaahamaha (Fort Kamehameha). Catalogue XVII.
1961	Spec - BPBM-MO 218101	Off Fort Kamehameha. Catalogue XV.

Cypraea tessellata ***Swainson, 1822***

1932	Spec - BPBM-MO 197197	Keahi Point. Catalogue XIV.
1932	Spec - BPBM-MO 198047	Pearl Harbor channel. Catalogue XIV.

Family: DIASTOMIDAE

Genus: *Alaba*

Alaba goniochila ***(A. Adams, 1860)***

1973	Ref - Evans et al., 1974	Off Pearl Harbor.

Genus: *Alabina*

Alabina pearlensis ***Dall***

Unknown	Spec - BPBM-MO 65635	Catalogue V.

Genus: *Obtortio*

Obtortio fulva ***Watson***

1973	Ref - Evans et al., 1974	

Obtortio perparvulum ***(Watson)***

1973	Ref - Evans et al., 1974	

Family: EULIMIDAE

Genus: *Balcis*

Balcis sp.

1976	Ref - Cooke et al., 1980	
1996	This Project	

Balcis thaanumi ***Pilsbry***

1936 Spec - BPBM-MO 230613 Reef at Fort Kamehameha. Catalogue XVI.

Genus: *Leiostraca*

Leiostraca sp.

1973 Ref - Evans et al., 1974

Family: HIPPONICIDAE

Genus: *Amalthea*

Amalthea sp. ***(?W.H.)***

1930 Spec - BPBM-MO 195332 Pearl Locks Peninsula, makai face of little pier just mauka of Dr. Whitney's place.. Catalogue XIV.

1932 Spec - BPBM-MO 200163 Waipio Peninsula, end. Catalogue XIV.

Amalthea barbatus

1932 Spec - BPBM-MO 200171 Fort Kamehameha and Barber's Point, beach between. Catalogue XIV.

Genus: *Antisabia*

Antisabia foliacea

Unknown Spec - BPBM-MO 209902 Fort Kamehameha Army Housing (S.C.) 910509AS. Catalogue XIV.

Genus: *Hipponix*

Hipponix sp.

1973 Ref - Evans et al., 1974

1996 This Project

Hipponix (Cochlear) imbricatus ***Gould, 1846***

Unknown Spec - BPBM-MO 64817 Catalogue V.

Hipponix antuguatus ***Linnaeus***

1930 Spec - BPBM-MO 196836 Peninsula. Catalogue XIV.

Hipponix australis

1961 Spec - BPBM-MO 217888 Off Fort Kamehameha. Catalogue XV.

Hipponix grayanus

1961 Spec - BPBM-MO 217892 Off Fort Kamehameha. Catalogue XV.

Hipponix imbricatus ***Gould, 1846***

Unknown Spec - BPBM-MO 63956 Ford Island. Catalogue V.

1927 Spec - BPBM-MO 231294 Ford Island, on pearl oyster, along shore, on rocks. Catalogue XVI.

1949 Spec - BPBM-MO 231301 Fort Kamehameha. Catalogue XVI.

1996 This Project

Hipponix pilosus ***(Deshayes, 1832)***

1973 Ref - Evans et al., 1974

1979 Ref - AECOS, 1979 Off Pearl Harbor. Recorded as Hipponyx cf. barbatus.

1996 This Project

Hipponix pilosus imbricatus ***Gould***

Unknown Spec - BPBM-MO 204603 Catalogue XIV.

Family: LITTORINIDAE

Genus: *Littoraria* ***Common name(s): Periwinkle; Hawaiian name(s): pupu kolea.***

Littoraria coccinea

1930 Spec - BPBM-MO 196989 Peninsular, Pearl Lochs, N. of Dr. Whitney's place. Catalogue XIV.

Littoraria intermedia

1930 Spec - BPBM-MO 196735 S.E. coast of peninsular Pearl Lochs. Catalogue XIV.

1930 Spec - BPBM-MO 196745 Pearl Lochs. Catalogue XIV.

Littoraria pintado ***New record for Pearl Harbor.***

1996 This Project

Littoraria scabra ***(Linnaeus, 1758) Hawaiian name(s): kukae kolea; pupu kolea; kolealea; pipipi***

Unknown Spec - BPBM-MO 204655 Ford Island. Catalogue XIV.

Unknown Spec - BPBM-MO 63606 Catalogue V.

Unknown	Spec - BPBM-MO 63608	Catalogue V.
Unknown	Spec - BPBM-MO 64830	Catalogue V.
1915	Spec - BPBM-MO 228535	Ford Island. Catalogue XVI.
1923	Spec - BPBM-MO 228540	Peninsula; sea wall at Dowsett's Wharf. Catalogue XVI.
1923	Spec - BPBM-MO 228541	Peninsula; along shore near Railroad Wharf. Catalogue XVI.
1930	Spec - BPBM-MO 196741	Peninsular Pearl Lochs, North of Dr. Whitney's place. Catalogue XIV.
1930	Spec - BPBM-MO 197004	Peninsular, Pearl Lochs. Catalogue XIV.
1930	Spec - BPBM-MO 197005	Peninsular, Pearl Lochs. Catalogue XIV.
1930	Spec - BPBM-MO 197006	Peninsular, Pearl Lochs. Catalogue XIV.
1932	Spec - BPBM-MO 200143	Peninsula. Catalogue XIV.
1973	Ref - Evans et al., 1974	Recorded as Littorina scabra.
1993	Ref - Brock, 1994	Recorded as Littorina scabra.
1994	Ref - Brock, 1995	Recorded as Littorina scabra.
1996	This Project	

Family: MODULIDAE

Genus: *Modulus*

Modulus sp.

1934	Spec - BPBM-MO 205575	Dredge. Catalogue XIV.

Modulus tectum ***Gmelin*** ***Hawaiian name(s): pupu.***

1932	Spec - BPBM-MO 199280	Reef off Fort Kamehameha. Catalogue XIV.

Family: NATICIDAE

Genus: *Natica*

Natica sp.

1961	Spec - BPBM-MO 218130	Off Fort Kamehameha. Catalogue XV.
1973	Ref - Evans et al., 1974	

Natica gualteriana ***Recluz, 1844*** ***Hawaiian name(s): pupu kui; kio noho one.***

1915	Spec - BPBM-MO 64034	Catalogue V.
1932	Spec - BPBM-MO 199329	Reef off Fort Kamehameha. Catalogue XIV.
1932	Spec - BPBM-MO 199336	Entrance Channel. Catalogue XIV.
1932	Spec - BPBM-MO 199337	Pearl City. Catalogue XIV.
1973	Ref - Evans et al., 1974	

Natica tessellata

1961	Spec - BPBM-MO 218143	Off Fort Kamehameha. Catalogue XV.

Genus: *Polinices*

Polinices sp.

1934	Spec - BPBM-MO 205566	Dredge. Catalogue XIV.

Polinices virginea

1961	Spec - BPBM-MO 218188	Off Fort Kamehameha. Catalogue XV.
1962	Spec - BPBM-MO 218195	Just Ewa of restricted area. Catalogue XV.

Family: RISSOELLIDAE

Genus: *Rissoella*

Rissoella sp.

1973	Ref - Evans et al., 1974	

Family: RISSOIDAE

Genus: *Cithna*

Cithna sp.

1973	Ref - Evans et al., 1974	Off Pearl Harbor.

Genus: *Merelina*

Merelina sp.

1973	Ref - Evans et al., 1974	

Genus: *Parashiela*

Parashiela beetsi ***Ladd, 1966***

1973	Ref - Evans et al., 1974	Off Pearl Harbor.

Legacy Project - Species Report (Cont.)

Genus: ***Rissoina***

Rissoina ambigua ***(Gould, 1849)***

1973	Ref - Evans et al., 1974	

Rissoina miltozona ***Tomlin, 1915***

1973	Ref - Evans et al., 1974	
1996	This Project	

Rissoina rhyssa ***Dall***

Unknown	Spec - BPBM-MO 228923	Catalogue XVI.
Unknown	Spec - BPBM-MO 65714	Catalogue V.

Rissoina turricula ***Pease, 1861***

1973	Ref - Evans et al., 1974	
1996	This Project	

Genus: ***Schwartziella***

Schwartziella gracilis

1973	Ref - Evans et al., 1974	Recorded as Rissoina gracilis.

Genus: ***Zebina***

Zebina tridentata ***(Michaud, 1830)***

Unknown	Spec - BPBM-MO 63855	Catalogue V.
1973	Ref - Evans et al., 1974	Off Pearl Harbor.
1996	This Project	

Family: STROMBIDAE

Genus: ***Strombus***

Strombus dentatus

1961	Spec - BPBM-MO 217932	Off Fort Kamehameha. Catalogue XV.

Strombus helli

1961	Spec - BPBM-MO 217953	Off Fort Kamehameha. Catalogue XV.
1961	Spec - BPBM-MO 217954	Off Fort Kamehameha. Catalogue XV.

Strombus maculatus ***Nutt*** ***Hawaiian name(s): mamaiki; pupu mamaiki; pu leholeho.***

1932	Spec - BPBM-MO 199101	Reef off Fort Kamehameha. Catalogue XIV.

Family: TONNIDAE

Genus: ***Tonna*** ***Hawaiian name(s): pu`oni`oni`o.***

Tonna perdix ***Linnaeus, 1758*** ***Hawaiian name(s): puleho.***

1936	Spec - BPBM-MO 240897	Reef off Fort Kamehameha. Catalogue XVII.

Family: TRIPHORIDAE

Genus: ***Triforis***

Triforis flammulata ***Pease***

Unknown	Spec - BPBM-MO 62886	Ford Island. Catalogue V.

Genus: ***Triphora***

Triphora {Triphoridae}

1932	Spec - BPBM-MO 198048	Pearl Harbor entrance channel. Catalogue XIV.
1973	Ref - Evans et al., 1974	
1996	This Project	

Genus: ***Viriola***

Viriola incisa ***Pease***

1936	Spec - BPBM-MO 230149	E shore of entrance; reef at Fort Kamehameha. Catalogue XVI.

Family: VERMETIDAE

Unidentified Vermetidae

Unknown	Spec - BPBM-MO 229146	Catalogue XVI.
Unknown	Spec - BPBM-MO 51	
Unknown	Spec - BPBM-MO 65695	Catalogue V.
1934	Spec - BPBM-MO 205562	Dredge. Catalogue XIV.
1948	Spec - BPBM-MO 43	Bottom of portable dry dock in Dry Dock #4..

1978 Ref - Grovhoug, 1979

Genus: *Dendropoma*

Dendropoma sp.

1972 Ref - Long, 1974

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Dendropoma platypus ***Morch, 1861***

1973 Ref - Evans et al., 1974

1987 Ref - Brewer & Assoc., 1987

Dendropoma psarocephala ***Hadfield & Kay, 1972***

1975 Ref - Grovhoug, 1976

Dendropoma psarocephala? ***Hadfield & Kay, 1972***

1973 Ref - Evans et al., 1974

Genus: *Vermetus* ***Hawaiian name(s): pohokupele; kauno`a.***

Vermetus sp.

Unknown Spec - BPBM-MO 63578 Catalogue V.

1973 Ref - Evans et al., 1974

Vermetus alii ***Hadfield & Kay, 1972 Introduced.***

1973 Ref - Evans et al., 1974

1975 Ref - Grovhoug, 1976

1986 Ref - Lenihan, 1990

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

1996 This Project

Family: VITRINELLIDAE

Genus: *Cyclostremiscus*

Cyclostremiscus sp. A

1973 Ref - Evans et al., 1974 Off Pearl Harbor. Recorded as Cyclostremiscus sp. A.

Cyclostremiscus sp. B

1973 Ref - Evans et al., 1974 Off Pearl Harbor. Recorded as Cyclostremiscus sp. B.

Cyclostremiscus sp. C

1973 Ref - Evans et al., 1974 Off Pearl Harbor. Recorded as Cyclostremiscus sp. C.

Cyclostremiscus sp. D

1973 Ref - Evans et al., 1974 Off Pearl Harbor. Recorded as Cyclostremiscus sp. D.

Cyclostremiscus emeryi ***Ladd, 1966***

1973 Ref - Evans et al., 1974 Off Pearl Harbor.

Family: XENOPHORIDAE

Genus: *Xenophora*

Xenophora pallida

1961 Spec - BPBM-MO 217922 Off Fort Kamehameha. Catalogue XV.

Order: NEOGASTROPODA

Family: BUCCINIDAE

Genus: *Cantharus*

Cantharus farinosus ***(Gould, 1850)***

1973 Ref - Evans et al., 1974

Genus: *Colubraria*

Colubraria obscura ***Reeve, 1844***

Unknown Spec - BPBM-MO 240920 Channel. Catalogue XVII.

Genus: *Engina*

Engina sp.

1973 Ref - Evans et al., 1974

Genus: *Prodotia*

Prodotia ignea ***Gmelin, 1791***

Unknown	Spec - BPBM-MO 235895	Catalogue XVI.
Unknown	Spec - BPBM-MO 65702	Catalogue V.
1928	Spec - BPBM-MO 240939	Reef off Fort Kamehameha. Catalogue XVII.
1932	Spec - BPBM-MO 199738	Fort Kamehameha, reef off. Catalogue XIV.

Prodotia iostomus

1932	Spec - BPBM-MO 199731	Fort Kamehameha, reef off. Catalogue XIV.

Family: COLUMBELLIDAE

Genus: *Anachis*

Anachis miser ***(Sowerby, 1844)***

1973	Ref - Evans et al., 1974	Recorded as A. zebra.

Genus: *Columbella* ***Hawaiian name(s): pupu Ni`ihau.***

Columbella varians ***Sowerby***

1932	Spec - BPBM-MO 199827	Fort Kamehameha, reef off. Catalogue XIV.

Genus: *Euplica*

Euplica varians ***New record for Pearl Harbor.***

1996	This Project	

Genus: *Mitrella*

Mitrella margarita ***Reeve***

1961	Spec - BPBM-MO 221163	Off Fort Kamehameha?. Catalogue XV.

Genus: *Seminella*

Seminella sp.

1996	This Project	

Family: CONIDAE

Genus: *Conus* ***Common name(s): Cone shell; Hawaiian name(s): pupu`ala; pupu***

Conus sp.

1961	Spec - BPBM-MO 220384	Off Fort Kamehameha. Catalogue XV.

Conus abbreviatus ***Reeve***

1932	Spec - BPBM-MO 199015	Fort Kamehameha. Catalogue XIV.

Conus acutangulus ***Lamark***

1961	Spec - BPBM-MO 220118	Off Fort Kamehameha. Catalogue XV.
1961	Spec - BPBM-MO 220119	Off Fort Kamehameha. Catalogue XV.

Conus catus ***Hwass, 1792***

1932	Spec - BPBM-MO 198911	Reef off Fort Kamehameha. Catalogue XIV.
1936	Spec - BPBM-MO 238941	Fort Kamehameha. Catalogue XVI.

Conus clavus ***Linnaeus***

1929	Spec - BPBM-MO 63	Brought up by dredger opperations in entrance to Pearl Harbor.

Conus dactylasus ***Kiener***

1929	Spec - BPBM-MO 64	Brought up by dredger opperations in entrance to Pearl Harbor.

Conus ebraeus ***Linnaeus*** ***Hawaiian name(s): ohana o ka pupu`ala; ke`oke`o; `ele`ele.***

1932	Spec - BPBM-MO 199614	Fort Kamehameha. Catalogue XIV.

Conus flavidus ***Lam.***

1932	Spec - BPBM-MO 199052	Fort Kamehameha. Catalogue XIV.

Conus lividus ***Hwass***

1932	Spec - BPBM-MO 198981	Fort Kamehameha. Catalogue XIV.

Conus marmoreus ***Linnaeus***

1932	Spec - BPBM-MO 200269	Pearl Harbor channel; entrance, near seaward end. Catalogue XIV.

Conus miles ***Linnaeus***

1932	Spec - BPBM-MO 199134	Fort Kamehameha, near outer edge of the reef. Catalogue XIV.
1932	Spec - BPBM-MO 199135	Reef off Fort Kamehameha. Catalogue XIV.1

1936	Spec - BPBM-MO 2	Off Fort Kamehameha, on the reef.
1936	Spec - BPBM-MO 239251	Off Fort Kamehameha, on the reef. Catalogue XVI.

Conus nussatella ***Linnaeus, 1758***

1927	Spec - BPBM-MO 241003	Off Fort Kamehameha, under loose, dead coral. Catalogue XVII.
1936	Spec - BPBM-MO 239257	E shore of entrance; reef at Fort Kamehameha. Catalogue XVI.
1936	Spec - BPBM-MO 62	Reef at Fort Kamehameha.

Conus pennaccus

Unknown	Spec - BPBM-MO 239602	Catalogue XVI.
1932	Spec - BPBM-MO 199642	Watertown. Catalogue XIV.
1932	Spec - BPBM-MO 200257	Fort Kamehameha, reef. Catalogue XIV.

Conus quercinus ***Lightfoot***

1932	Spec - BPBM-MO 199691	Pearl Harbor Channel; Watertown. Catalogue XIV.
1961	Spec - BPBM-MO 220303	Off Fort Kamehameha. Catalogue XV.
1961	Spec - BPBM-MO 220304	Off Fort Kamehameha. Catalogue XV.
1961	Spec - BPBM-MO 220305	Off Fort Kamehameha. Catalogue XV.

Conus rattus ***Hwass***

1932	Spec - BPBM-MO 199084	Fort Kamehameha. Catalogue XIV.

Conus sponsalis

1932	Spec - BPBM-MO 199201	Reef off Fort Kamehameha. Catalogue XIV.

Conus textile ***Linnaeus***

1915	Spec - BPBM-MO 239129	Reef Waikiki of entrance to Pearl Harbor, under a rock in five feet of water. Catalogue XVI.
1936	Spec - BPBM-MO 65	Fort Kamehameha Reef.

Conus vexillum

1932	Spec - BPBM-MO 199346	Reef off Fort Kamehameha. Catalogue XIV.
1932	Spec - BPBM-MO 199347	Fort Kamehameha. Catalogue XIV.

Conus vitulinus ***Hwass, 1792***

1932	Spec - BPBM-MO 199673	Fort Kamehameha, reef off. Catalogue XIV.
1932	Spec - BPBM-MO 199674	Fort Kamehameha. Catalogue XIV.
1936	Spec - BPBM-MO 239424	E shore of entrance; reef at Fort Kamehameha. Catalogue XVI.
1936	Spec - BPBM-MO 52	Reef at Fort Kamehameha.

Family: FASCIOLARIIDAE

Genus: *Fusinus*

Fusinus sp.

1934	Spec - BPBM-MO 205567	Dredge. Catalogue XIV.
1961	Spec - BPBM-MO 218747	Off Fort Kamehameha, Station 2. Catalogue XV.

Fusinus sandvicensis ***Saverly***

1934	Spec - BPBM-MO 215733	West Lock, Dredging. Catalogue XV.
1940	Spec - BPBM-MO 249147	Dredging. Catalogue XVII.

Genus: *Fusolatirus*

Fusolatirus kuroseanus?

1961	Spec - BPBM-MO 222218	Off Fort Kamehameha. Catalogue XV.

Genus: *Peristernia*

Peristernia chlorostoma ***(Sowerby, 1825)*** ***Hawaiian name(s): kolealea.***

Unknown	Spec - BPBM-MO 204253	Catalogue XIV.
Unknown	Spec - BPBM-MO 240953	Catalogue XVII.
1923	Spec - BPBM-MO 237440	At Railroad Wharf. Catalogue XVI.
1923	Spec - BPBM-MO 237442	Near inside entrance to Pearl Harbor. Catalogue XVI.
1924	Spec - BPBM-MO 237447	At Naval Station. Catalogue XVI.
1932	Spec - BPBM-MO 198883	Fort Kamehameha. Catalogue XIV.
1932	Spec - BPBM-MO 198891	Peninsula; Railroad Wharf. Catalogue XIV.
1932	Spec - BPBM-MO 198892	End of Waipio Peninsula. Catalogue XIV.
1973	Ref - Evans et al., 1974	

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Family: MAGILIDAE

Genus: *Coralliophila*

Coralliophila d'orbignyana ***Petit***

1932 Spec - BPBM-MO 198738 Reef off Fort Kamehameha. Catalogue XIV.

1936 Spec - BPBM-MO 235759 E shore of entrance; reef at Fort Kamehameha. Catalogue XVI.

Coralliophila violacea ***Kiener, 1836***

1928 Spec - BPBM-MO 240915 Reef off Fort Kamehameha. Catalogue XVII.

1932 Spec - BPBM-MO 198753 Reef off Fort Kamehameha. Catalogue XIV.

Unidentified Coralliophila erosa

1932 Spec - BPBM-MO 198732 Reef off Fort Kamehameha. Catalogue XIV.

Family: MARGINELLIDAE

Genus: *Cystiscus*

Cystiscus sp.

1973 Ref - Evans et al., 1974

Genus: *Granula*

Granula sandwicensis ***(Pease, 1860)*** ***Hawaiian name(s): pupu `aha`aha.***

1973 Ref - Evans et al., 1974 Recorded as Kogomea sandwicensis (Pease).

Genus: *Marginella*

Marginella sp. a-1

Unknown Spec - BPBM-MO 61271 Catalogue V.

Family: MITRIDAE

Genus: *Cancilla*

Cancilla granatina ***Lamark***

1961 Spec - BPBM-MO 219301 Off Fort Kamehameha. Catalogue XV.

1961 Spec - BPBM-MO 219302 Off Fort Kamehameha. Catalogue XV.

1961 Spec - BPBM-MO 219303 Off Fort Kamehameha. Catalogue XV.

Genus: *Imbricaria*

Imbricaria punctata ***Swainson***

1961 Spec - BPBM-MO 219471 Off Fort Kamehameha. Catalogue XV.

Genus: *Mitra*

Mitra sp.

1973 Ref - Evans et al., 1974

Mitra assimilis

1932 Spec - BPBM-MO 199442 Fort Kamehameha. Catalogue XIV.

Mitra brunnea ***Pease***

1915 Spec - BPBM-MO 6 Fort Kamahameha.

Mitra litterata ***Lam., 1811***

1936 Spec - BPBM-MO 238093 E shore of entrance; reef at Fort Kamehameha. Catalogue XVI.

Mitra mitra ***Linnaeus***

1961 Spec - BPBM-MO 219381 Off Fort Kamehameha. Catalogue XV.

Mitra pellisserpentis

1932 Spec - BPBM-MO 199367 Fort Kamehameha. Catalogue XIV.

1932 Spec - BPBM-MO 199470 Fort Kamehameha, reef off. Catalogue XIV.

1936 Spec - BPBM-MO 238107 E shore of entrance; reef at Fort Kamehameha. Catalogue XVI.

Mitra ticaonica

1932 Spec - BPBM-MO 199503 Fort Kamehameha, reef off. Catalogue XIV.

Genus: *Neocancilla*

Neocancilla waikikiensis ***Pilsbry***

1961 Spec - BPBM-MO 219594 Off Fort Kamehameha. Catalogue XV.

Legacy Project - Species Report (Cont.)

Genus: ***Scabricola***

Scabricola newcombii ***Pease***

1961	Spec - BPBM-MO 219413	Off Fort Kamehameha. Catalogue XV.

Genus: ***Subcancilla***

Subcancilla flammea

1982	Spec - BPBM-MO 242714	Entrance to west. Catalogue XVII.

Genus: ***Vexillum***

Vexillum (Pusia) lautum

1932	Spec - BPBM-MO 199456	Fort Kamehameha, reef off. Catalogue XIV.

Vexillum bellum ***Pease, 1860***

1962	Spec - BPBM-MO 219200	Off Fort Kamehameha. Catalogue XV.

Vexillum filistriatum

1982	Spec - BPBM-MO 243097	Entrance to west. Catalogue XVII.

Vexillum pacificum ***Reeve***

1961	Spec - BPBM-MO 219231	Off Fort Kamehameha. Catalogue XV.
1961	Spec - BPBM-MO 219232	Off Fort Kamehameha. Catalogue XV.
1961	Spec - BPBM-MO 219233	Off Fort Kamehameha. Catalogue XV.
1961	Spec - BPBM-MO 219234	Off Fort Kamehameha. Catalogue XV.

Family: MURICIDAE

Genus: ***Aspella***

Aspella producta ***(Pease, 1861)***

1932	Spec - BPBM-MO 200760	Fort Kamehameha, reef off. Catalogue XIV.
1973	Ref - Evans et al., 1974	

Genus: ***Chicoreus***

Chicoreus insularum

1961	Spec - BPBM-MO 218423	Off Fort Kamehameha. Catalogue XV.

Genus: ***Drupella***

Drupella elata

1932	Spec - BPBM-MO 198217	Fort Kamehameha. Catalogue XIV.
1961	Spec - BPBM-MO 218493	Off Fort Kamehameha. Catalogue XV.
1961	Spec - BPBM-MO 218494	Off Fort Kamehameha. Catalogue XV.

Genus: ***Morula***

Morula sp.

1932	Spec - BPBM-MO 198193	End of Waipio Peninsula. Catalogue XIV.
1932	Spec - BPBM-MO 198194	End of Waipio Peninsula. Catalogue XIV.
1932	Spec - BPBM-MO 198196	Peninsula; Railroad Wharf. Catalogue XIV.
1932	Spec - BPBM-MO 198197	Peninsula; Railroad Wharf. Catalogue XIV.

Morula dermosa

1932	Spec - BPBM-MO 198253	Fort Kamehameha. Catalogue XIV.
1932	Spec - BPBM-MO 198254	Fort Kamehameha. Catalogue XIV.
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Morula foliacea ***Conrad***

1932	Spec - BPBM-MO 198180	Reef off Fort Kamehameha. Catalogue XIV.
1936	Spec - BPBM-MO 234727	Reefs at Fort Kamehameha. Catalogue XVI.

Morula granulata ***Duclos*** ***Hawaiian name(s): pupu maka`awa; maka`awa.***

Unknown	Spec - BPBM-MO 204188	Fort Kamehameha. Catalogue XIV. May be M. uva.
Unknown	Spec - BPBM-MO 62001	Catalogue V.
1927	Spec - BPBM-MO 234751	Naval Station. Catalogue XVI.
1927	Spec - BPBM-MO 74	Naval Station.
1932	Spec - BPBM-MO 198242	Fort Kamehameha. Catalogue XIV. May be M. uva.
1932	Spec - BPBM-MO 198243	Fort Kamehameha. Catalogue XIV. May be M. uva.
1932	Spec - BPBM-MO 198300	End of Waipio Peninsula. Catalogue XIV.

1932 Spec - BPBM-MO 198301 End of Waipio Peninsula. Catalogue XIV.

Morula mitosa? ***Dall***

1927 Spec - BPBM-MO 73 Naval Station.

Morula spinosa

1932 Spec - BPBM-MO 198280 Fort Kamehameha. Catalogue XIV.

Morula uva ***Roding***

1949 Spec - BPBM-MO 234787 E shore of entrance; reef at Fort Kamehameha. Catalogue XVI.

Morula vexilla

1961 Spec - BPBM-MO 222217 Off Fort Kamehameha. Catalogue XV.

Genus: *Murex*

Murex sandwichensis ***Pease***

1932 Spec - BPBM-MO 198399 Fort Kamehameha, reef off. Catalogue XIV.

Genus: *Vitularia*

Vitularia miliaris ***Gmelin, 1791*** ***Cryptogenic.***

1916 Spec - BPBM-MO 234532 Reef Waikiki of entrance to Pearl Harbor. Catalogue XVI.

1936 Spec - BPBM-MO 234537 E shore of entrance; reef at Fort Kamehameha. Catalogue XVI.

1950 Ref - Burgess, 1963 Recorded as Vitularia milaris.

Family: NASSARIIDAE

Genus: *Nassarius*

Nassarius crematus

1961 Spec - BPBM-MO 220604 Off Fort Kamehameha. Catalogue XV.

1961 Spec - BPBM-MO 220605 Off Fort Kamehameha. Catalogue XV.

1961 Spec - BPBM-MO 220606 Off Fort Kamehameha. Catalogue XV.

Family: NEPTUNEIDAE

Genus: *Caducifer*

Caducifer decapitata ***Reeve***

1936 Spec - BPBM-MO 235879 E shore of entrance; reef at Fort Kamehameha. Catalogue XVI.

Caducifer decapitata hawaiiensis ***Dall***

1932 Spec - BPBM-MO 200762 Fort Kamehameha, reef off. Catalogue XIV.

Family: PYRAMIDELLIDAE

Genus: *Evalea*

Evalea peasei ***Dautzenberg & Bouge, 1933 Hawaiian name(s): pupu po`ai.***

1973 Ref - Evans et al., 1974 Recorded as Odostomia eclecta Pilsbry.

Genus: *Herviera*

Herviera patricia ***Pilsbry, 1918***

1973 Ref - Evans et al., 1974 Recorded as Odostomia patricia Pilsbry.

Genus: *Hinemoa*

Hinemoa indica ***(Melvill, 1896) Cryptogenic.***

1973 Ref - Evans et al., 1974 Recorded as Odostomia indica Melvill.

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Genus: *Miralda*

Miralda paulbartschi ***Pilsbry, 1918***

1973 Ref - Evans et al., 1974 Recorded as Odostomia paulbartschi Pilsbry.

Miralda scopulorum ***Watson, 1886***

1973 Ref - Evans et al., 1974 Recorded as Odostomia scopulorum Watson.

Genus: *Odostomia*

Odostomia sp.

1943 Spec - BPBM-MO 11 From Railroad Wharf, Peninsula.

1973 Ref - Evans et al., 1974

Odostomia stearnsiella ***Pilsbry, 1918***

1973 Ref - Evans et al., 1974

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Genus: *Pyramidella*

Pyramidella sp.

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Pyramidella dolabrata

1961 Spec - BPBM-MO 220403 Off Fort Kamehameha. Catalogue XV.

Pyramidella miralis hawaiiensis Dall

1932 Spec - BPBM-MO 200124 Fort Kamehameha, reef. Catalogue XIV.

Pyramidella nitida A. Adams

Unknown Spec - BPBM-MO 64185 Ford Island. Catalogue V.

Pyramidella oahuanus Pils

1932 Spec - BPBM-MO 200126 Fort Kamehameha, reef. Catalogue XIV.

Pyramidella sulcata A. Adams, 1859 Hawaiian name(s): pupu `ole.

1915 Spec - BPBM-MO 64201 Catalogue V.

1961 Spec - BPBM-MO 220435 Off Fort Kamehameha. Catalogue XV.

Genus: *Pyrgulina*

Pyrgulina oodes (Watson, 1886) Cryptogenic.

1973 Ref - Evans et al., 1974 Recorded as Odostomia oodes Watson.

1996 This Project

Genus: *Turbonilla*

Turbonilla sp.

1973 Ref - Evans et al., 1974

Family: TEREBRIDAE

Unidentified Terebridae

1961 Spec - BPBM-MO 222351 Off Fort Kamehameha. Catalogue XV.

1961 Spec - BPBM-MO 222352 Off Fort Kamehameha. Catalogue XV.

1961 Spec - BPBM-MO 222353 Off Fort Kamehameha. Catalogue XV.

1982 Spec - BPBM-MO 246144 Entrance to west. Catalogue XVII.

Genus: *Hastula*

Hastula matheroniana Desh

1961 Spec - BPBM-MO 219838 Off Fort Kamehameha. Catalogue XV.

Hastula nitida Hinds

1961 Spec - BPBM-MO 220973 Off Fort Kamehameha. Catalogue XV.

1961 Spec - BPBM-MO 221008 Off Fort Kamehameha. Catalogue XV.

Hastula penicillata Hinds

1961 Spec - BPBM-MO 220950 Off Fort Kamehameha. Catalogue XV.

Genus: *Terebra* ***Hawaiian name(s): loloa; `oi `oi.***

Duplicaria gouldi Deshayes

1915 Spec - BPBM-MO 54 Off entrance, M. 5, l. 1.

1961 Spec - BPBM-MO 219771 Off Fort Kamehameha. Catalogue XV.

1961 Spec - BPBM-MO 219772 Off Fort Kamehameha. Catalogue XV.

1961 Spec - BPBM-MO 219773 Off Fort Kamehameha. Catalogue XV.

Terebra sp.

1932 Spec - BPBM-MO 199570 Fort Kamehameha, reef off. Catalogue XIV.

Terebra achates Dall

1932 Spec - BPBM-MO 199574 Catalogue XIV.

Terebra amoena

1961 Spec - BPBM-MO 222344 Off Fort Kamehameha. Catalogue XV.

Terebra cerithina Lam.

1961 Spec - BPBM-MO 220041 Off Fort Kamehameha. Catalogue XV.

Legacy Project - Species Report (Cont.)

Terebra cerithina? ***Lam.***

1991 Spec - BPBM-MO 246085 Fort Kamehameha south end housing area. Catalogue XVII.

Terebra columellaris ***Hinds***

1961 Spec - BPBM-MO 219725 Off Fort Kamehameha. Catalogue XV.

1961 Spec - BPBM-MO 221205 Off Fort Kamehameha. Catalogue XV.

1961 Spec - BPBM-MO 222330 Off Fort Kamehameha. Catalogue XV.

Terebra funiculata ***Hind***

1915 Spec - BPBM-MO 19 Dredged off entrance to Pearl Harbor, Map 35, loc. 1.

1961 Spec - BPBM-MO 219728 Off Fort Kamehameha. Catalogue XV.

Terebra lanta ***Pease***

1915 Spec - BPBM-MO 9 Dredged off entrance to Pearl Harbor, Map 34, loc. 1.

Terebra maculata ***Linnaeus*** ***Hawaiian name(s): pupu `ole.***

1961 Spec - BPBM-MO 219863 Off Fort Kamehameha. Catalogue XV.

1961 Spec - BPBM-MO 219864 Off Fort Kamehameha. Catalogue XV.

Terebra pertusa ***Born***

1917 Spec - BPBM-MO 29 Off Pearl Harbor.

Terebra plumbea ***Quoy***

1915 Spec - BPBM-MO 7 Dredged off entrance to Pearl Harbor, Map 35, loc. 1.

Family: THAIDIDAE

Genus: *Muricodrupa*

Muricodrupa funiculus ***Wood***

Unknown Spec - BPBM-MO 234516 Catalogue XVI.

Genus: *Nassa*

Nassa sp.

1934 Spec - BPBM-MO 205582 Dredge. Catalogue XIV.

Nassa serta

1932 Spec - BPBM-MO 198407 Fort Kamehameha, reef off. Catalogue XIV.

Genus: *Pinaxia*

Pinaxia versicolor ***Gray***

1936 Spec - BPBM-MO 234832 E shore of entrance; reef at Fort Kamehameha. Catalogue XVI.

Genus: *Vexilla*

Vexilla sp.

1932 Spec - BPBM-MO 198326 Fort Kamehameha, reef off. Catalogue XIV.

Family: TURRIDAE

Unidentified Turridae

1973 Ref - Evans et al., 1974

Genus: *Anacithara*

Anacithara perfecta

Unknown Spec - BPBM-MO 9817 Honouliuli, West Loch. Catalogue I.

Genus: *Carinapex*

Carinapex sp.

1973 Ref - Evans et al., 1974

Genus: *Cymatosyrinx*

Cymatosyrinx mighelsi ***Dall***

Unknown Spec - BPBM-MO 65654 Catalogue V.

Genus: *Etrema*

Etrema sp.?

1961 Spec - BPBM-MO 220816 Off Fort Kamehameha. Catalogue XV.

Genus: *Gemmula*

Gemmula interpolata ***Powell***

1961 Spec - BPBM-MO 220825 Off Fort Kamehameha. Catalogue XV.

Gemmula monilifera ***Pease***

1961 Spec - BPBM-MO 220764 Off Fort Kamehameha. Catalogue XV.

Genus: ***Kermia***

Kermia sp.

1996 This Project

Genus: ***Lora***

Lora sp. a-7

Unknown Spec - BPBM-MO 61097 Catalogue V.

Genus: ***Philbertia***

Philbertia katharia ***Dall***

Unknown Spec - BPBM-MO 65696 Catalogue V.

Philbertia lutea ***Pease***

Unknown Spec - BPBM-MO 65697 Catalogue V.

Genus: ***Turris***

Turris crispa intricata

1961 Spec - BPBM-MO 220826 Off Fort Kamehameha. Catalogue XV.

Order: CEPHALASPIDEA

Family: ACTEONIDAE

Genus: ***Pupa***

Pupa alveola ***Souverbie***

1938 Spec - BPBM-MO 12 Fossil near Yacht Club.

Pupa tessellata

1961 Spec - BPBM-MO 220460 Off Fort Kamehameha. Catalogue XV.

Family: ATYIDAE

Genus: ***Haminea***

Haminoea galba ***Pease***

1936 Spec - BPBM-MO 13 Fossil near Yacht Club.

Family: BULLIDAE

Genus: ***Bulla***

Bulla vernicosa ***Hawaiian name(s): pupu waha loa.***

1961 Spec - BPBM-MO 220487 Off Fort Kamehameha. Catalogue XV.

1961 Spec - BPBM-MO 220488 Off Fort Kamehameha. Catalogue XV.

1996 This Project

Family: HAMINOEIDAE

Genus: ***Atys***

Atys kuhnsi

1996 This Project

Atys kuhnsi?

1961 Spec - BPBM-MO 220543 Off Fort Kamehameha. Catalogue XV.

Atys semistriata ***Pease, 1860***

1921 Ref - Pilsbry, 1921 Recorded as Atys semistriata fordinsulae.

Family: HYDATINIDAE

Genus: ***Hydatina***

Hydatina amplustre ***Hawaiian name(s): pupu leholeho oni`oni`o; pupu lei hala.***

1961 Spec - BPBM-MO 220478 Off Fort Kamehameha. Catalogue XV.

Order: BASOMMATOPHORA

Family: ELLOBIIDAE

Genus: ***Melampus***

Melampus castaneus ***Montfort*** ***Hawaiian name(s): `aoa.***

1923 Spec - BPBM-MO 1 Near Railroad Wharf.

Legacy Project - Species Report (Cont.)

Family: SIPHONARIIDAE

Genus: *Siphonaria*

Siphonaria normalis ***Gould, 1846*** ***Hawaiian name(s): `opihi awa; `opihi maikauli.***

Unknown	Spec - BPBM-MO 60569	Catalogue V.
1973	Ref - Evans et al., 1974	
1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
1996	This Project	

Genus: *Williamia*

Williamia cf. radiata sp. ***(Pease, 1861)*** ***New record for Pearl Harbor.***

1996	This Project	

Order: SACOGLOSSA

Family: CALIPHYLLIDAE

Genus: *Cyerce*

Cyerce elegans ***New record for Pearl Harbor.***

1996	This Project	

Family: JULIIDAE

Genus: *Julia*

Julia exquisita ***Gould, 1862***

1973	Ref - Evans et al., 1974	Off Pearl Harbor.

Order: NOTASPIDEA

Family: UMBRACULIDAE

Genus: *Umbraculum*

Umbraculum sp.

1996	This Project	

Umbraculum sinicum

1932	Spec - BPBM-MO 200038	Pearl Harbor channel. Catalogue XIV.
1932	Spec - BPBM-MO 200039	Fort Kamehameha, reef. Catalogue XIV.

Order: NUDIBRANCHIA

Unidentified Nudibranchia

1996	This Project	

Family: DENDRODORIDIDAE

Genus: *Dendrodoris*

Dendrodoris nigra ***(Stimpson, 1856)***

1975	Ref - Grovhoug, 1976	

Family: TETHYIDAE

Genus: *Tethya*

Tethya sp.

1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	

Tethya dipoderma ***Schmidt, 1870***

1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	

Order: CRYPTOBRANCHIA

Family: DORIDIDAE

Genus: *Hypselodoris*

Hypselodoris infucata ***New record for Pearl Harbor.***

1996	This Project	

Family: HEXABRANCHIDAE

Genus: *Hexabranchus*

Hexabranchus sanguineu	1949	Spec - BPBM-MO 209630	Found at Pearl Harbor (#15). Catalogue XIV.

1949	Spec - BPBM-MO 209631	(#16). Catalogue XIV.
1949	Spec - BPBM-MO 209632	From open shore (#17). Catalogue XIV.
1950	Spec - BPBM-MO 209633	(#18). Catalogue XIV.
1950	Spec - BPBM-MO 209634	(#19). Catalogue XIV.
1950	Spec - BPBM-MO 209636	Probably Pearl Harbor (#21). Catalogue XIV.

Order: ARCHAEOPULMONATA

Family: MELAMPODIDAE

Genus: *Allochroa*

Allochroa bronni

Unknown	Spec - BPBM-MO 10998	Catalogue II.
Unknown	Spec - BPBM-MO 64832	Hoaiai. Catalogue V.

Genus: *Laemodonta*

Laemodonta octanfracta

Unknown	Spec - BPBM-MO 64874	Hoaiai. Catalogue V.
Unknown	Spec - BPBM-MO 64875	Hoaiai. Catalogue V.
1915	Spec - BPBM-MO 14	Ford Island.
1915	Spec - BPBM-MO 16	Ford Island.
1923	Spec - BPBM-MO 15	Under rocks near Railroad Wharf, opposite Ford Island.
1923	Spec - BPBM-MO 17	Near Railroad Wharf, opposite Ford Island.
1923	Spec - BPBM-MO 67478	Pearl City Peninsula. Catalogue V.
1932	Spec - BPBM-MO 199237	Fort Kamehameha, shore at. Catalogue XIV.
1932	Spec - BPBM-MO 199238	Peninsula; along shore at Cobb's place. Catalogue XIV.
1932	Spec - BPBM-MO 199241	Pearl City Peninsula, near Railroad Wharf, along shore at Cobb's place. Catalogue XIV.
1932	Spec - BPBM-MO 199242	Eastern side of Peninsula, Fish Pond wall. Catalogue XIV.

Genus: *Plectotrema*

Plectotrema sp.

1932	Spec - BPBM-MO 199243	Eastern side of Peninsula, Fish Pond wall. Catalogue XIV.

Class: POLYPLACOPHORA

Order: ISCHNOCHITONIDA

Family: ISCHNOCHITONIDAE

Genus: *Ischnochiton*

Ischnochiton petaloides ***Gould*** ***Hawaiian name(s): pupu mo`o.***

Unknown	Spec - BPBM-MO 64604	Ford Island. Catalogue V.
1931	Spec - BPBM-MO 78	
1932	Spec - BPBM-MO 199796	Peninsula, Railroad Wharf. Catalogue XIV.

Family: MOPALIIDAE

Genus: *Plaxiphora*

Plaxiphora kamehamehae ***Ferreira & Bertsch, 1979***

1977	Spec - BPBM-MO 207066	Fort Kamehameha Beach. Catalogue XIV.

Order: ACANTHOCHITONIDA

Family: ACANTHOCHITONIDAE

Genus: *Acanthochiton*

Acanthochiton viridis ***Pease*** ***Hawaiian name(s): kuakulu; kuapa`a; pe`elua; pupu pe`elua.***

Unknown	Spec - BPBM-MO 64598	Ford Island. Catalogue V.
Unknown	Spec - BPBM-MO 64600	Ford Island. Catalogue V.
Unknown	Spec - BPBM-MO 64601	Ford Island. Catalogue V.
Unknown	Spec - BPBM-MO 64783	Ford Island. Catalogue V.

Class: BIVALVIA

Unidentified Bivalvia

1996	This Project	

Family: EURYCYNIDAE

Unidentified Eurycynidae

1996	This Project	

Legacy Project - Species Report (Cont.)

Order: ARCOIDA

Family: ANOMIIDAE

Genus: *Anomia*

Anomia nobilis ***Reeve, 1856*** ***Cryptogenic. Hawaiian name(s): pa; papaua.***

Unknown	Spec - BPBM-MO 60317	Ford Island. Catalogue V.
1912	Spec - BPBM-MO 68170	(Pliocene). Catalogue V.
1915	Spec - BPBM-MO 20	Map 35, l.2.
1915	Ref - Bryan, 1915	
1919	Spec - BPBM-MO 60319	Drydock. Catalogue V.
1923	Spec - BPBM-MO 30	At Railroad Wharf opposite Ford Island, Peninsula.
1923	Spec - BPBM-MO 67480	Railroad Wharf, Pearl City Peninsula. Catalogue V.
1932	Spec - BPBM-MO 200174	Pearl City Peninsula, end. Catalogue XIV.
1932	Spec - BPBM-MO 200175	Pearl Harbor Channel; Watertown. Catalogue XIV.
1932	Spec - BPBM-MO 201515	Pearl City Peninsula, Railroad Wharf. Catalogue XIV.
1935	Ref - Edmondson, 1944	
1936	Ref - Edmondson & Ingram, 1939	
1938	Ref - Dall et al., 1938	USNM 337552.
1938	Ref - Dall et al., 1938	USNM 321285.
1938	Ref - Dall et al., 1938	USNM 337554.
1947	Spec - BPBM-MO 46	Bottom of barge in dry dock..
1948	Spec - BPBM-MO 40	Motile dry dock in Dry Dock #2..
1948	Spec - BPBM-MO 48	Bottom of steel barge..
1972	Ref - Long, 1974	
1973	Ref - Evans et al., 1974	
1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	
1978	Ref - Grovhoug, 1979	
1985	Ref - Hurlbut, 1990	
1986	Ref - Lenihan, 1990	
1987	Ref - Brewer & Assoc., 1987	
1996	This Project	

Family: ARCIDAE

Genus: *Arca* ***Hawaiian name(s): kupukele.***

Arca sp.

1973	Ref - Evans et al., 1974	

Arca sp. a-3

Unknown	Spec - BPBM-MO 60151	Catalogue V.

Arca antiguata ***Fossil.***

1923	Spec - BPBM-MO 21	Near Ford Island Wharf in short bluffs.
1938	Ref - Dall et al., 1938	Recorded as Arca vetula. USNM 36158.

Genus: *Barbatia*

Barbatia sp.

1982	Spec - BPBM-MO 207410	Off Pearl Harbor. Catalogue XIV.

Barbatia divaricata ***Sowerby, 1833***

1959	Spec - BPBM-MO 218776	Off Fort Kamehameha. Catalogue XV.

Barbatia foliata ***Forskal, 1775*** ***Fossil.***

1938	Ref - Dall et al., 1938	Recorded as Barbatia hendersoni. BPBM 351286.
1950	Spec - BPBM-MO 250728	Ship bottom (with Mytilidae). Catalogue XVII.

Barbatia nuttingi ***(Dall Bartsch & Rehder, 1938)*** ***Indigenous.***

1973	Ref - Evans et al., 1974	

Barbatia tenella

1938	Ref - Dall et al., 1938	Off Pearl Harbor. Recorded as Calloarca hua. USNM 427760.

Legacy Project - Species Report (Cont.)

Genus: ***Bentharca***

Bentharca asperula ***Dall***

1959	Spec - BPBM-MO 221099	Off Pearl Harbor. Catalogue XV.

Family: GLYCYMERIDIDAE

Genus: ***Glycymeris***

Glycymeris molokaia ***D.B.R.***

1961	Spec - BPBM-MO 218786	Off Fort Kamehameha. Catalogue XV.

Family: GRYPHAEIDAE

Genus: ***Hyotissa***

Hyotissa hyotis ***Linnaeus, 1758 Introduced.***

1950	Ref - Paulay, 1996	USNM 700474.
1950	Ref - Paulay, 1996	USNM 699996.

Genus: ***Parahyotissa***

Parahyotissa numisma ***(Lamarck, 1819) Indigenous.***

Unknown	Spec - BPBM-MO 60242	Catalogue V.
1902	Ref - Dall et al., 1938	Recorded as O. thaanami Dall et al., 1938. USNM 335600.
1932	Spec - BPBM-MO 200507	Fort Kamehameha, reef off. Catalogue XIV.
1935	Ref - Ingram, 1937	Recorded as O. thaanumi.
1973	Ref - Evans et al., 1974	Recorded as Ostrea hanleyana.

Family: ISOGNOMONIDAE

Genus: ***Isognomon***

Isognomon sp.

1934	Spec - BPBM-MO 205583	Dredge. Catalogue XIV.
1973	Ref - Evans et al., 1974	
1979	Ref - AECOS, 1979	Off Pearl Harbor.
1986	Ref - Lenihan, 1990	

Isognomon sp. m-2

Unknown	Spec - BPBM-MO 60199	Catalogue V.

Isognomon anomioides ***Reeve***

1932	Spec - BPBM-MO 200513	Fort Kamehameha. Catalogue XIV.

Isognomon incisum ***Conrad***

Unknown	Spec - BPBM-MO 203996	Fort Kamehameha. Catalogue XIV.
Unknown	Spec - BPBM-MO 60162	Catalogue V.
1936	Spec - BPBM-MO 22	Reef at Fort Kamahameha.
1949	Spec - BPBM-MO 23	Reef at Fort Kamahameha.

Isognomon legumen ***New record for Pearl Harbor.***

1996	This Project	

Isognomon perna ***(Linnaeus, 1767) Hawaiian name(s): nahawele.***

Unknown	Spec - BPBM-MO 60176	Catalogue V.
1920	Ref - Dall et al., 1938	Recorded as Isognomon costellatum. USNM 428275.
1920	Ref - Dall et al., 1938	Recorded as Isognomon costellatum. USNM 337484.
1973	Ref - Evans et al., 1974	

Family: LIMIDAE

Genus: ***Lima***

Lima aperta ***Sowerby***

1932	Spec - BPBM-MO 200194	Fort Kamehameha; along edge of channel. Catalogue XIV. Questionable ID.

Family: MALLEIDAE

Genus: ***Malleus***

Malleus daemonicus? ***Reeve, 1858***

1950	Spec - BPBM-MO 250727	Ship bottom. Catalogue XVII.

Malleus regula ***(Forsskal, 1775)***

1943	Ref - Hutchins, 1949	Recorded as Malleus nuttalli.

Legacy Project - Species Report (Cont.)

Family: MYTILIDAE

Unidentified Mytilidae

1950	Spec - BPBM-MO 250729	Ship bottom (with BPBM 250728). Catalogue XVII.

Genus: *Brachidontes*

Brachidontes crebristriatus ***(Conrad, 1837)*** ***Indigenous. Hawaiian name(s): `owa`owaka; nahawelepahikaua;***

Unknown	Spec - BPBM-MO 60320	Catalogue V.
1902	Ref - Dall et al., 1938	USNM 335839.
1920	Ref - Dall et al., 1938	USNM 428391.
1921	Ref - Pilsbry, 1921	Recorded as Mytilus crebristiatus.
1923	Spec - BPBM-MO 196317	Peninsula; Railroad Wharf. Catalogue XIV.
1938	Ref - Dall et al., 1938	BPBM 159.
1938	Ref - Dall et al., 1938	USNM 337445.
1973	Ref - Evans et al., 1974	Recorded as Hormomya crebristriatus (Conrad).
1996	This Project	

Brachidontes crebristriatus ***(Pilsbry, 1921)***

1920	Ref - Dall et al., 1938	USNM 428270.

Genus: *Lithophaga*

Lithophaga fasciola ***New record for Pearl Harbor.***

1996	This Project	

Genus: *Musculus*

Musculus oahuensis ***Dall Bartsch & Rehder, 1938***

1920	Ref - Dall et al., 1938	USNM 484181.

Genus: *Septifer*

Septifer bryanae ***Pilsbry, 1921***

1972	Ref - Long, 1974	Off Pearl Harbor.

Family: OSTREIDAE

Unidentified Ostreidae

1996	This Project	

Genus: *Crassostrea*

Crassostrea sp.

1996	This Project	

Crassostrea gigas ***(Thunberg, 1793)*** ***Introduced.***

1938	Ref - Brock, 1960	
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	

Crassostrea retusa ***Sowerby*** ***Fossil.***

1899	Spec - BPBM-MO 67990	1/4 mile E. of Waipio Station in Railway cut near Pearl Harbor 30ft. above Tide.. Catalogue V.
1912	Spec - BPBM-MO 68168	(Pliocene). Catalogue V.
1923	Spec - BPBM-MO 67483	Shore. Eastside of Waipio Peninsula. Catalogue V.
1932	Spec - BPBM-MO 200301	Waipio Peninsula. Catalogue XIV.

Crassostrea virginica ***(Gmelin, 1791)*** ***Introduced.***

Unknown	Spec - BPBM-MO 50	
1866	Ref - Kay, 1979	
1893	Ref - Kay, 1979	
1920	Ref - Edmondson & Wilson, 1940	
1962	Ref - Sparks, 1963	
1964	Ref - Sakuda, 1964	
1965	Ref - Rifkin & Cheng, 1968	
1972	Ref - Kawamoto & Sakuda, 1973	
1973	Ref - Evans et al., 1974	
1987	Ref - AECOS, 1987	
1987	Ref - Brewer & Assoc., 1987	

1996	This Project	

Genus: *Dendrostrea*

Dendrostrea sandvichensis ***Sowerby, 1871*** ***Cryptogenic.***

Unknown	Spec - BPBM-MO 60225	Catalogue V.
Unknown	Spec - BPBM-MO 60226	Catalogue V.
Unknown	Spec - BPBM-MO 60228	Catalogue V.
Unknown	Spec - BPBM-MO 60231	Catalogue V.
1902	Ref - Dall et al., 1938	Recorded as O. kupua Dall et al., 1938. USNM 335586.
1902	Ref - Dall et al., 1938	Recorded as Ostrea sandvichensis. USNM 335584.
1912	Spec - BPBM-MO 68169	(Pliocene). Catalogue V.
1915	Spec - BPBM-MO 31	Ford Island.
1915	Ref - Bryan, 1915	Recorded as O. rosacea.
1920	Ref - Dall et al., 1938	Recorded as O. kupua Dall et al., 1938. USNM 321289.
1920	Ref - Dall et al., 1938	Recorded as O. kupua Dall et al., 1938. USNM 321284.
1920	Ref - Dall et al., 1938	Recorded as O. kupua Dall et al., 1938. USNM 484156.
1921	Ref - Pilsbry, 1921	Recorded as Ostrea sandvichensis. MCZ 31714.
1921	Ref - Pilsbry, 1921	Recorded as Ostrea sandvichensis.
1923	Spec - BPBM-MO 32	At Railroar Wharf opposite Ford Island, Peninsula.
1932	Spec - BPBM-MO 200209	Pearl City Peninsula, East side. Catalogue XIV.
1932	Spec - BPBM-MO 200508	Peninsula, Railroad Wharf. Catalogue XIV.
1935	Ref - Edmondson, 1944	Recorded as Ostrea sandvichensis.
1936	Ref - Edmondson & Ingram, 1939	Recorded as Ostrea sandvichensis.
1938	Ref - Dall et al., 1938	Recorded as Ostrea sandvichensis. USNM 337472.
1938	Ref - Dall et al., 1938	Recorded as O. kupua Dall et al., 1938. BPBM 60225.
1972	Ref - Long, 1974	Recorded as O. sandvichensis var. thaanumi.
1973	Ref - Evans et al., 1974	Recorded as Ostrea sandvichensis.
1987	Ref - Brewer & Assoc., 1987	Recorded as Ostrea sandvichensis.
1993	Ref - Brock, 1994	Recorded as Ostrea sandvichensis.
1994	Ref - Brock, 1995	Recorded as Ostrea sandvichensis.
1996	This Project	

Genus: *Lopha*

Lopha cristigalli ***(Linnaeus, 1758)*** ***Introduced.***

1951	Ref - Paulay, 1996	USNM 699998.

Genus: *Nanostrea*

Nanostrea exigua ***Harry, 1985***

1985	Ref - Harry, 1985	
1996	Ref - Paulay, 1996	USNM 337556.

Genus: *Ostrea*

Ostrea sp.

1923	Spec - BPBM-MO 241135	Pearl City Peninsula, Railroad Wharf. Catalogue XVII.
1932	Spec - BPBM-MO 198727	Naval Station, Hospital Point. Catalogue XIV.
1932	Spec - BPBM-MO 200186	Peninsula; Railroad Wharf. Catalogue XIV.
1932	Spec - BPBM-MO 201517	Pearl City Peninsula, Railroad Wharf. Catalogue XIV.
1950	Spec - BPBM-MO 57	Pahu, Ship bottom..
1950	Spec - BPBM-MO 58	
1972	Ref - Long, 1974	Recorded as Ostrea frons.
1973	Ref - Evans et al., 1974	
1986	Ref - Lenihan, 1990	
1996	This Project	

Ostrea lima ***Sowerby, 1871*** ***Indigenous.***

1972	Ref - Long, 1974	Recorded as O. kavaia Dall et al., 1938.

Ostrea margaritae ***Dall***

Unknown	Spec - BPBM-MO 65691	Catalogue V.

Genus: ***Saccostrea***

Saccostrea cucullata ***New record for Pearl Harbor.***

1996	This Project	

Family: PECTINIDAE

Genus: ***Anguipecten***

Anguipecten lamberti ***Sowerby***

1961	Spec - BPBM-MO 218856	Off Fort Kamehameha. Catalogue XV. Questionable ID.

Genus: ***Chlamys***

Chlamys sp.

1934	Spec - BPBM-MO 205571	Dredge. Catalogue XIV.
1934	Spec - BPBM-MO 205572	Dredge. Catalogue XIV.

Genus: ***Laevichlamys***

Laevichlamys irregularis ***Sowerby Indigenous.***

Unknown	Spec - BPBM-MO 60247	Catalogue V.
1923	Spec - BPBM-MO 39	Ford Island Wharf on Penisula.
1927	Spec - BPBM-MO 196278	Pearl Harbor channel, at Watertown. Catalogue XIV.
1961	Spec - BPBM-MO 218823	Off Fort Kamehameha. Catalogue XV.
1961	Spec - BPBM-MO 218824	Off Fort Kamehameha. Catalogue XV.

Genus: ***Pecten***

Pecten n. sp. p-4

Unknown	Spec - BPBM-MO 60291	Ford Island. Catalogue V. Questionable ID.

Pecten n. sp. p-5

Unknown	Spec - BPBM-MO 60292	Catalogue V. Questionable ID.

Family: PINNIDAE

Genus: ***Pinna***

Pinna sp.

1973	Ref - Evans et al., 1974	

Pinna muricata ***Linnaeus, 1758***

1972	Ref - Long, 1974	Off Pearl Harbor.

Family: PTERIIDAE

Genus: ***Pinctada***

Pinctada sp.

Unknown	Spec - BPBM-MO 45	

Pinctada cumingi ***Reeve***

1923	Spec - BPBM-MO 196332	End of Wipio Peninsula. Catalogue XIV. Questionable ID.
1927	Spec - BPBM-MO 196322	Reef off Fort Kamehameha, shallow water, in hole in reef. Catalogue XIV. Questionable ID.

Pinctada margaritifera ***(Linnaeus, 1758) Common name(s): mother-of-pearl shell; Hawaiian name(s): pa;***

1915	Ref - Bryan, 1915	Recorded as Avicula margaritifera.
1926	Spec - BPBM-MO 208454	Shore, rocks east of Mokapu. Catalogue XIV.
1936	Spec - BPBM-MO 24	Reef at Fort Kamahameha.
1972	Ref - Long, 1974	Off Pearl Harbor.
1973	Ref - Evans et al., 1974	
1996	This Project	

Pinctada radiata ***(Leach, 1814) Indigenous. Hawaiian name(s): unahi pipi; pipi.***

Unknown	Spec - BPBM-MO 203988	Catalogue XIV.
Unknown	Spec - BPBM-MO 203989	Catalogue XIV.
Unknown	Spec - BPBM-MO 60216	Catalogue V.
Unknown	Spec - BPBM-MO 67565	Catalogue V.
1915	Spec - BPBM-MO 25	
1915	Ref - Bryan, 1915	Recorded as Margaritifera fimbriata.
1917	Spec - BPBM-MO 60222	Catalogue V.
1923	Spec - BPBM-MO 196320	Waipio Peninsula, extreme seaward end. Catalogue XIV.

1923	Spec - BPBM-MO 26	At Railroad Wharf, Ford Island, Peninsula..
1924	Spec - BPBM-MO 67482	Railroad Wharf, Pearl City Peninsula. Catalogue V.
1936	Ref - Edmondson & Ingram, 1939	Recorded as P. nebulosa.
1938	Ref - Dall et al., 1938	Recorded as P. nebulosa (Conrad, 1837). USNM 337475.
1938	Ref - Dall et al., 1938	Recorded as P. nebulosa (Conrad, 1837). BPBM 9.
1939	Ref - Dall et al., 1938	Recorded as P. nebulosa (Conrad, 1837). USNM 382878.
1996	This Project	

Genus: *Pteria*

Pteria loveni ***(Dunker, 1872)***

1972	Ref - Long, 1974	Off Pearl Harbor. Questionable ID.

Family: SPONDYLIDAE

Genus: *Spondylus*

Spondylus sp.

1950	Spec - BPBM-MO 250726	Ship bottom. Catalogue XVII.
1950	Spec - BPBM-MO 53	Bottom of YOC-41 in Dry Dock #2..
1973	Ref - Evans et al., 1974	

Spondylus sp.?

1950	Spec - BPBM-MO 49	

Spondylus linguaefelis ***Sowerby***

1972	Ref - Long, 1974	Off Pearl Harbor. Recorded as Spondylus gloriosis.

Spondylus linguaefelis? ***Sowerby***

1961	Spec - BPBM-MO 221073	Off Fort Kamehameha. Catalogue XV.

Spondylus sparsispinosus

1918	Spec - BPBM-MO 28	

Spondylus violacescens ***Reeve, 1856 Hawaiian name(s): `okupe; pupu momi.***

Unknown	Spec - BPBM-MO 60310	Catalogue V.
1932	Spec - BPBM-MO 200223	Fort Kamehameha; along edge of channel. Catalogue XIV.
1973	Ref - Evans et al., 1974	Recorded as Spondylus hawaiensis Dall et al., 1938.
1993	Ref - Brock, 1994	Recorded as Spondylus tenebrosus.
1994	Ref - Brock, 1995	Recorded as Spondylus tenebrosus.

Order: VENEROIDA

Family: CARDIIDAE

Genus: *Trachycardium*

Trachycardium orbita ***Sowerby, 1833 Hawaiian name(s): `olepe kupa; pupu kupa.***

1920	Ref - Dall et al., 1938	Recorded as T. hawaiiensis. USNM 346229.
1932	Spec - BPBM-MO 200248	Pearl Harbor Channel; Watertown. Catalogue XIV.

Family: CHAMIDAE

Genus: *Chama*

Chama sp.

1973	Ref - Evans et al., 1974	
1996	This Project	

Chama brassica ***Reeve, 1847 Introduced.***

1951	Ref - Paulay, 1996	USNM 700006.

Chama elatensis ***Delsaerdt, 1986 New record for Pearl Harbor. Introduced.***

1996	This Project	

Chama fibula ***Reeve, 1846 Introduced.***

1920	Ref - Dall et al., 1938	Recorded as C. hendersoni. USNM 341296.
1920	Ref - Dall et al., 1938	Recorded as C. hendersoni. USNM 484174.
1935	Spec - BPBM-MO 35	Near Yacht Club.
1979	Ref - Kay, 1979	
1996	This Project	

Chama iostoma ***Conrad, 1837***

Unknown	Spec - BPBM-MO 60395	Catalogue V.
1920	Ref - Dall et al., 1938	USNM 484173.
1923	Spec - BPBM-MO 36	Near entrance.

Chama lazarus ***Linnaeus, 1758 Introduced.***

1950	Ref - Paulay, 1996	USNM 699558.
1996	This Project	

Chama pacifica ***Brodrip, 1835 Introduced.***

1950	Ref - Paulay, 1996	USNM 699565.
1950	Ref - Paulay, 1996	USNM 699561.
1950	Ref - Paulay, 1996	USNM 699558.
1951	Ref - Paulay, 1996	USNM 699563.
1996	This Project	

Family: GLOSSIDAE

Genus: *Meiocardia*

Meiocardia hawaiana ***D.B.R.***

1961	Spec - BPBM-MO 218932	Off Fort Kamehameha. Catalogue XV.

Family: KELLIIDAE

Genus: *Lasaea*

Lasaea hawaiensis ***Dall Bartsch & Rehder, 1938***

1923	Spec - BPBM-MO 240097	Crevices in shore rocks, Peninsula. Catalogue XVI.
1923	Ref - Dall et al., 1938	Recorded as Lasaea hawaiiensis. BPBM 3.

Family: LUCINIDAE

Genus: *Anodontia*

Anodontia edentula ***Linnaeus***

1961	Spec - BPBM-MO 218798	Off Fort Kamehameha. Catalogue XV.

Genus: *Ctena* ***Hawaiian name(s): `olepe kupe.***

Ctena sp.

1934	Spec - BPBM-MO 205589	Dredge. Catalogue XIV.

Ctena bella ***(Conrad, 1837) Hawaiian name(s): `olepe kupe `opiopio.***

1920	Ref - Dall et al., 1938	USNM 428390.
1920	Ref - Dall et al., 1938	USNM 428228.
1920	Ref - Dall et al., 1938	USNM 341291.
1923	Spec - BPBM-MO 196300	Peninsula; Railroad Wharf. Catalogue XIV.
1923	Spec - BPBM-MO 33	At Railroar Wharf opposite Ford Island, Peninsula.
1938	Spec - BPBM-MO 34	Near Yacht Club.
1961	Spec - BPBM-MO 218950	Off Fort Kamehameha. Catalogue XV.
1973	Ref - Evans et al., 1974	
1996	This Project	

Genus: *Pillucina*

Pillucina spaldingi ***(Pilsbry, 1921)***

1973	Ref - Evans et al., 1974	
1996	This Project	

Family: MACTRIDAE

Genus: *Mactra*

Mactra thaanumi ***D.,B.,& R.***

1963	Spec - BPBM-MO 221087	Off Pearl Harbor. Catalogue XV.

Family: SEMELIDAE

Genus: *Abra*

Abra sp. A sp. ***New record for Hawaii. Introduced.***

1996	This Project	

Legacy Project - Species Report (Cont.)

Genus: *Semele*

Semele australis ***Sowerby, 1832***

Unknown	Spec - BPBM-MO 209617	Catalogue XIV.

Family: TELLINIDAE

Unidentified Tellinidae

1996	This Project	

Genus: *Macoma*

Macoma dispar ***(Conrad, 1837)***

Unknown	Spec - BPBM-MO 60512	Ford Island. Catalogue V.
1915	Spec - BPBM-MO 27	Ford Island.
1920	Ref - Dall et al., 1938	Recorded as Scissulina dispar. USNM 341298.
1935	Spec - BPBM-MO 3	In a road cut near Yacht Club.
1938	Ref - Dall et al., 1938	Recorded as Scissulina dispar. USNM 33754.
1938	Ref - Dall et al., 1938	Recorded as Scissulina dispar. USNM 337353.

Macoma obliquilineata ***(Conrad, 1837)***

1920	Ref - Dall et al., 1938	Recorded as Jactellina obliquilineata. USNM 331294.

Genus: *Pharoanella*

Pharoanella variabilis ***Nutt***

Unknown	Spec - BPBM-MO 64344	Catalogue V. Questionable ID.

Genus: *Tellina*

Tellina sp.

1934	Spec - BPBM-MO 205593	Dredge. Catalogue XIV.
1961	Spec - BPBM-MO 219133	Off Fort Kamehameha. Catalogue XV.
1996	This Project	

Tellina sp. A ***New record for Pearl Harbor.***

1996	This Project	

Tellina sp.?

1934	Spec - BPBM-MO 205579	Dredge. Catalogue XIV.

Tellina (Arcopagia) robusta ***(Hanley, 1844)***

1920	Ref - Dall et al., 1938	Recorded as Pinquitellina robusta. USNM 341229.
1938	Ref - Dall et al., 1938	Recorded as Pinquitellina robusta. USNM 337359.
1973	Ref - Evans et al., 1974	Recorded as Angulus nucella Dall et al., 1938.

Tellina palatam ***Iredale, 1929***

Unknown	Spec - BPBM-MO 209618	Catalogue XIV.
Unknown	Spec - BPBM-MO 60526	Ford Island. Catalogue V.
Unknown	Spec - BPBM-MO 60527	Catalogue V.
1902	Ref - Dall et al., 1938	Recorded as Quidnipagus palatum. USNM 335579.
1915	Spec - BPBM-MO 60524	Catalogue V.
1920	Ref - Dall et al., 1938	Recorded as Quidnipagus palatum. USNM 341287.
1924	Spec - BPBM-MO 8	
1927	Spec - BPBM-MO 196248	E. side Pearl City Peninsula. Catalogue XIV.
1930	Spec - BPBM-MO 196571	Pearl Lochs. Catalogue XIV.
1938	Ref - Dall et al., 1938	Recorded as Quidnipagus palatum. BPBM.

Family: TRAPEZIIDAE

Genus: *Trapezium*

Trapezium sp.

1934	Spec - BPBM-MO 205590	Dredge. Catalogue XIV.

Family: VENERIDAE

Genus: *Lioconcha*

Lioconcha hieroglyphica ***(Conrad, 1837)***

Unknown	Spec - BPBM-MO 196259	E. side Pearl City Peninsula. Catalogue XIV.
Unknown	Spec - BPBM-MO 204102	Catalogue XIV.
Unknown	Spec - BPBM-MO 209620	Catalogue XIV.

1920	Ref - Dall et al., 1938	USNM 42195.
1927	Spec - BPBM-MO 196258	E. side Pearl City Peninsula. Catalogue XIV.
1930	Spec - BPBM-MO 196449	Pearl Lochs. Catalogue XIV.
1938	Ref - Dall et al., 1938	BPBM 165.
1961	Spec - BPBM-MO 218979	Off Fort Kamehameha. Catalogue XV.
1996	This Project	

Genus: *Periglypta*

Periglypta sp.

1934	Spec - BPBM-MO 205573	Dredge. Catalogue XIV.
1934	Spec - BPBM-MO 205574	Dredge. Catalogue XIV.

Periglypta reticulata (Linnaeus, 1758)

Unknown	Spec - BPBM-MO 196218	Fort Kamehameha, 100 ft. inland from outer edge of reef.. Catalogue XIV.
Unknown	Spec - BPBM-MO 209622	Catalogue XIV.
1916	Spec - BPBM-MO 38	Reef Waikiki of Pearl Harbor channel entrance.
1920	Ref - Dall et al., 1938	Recorded as P. edmonsoni. USNM 428286.
1938	Ref - Dall et al., 1938	Recorded as P. edmonsoni. BPBM 2016c.

Genus: *Venerupis*

Venerupis (Ruditapes) phillipinarum Introduced.

Unknown	Spec - BPBM-MO 209621	Catalogue XIV.
1918	Ref - Dall et al., 1938	Recorded as Venerupis philippinarum. USNM 337389.
1919	Ref - Bryan, 1919	Recorded as Tapes philippinarum okupi.
1920	Ref - Edmondson & Wilson, 1940	Recorded as Tapes philippinarum.
1920	Ref - Thaanaum, 1921	Recorded as Tapes philippinarum.
1924	Spec - BPBM-MO 10	Bought in fish market in Honolulu.
1924	Spec - BPBM-MO 67484	Catalogue V.
1937	Ref - Edmondson & Wilson, 1940	Recorded as Tapes philippinarum.
1996	This Project	

Genus: *Venus*

Venus sp.

1934	Spec - BPBM-MO 205578	Dredge. Catalogue XIV.

Order: MYOIDA

Family: GASTROCHAENIDAE

Genus: *Gastrochaena*

Gastrochaena gigantea Spengler, 1783 Hawaiian name(s): `olepe waha nui;.

Unknown	Spec - BPBM-MO 204046	Ford Island. Catalogue XIV.
Unknown	Spec - BPBM-MO 60547	Catalogue V.
Unknown	Spec - BPBM-MO 60548	Ford Island. Catalogue V.
Unknown	Spec - BPBM-MO 60549	Ford Island. Catalogue V.
Unknown	Spec - BPBM-MO 60550	Ford Island. Catalogue V.
1915	Spec - BPBM-MO 4	Ford Island.
1920	Ref - Dall et al., 1938	Recorded as Rocellaria hawaiiensis. USNM 341293.
1938	Ref - Dall et al., 1938	Recorded as Rocellaria hawaiiensis. BPBM 94.
1938	Ref - Dall et al., 1938	Recorded as Rocellaria hawaiiensis. USNM 337310.
1938	Ref - Dall et al., 1938	Recorded as Rocellaria hawaiiensis. BPBM 60549.
1938	Ref - Dall et al., 1938	Recorded as Rocellaria hawaiiensis. USNM 361952.

Genus: *Rocellaria*

Rocellaria sp.

1973	Ref - Evans et al., 1974	

Rocellaria gigantea Desh Hawaiian name(s): `olepe waha nui; pupu olepe waha nui.

1923	Spec - BPBM-MO 196238	End of Waipio Peninsula. Catalogue XIV.
1925	Spec - BPBM-MO 196241	Peninsula; Railroad Wharf. Catalogue XIV.
1927	Spec - BPBM-MO 196237	Pearl Harbor channel, off Fort Kamehameha. Catalogue XIV.

Family: HIATELLIDAE

Genus: *Hiatella*

Hiatella arctica ***(Linnaeus, 1767) Cryptogenic.***

1973	Ref - Evans et al., 1974	Recorded as Hiatella hawaiensis Dall et al., 1938.
1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	
1975	Ref - Grovhoug, 1976	Recorded as Hiatella hawaiensis Dall et al., 1938.
1978	Ref - Grovhoug, 1979	Hiatella hawaiensis Dall, Bartsch & Rehder, 1938.
1987	Ref - Brewer & Assoc., 1987	Recorded as Hiatella hawaiensis Dall et al., 1938.
1996	This Project	

Sphenia luticola ***(H. & A. Adams, 1854) Introduced.***

1972	Ref - Long, 1974	Recorded as S. cf. fragilis (H. & A. Adams, 1846).

Family: MYIDAE

Genus: *Sphenia*

Sphenia sp. A sp. ***New record for Hawaii. Introduced.***

1996	This Project	

Family: PHOLADIDAE

Genus: *Martesia*

Martesia sp.

1939	Spec - BPBM-MO 205356	Catalogue XIV.

Martesia striata ***(Linnaeus, 1758) Introduced. Hawaiian name(s): `olepe makaloa.***

Unknown	Spec - BPBM-MO 60554	Catalogue V.
1920	Ref - Dall et al., 1938	Recorded as M. hawaiiensis. USNM 484213.
1920	Ref - Dall et al., 1938	Recorded as M. hawaiiensis. USNM 218042.
1920	Ref - Dall et al., 1938	Recorded as M. hawaiiensis. USNM 484214.
1920	Ref - Dall et al., 1938	Recorded as M. hawaiiensis. BPBM 30.
1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	
1986	Ref - Lenihan, 1990	
1996	This Project	

Genus: *Pholas*

Pholas sp.

Unknown	Spec - BPBM-MO 67987	Said by Dr. C.M. Cooke to have come from Pearl Harbor. Catalogue V.

Family: TEREDINIDAE

Unidentified Teredinidae

1996	This Project	

Genus: *Bankia*

Bankia bipalmulata ***(Lamarck, 1801) Introduced.***

1936	Ref - Edmondson, 1942	Recorded as Bankia hawaiiensis.
1976	Ref - Cooke et al., 1980	

Genus: *Lyrodus*

Lyrodus affinis ***Deschayes, 1863 Introduced.***

1973	Ref - McCain, 1974	Recorded as Teredo ?milleri.
1973	Ref - McCain, 1975	Recorded as Teredo ?milleri.
1976	Ref - Cooke et al., 1980	

Lyrodus pedicillatus ***(Quatrefages, 1849) Introduced.***

1935	Ref - Edmondson, 1940	Recorded as Bankia hawaiiensis.
1938	Ref - Dall et al., 1938	Recorded as Teredo kauaiensis.
1976	Ref - Cooke et al., 1980	

Genus: *Teredo* ***Hawaiian name(s): wawahi wa`a.***

Teredo sp.

Unknown	Spec - BPBM-MO 67988	Said by Dr. C.M. Cooke to have come from Pearl Harbor. Catalogue V.
1973	Ref - Evans et al., 1974	

1986 Ref - Lenihan, 1990

Teredo bartschi ***Clapp, 1923 Introduced.***

1935 Ref - Edmondson, 1940
1935 Ref - Edmondson, 1942
1976 Ref - Cooke et al., 1980
1996 This Project

Teredo clappi ***Bartsch, 1923 Introduced.***

1923 Ref - Dall et al., 1938 Recorded as T. trulliformis Miller, 1924. USNM 361888.
1924 Ref - Miller, 1924 Recorded as T. trulliformis Miller, 1924.
1976 Ref - Cooke et al., 1980

Teredo diegensis ***Bartsch, 1916***

1924 Ref - Edmondson, 1940
1924 Ref - Edmondson, 1942
1973 Ref - McCain, 1974
1973 Ref - McCain, 1975

Teredo furcifera ***van Martens, 1894 Introduced.***

1921 Ref - Bartsch, 1921 Recorded as T. parksi Bartsch, 1921.
1921 Ref - Dall et al., 1938 Recorded as T. parksi Bartsch, 1921. USNM 489211.
1921 Ref - Dall et al., 1938 Recorded as T. parksi Bartsch, 1921. USNM 345311.
1921 Ref - Dall et al., 1938 Recorded as T. parksi Bartsch, 1921. USNM 341132.
1935 Ref - Edmondson, 1942 Recorded as T. parksi Bartsch, 1921.
1976 Ref - Cooke et al., 1980

Teredo oahuensis ***Edmondson, 1942***

1973 Ref - McCain, 1974
1973 Ref - McCain, 1975

Class: SCAPHOPODA
Order: DENTALIDA
Family: DENTALIIDAE
Genus: *Dentalium*
Dentalium sp.

1961 Spec - BPBM-MO 220733 Off Fort Kamehameha. Catalogue XV.

Class: CEPHALOPODA
Order: OCTOPODA
Family: OCTOPODIDAE
Genus: *Polypus* ***Hawaiian name(s): he`e mahola.***
Polypus sp.

1973 Ref - Evans et al., 1974 Off Pearl Harbor.

Phylum: ARTHROPODA
Unidentified Arthropoda

Unknown Spec - BPBM-S 5962 Identified by J.L. Barnard.
Unknown Spec - BPBM-S 5963 Identified by J.L. Barnard.
1948 Spec - BPBM-S 5323
1950 Spec - BPBM-S 5628

Class: PYCNOGONIDA
Unidentified Pycnogonida

1973 Ref - McCain, 1974
1973 Ref - McCain, 1975
1996 This Project

Order: PANTOPODA
Family: AMMOTHEIDAE
Genus: *Achelia*
Achelia plicata ***Dillwyn***

1973 Ref - Evans et al., 1974 Off Pearl Harbor.

Legacy Project - Species Report (Cont.)

Family: ENDEIDAE

Genus: *Endeis*

Endeis nodosa ***Hilton, 1942***

1973 Ref - Evans et al., 1974

Endeis procera ***(Loman) New record for Pearl Harbor.***

1996 This Project

Family: PYCNOGONIDAE

Genus: *Anoplodactylus*

Anoplodactylus sp.

1948 Spec - BPBM-S 8605 Identified by C.A. Child, 1969.

Anoplodactylus californicus ***Hall New record for Pearl Harbor.***

1996 This Project

Anoplodactylus portus ***Calman***

1937 Spec - BPBM-S 4963 Identified by J.H. Stock, 1967 (Loan #1616).

1945 Spec - BPBM-S 7219

1947 Spec - BPBM-S 7227

1948 Spec - BPBM-S 7243

1948 Spec - BPBM-S 8786 Drydock.

1973 Ref - Evans et al., 1974

Anoplodactylus projectus ***Hilton***

1938 Spec - BPBM-S 4702 Identified by Dr. Hilton.

Anoplodactylus pyncnosoma ***(Helfer) New record for Pearl Harbor.***

1996 This Project

Genus: *Pigrogromitus*

Pigrogromitus robustus ***Calman***

1948 Spec - BPBM-S 8606 Identified by C.A. Child, 1969.

Pigrogromitus timsanus ***Calman New record for Hawaii. Introduced.***

1996 This Project

Class: CRUSTACEA

Unidentified Cirripedia

1931 Spec - BPBM-B 277

1976 Spec - BPBM-B 587 Merry Point.

1982 Spec - BPBM-B 499 Off Pearl Harbor; from dredge spoil dumping site.

1982 Spec - BPBM-B 513 Off Pearl Harbor; from dredge spoil dumping site.

Unidentified Copepoda

1996 This Project

Unidentified Ostracoda

1973 Ref - Evans et al., 1974

1996 This Project

Order: CYCLOPOIDA

Family: SAPPHIRINIDAE

Genus: *Copilia*

Copilia sp.

1973 Ref - Evans et al., 1974

Order: THORACICA

Family: BALANIDAE

Unidentified Balanidae

1934 Spec - BPBM-MO 205563 Dredge. Catalogue XIV.

1934 Spec - BPBM-MO 205564 Dredge. Catalogue XIV.

Genus: *Balanus*

Balanus sp.

1973 Ref - Evans et al., 1974

1975	Spec - BPBM-B 565	
1976	Ref - Cooke et al., 1980	
1986	Ref - Lenihan, 1990	
1996	This Project	

Balanus amphitrite amphitrite ***Darwin, 1854*** ***Introduced.***

Unknown	Spec - BPBM-B 332	
1913	Ref - Pilsbry, 1928	
1915	Spec - BPBM-B 233	Identified by Pilsbry.
1929	Spec - BPBM-B 270	Weinrich's place.
1929	Spec - BPBM-B 272	Middle Loch.
1931	Spec - BPBM-B 276	
1933	Ref - Edmondson, 1933	Recorded as Balanus amphitrite.
1935	Ref - Edmondson & Ingram, 1939	Recorded as Balanus amphitrite.
1935	Ref - Edmondson, 1944	Recorded as B. amphitrite hawaiiensis Broch.
1935	Ref - Ingram, 1937	Recorded as Balanus amphitrite.
1943	Ref - Hutchins, 1949	Recorded as Balanus amphitrite.
1944	Spec - BPBM-B 312	Off Pearl Harbor.
1944	Spec - BPBM-B 313	Off Pearl Harbor.
1944	Spec - BPBM-B 314	Off Pearl Harbor.
1944	Spec - BPBM-B 315	Off Pearl Harbor.
1944	Spec - BPBM-B 316	Off Pearl Harbor.
1944	Spec - BPBM-B 331	Off Pearl Harbor.
1946	Ref - Edmondson, 1946	Recorded as B. amphitrite hawaiiensis.
1948	Ref - Henry & Mclaughlin, 1975:33	
1972	Ref - Long, 1974	
1973	Ref - Evans et al., 1974	Recorded as B. amphitrite hawaiiensis Broch.
1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	
1975	Ref - Grovhoug, 1976	Recorded as B. amphitrite hawaiiensis Broch.
1987	Ref - Brewer & Assoc., 1987	Recorded as B. amphitrite hawaiiensis Broch.
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
1996	This Project	

Balanus amphitrite? ***Broch., 1922***

1975	Spec - BPBM-B 568	Identified by T.L. Smalley.
1977	Spec - BPBM-B 615	Pearl Harbor?. Identified by T.L. Smalley.

Balanus crenatus ***Bruguiere, 1789***

1972	Ref - Long, 1974	Off Pearl Harbor.

Balanus eburneus ***Gould, 1841*** ***Introduced.***

1929	Spec - BPBM-B 271	
1943	Ref - Hutchins, 1949	
1946	Ref - Edmondson, 1946	
1948	Spec - BPBM-B 349	
1950	Spec - BPBM-B 368	
1972	Ref - Long, 1974	
1973	Ref - Evans et al., 1974	
1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	
1975	Spec - BPBM-B 567	Identified by T.L. Smalley.
1975	Ref - Grovhoug, 1976	
1975	Ref - Henry & Mclaughlin, 1975	Station number obtained from specimen cited in this publication.
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
1996	This Project	

Balanus reticulatus ***Utinomi, 1960*** ***Introduced.***

Unknown	Spec - BPBM-B 350	
1915	Ref - Henry & Mclaughlin, 1975:90	
1948	Ref - Henry & Mclaughlin, 1975	
1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	
1975	Ref - Grovhoug, 1976	
1996	This Project	

Balanus tintinnabulum ***(Linnaeus, 1758)***

1943	Ref - Hutchins, 1949	Off Pearl Harbor.
1972	Ref - Long, 1974	Off Pearl Harbor.

Balanus trigonus ***Darwin, 1854***

1943	Ref - Hutchins, 1949	
1948	Spec - BPBM-B 345	
1948	Spec - BPBM-B 350	
1972	Ref - Long, 1974	
1973	Ref - Evans et al., 1974	

Genus: ***Chelonibia***

Chelonibia sp.

1973	Ref - Evans et al., 1974	

Family: CHTHAMALIDAE

Genus: ***Chthamalus***

Chthamalus sp. ***Introduced.***

1993	Ref - Brock, 1994	Recorded as Chthamalus hembeli.
1994	Ref - Brock, 1995	Recorded as Chthamalus hembeli.

Chthamalus proteus ***New record for Hawaii. Introduced.***

1996	This Project	

Family: LEPADIDAE

Genus: ***Lepas***

Lepas anatifera ***Linnaeus, 1758***

1943	Ref - Hutchins, 1949	
1944	Spec - BPBM-B 330	Off Pearl Harbor.

Lepas anserifera anserifera ***Linnaeus, 1759***

1943	Ref - Hutchins, 1949	Recorded as L. anserifera.

Order: MYSIDACEA

Unidentified Mysidacea

1973	Ref - Evans et al., 1974	
1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	

Order: CUMACEA

Unidentified Cumacea

1996	This Project	

Order: TANAIDACEA

Family: APSEUDIDAE

Genus: ***Apseudes***

Apseudes sp.

1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	

Apseudes sp. 1

1973	Ref - Evans et al., 1974	Recorded as Apseudes sp. 1.
1978	Ref - Grovhoug, 1979	Recorded as Apseudes sp. 1.

Apseudes sp. 2

1973	Ref - Evans et al., 1974	Recorded as Apseudes sp. 2.

1978 Ref - Grovhoug, 1979 Recorded as Apseudes sp. 2.

Apseudes sp. A ***New record for Pearl Harbor.***

1996 This Project

Apseudes tropicalis ***New record for Pearl Harbor.***

1996 This Project

Genus: *Parapseudes*

Parapseudes neglectus ***New record for Pearl Harbor.***

1996 This Project

Parapseudes pedispinis ***New record for Hawaii. Cryptogenic.***

1996 This Project

Family: PSEUDOZEUXIDAE

Genus: *Leptochelia*

Leptochelia dubia ***(Kroyer, 1852) Cryptogenic.***

1973 Ref - Evans et al., 1974

1973 Ref - McCain, 1974

1973 Ref - McCain, 1975

1978 Ref - Grovhoug, 1979

1996 This Project

Family: TANAIDAE

Genus: *Anatanais*

Anatanais insularis ***Miller, 1940***

1973 Ref - Evans et al., 1974

1978 Ref - Grovhoug, 1979

1996 This Project

Order: ISOPODA

Family: ANTHURIDAE

Genus: *Mesanthura*

Mesanthura sp. A ***New record for Hawaii. Cryptogenic.***

1996 This Project

Mesanthura hieroglyphica ***Miller & Menzies, 1952***

1973 Ref - Evans et al., 1974

1978 Ref - Grovhoug, 1979

Family: CIROLANIDAE

Unidentified Cirolanidae

1973 Ref - McCain, 1974

1973 Ref - McCain, 1975

Genus: *Cirolana*

Cirolana sp.

1973 Ref - Evans et al., 1974

Cirolana parva?

1978 Ref - Grovhoug, 1979

Genus: *Hansenolana*

Hansenolana sphaeroformis ***(Hansen)***

1973 Ref - Evans et al., 1974

Family: IDOTEIDAE

Genus: *Colidotea*

Colidotea edmondsoni ***Miller, 1940***

1973 Ref - Evans et al., 1974

Family: JAEROPSIDIDAE

Genus: *Jaeropsis*

Jaeropsis hawaiiensis ***Miller, 1941***

1927 Ref - Miller, 1941

Legacy Project - Species Report (Cont.)

Family: JANIRIDAE

Genus: *Carpias*

Carpias sp.

1996 This Project

Genus: *Cerpias*

Cerpias algicola ***New record for Pearl Harbor.***

1996 This Project

Genus: *Janira*

Janira algicola ***Miller, 1941***

1927 Ref - Miller, 1941

Family: LIMNORIIDAE

Genus: *Limnoria*

Limnoria sp.

1973 Ref - Evans et al., 1974

1976 Ref - Cooke et al., 1980

1996 This Project

Limnoria lignorum ***New record for Pearl Harbor.***

1996 This Project

Limnoria tripunctata ***Menzies, 1957 Introduced.***

1973 Ref - Evans et al., 1974

1996 This Project

Family: MUNNIDAE

Genus: *Munna*

Munna acarina ***New record for Pearl Harbor.***

1996 This Project

Family: SCYPHACIDAE

Genus: *Armadilloniscus*

Armadilloniscus litoralis ***New record for Pearl Harbor.***

1996 This Project

Family: SPHAEROMATIDAE

Genus: *Dynamenella*

Dynamenella sp.

1973 Ref - Evans et al., 1974

1973 Ref - McCain, 1974

1973 Ref - McCain, 1975

1978 Ref - Grovhoug, 1979

Genus: *Exosphaeroma*

Exosphaeroma sp. A sp. ***New record for Hawaii. Cryptogenic.***

1996 This Project

Genus: *Paracerceis*

Paracerceis sculpta ***(Holmes, 1909) Introduced.***

1968 Ref - Miller, 1968

1973 Ref - Evans et al., 1974

1973 Ref - McCain, 1974

1973 Ref - McCain, 1975

1978 Ref - Grovhoug, 1979

Genus: *Sphaeroma*

Sphaeroma walkeri ***(Stebbing, 1905) Introduced.***

1973 Ref - Evans et al., 1974

1973 Ref - McCain, 1974

1973 Ref - McCain, 1975

Unidentified Sphaeroma

1996 This Project

Legacy Project - Species Report (Cont.)

Family: STENETRIIDAE

Genus: *Stenetrium*

Stenetrium medipacificum ***Miller, 1941*** ***Indigenous.***

1929 Ref - Miller, 1941

Family: TEREDICOLIDAE

Genus: *Teredicola*

Teredicola typicus ***Wilson, 1942***

1976 Ref - Cooke et al., 1980

Order: AMPHIPODA

Unidentified Amphipoda

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Family: AMPHILOCHIDAE

Genus: *Amphilochus*

Amphilochus kailua ***New record for Pearl Harbor.***

1996 This Project

Amphilochus likelike ***New record for Pearl Harbor.***

1996 This Project

Genus: *Gitanopsis*

Gitanopsis pele ***New record for Pearl Harbor.***

1996 This Project

Family: AMPITHOIDAE

Genus: *Ampithoe*

Ampithoe waialua ***New record for Pearl Harbor.***

1996 This Project

Genus: *Paragrubia*

Paragrubia vorax ***New record for Pearl Harbor.***

1996 This Project

Family: AORIDAE

Genus: *Grandidierella*

Grandidierella bispinosa ***New record for Hawaii. Cryptogenic.***

1996 This Project

Grandidierella japonica ***New record for Hawaii. Introduced.***

1996 This Project

Genus: *Lembos*

Lembos sp.

1973 Ref - Evans et al., 1974

Lembos macromanus ***(Shoemaker, 1925)***

1973 Ref - Evans et al., 1974

1978 Ref - Grovhoug, 1979

1996 This Project

Lembos pualani ***New record for Pearl Harbor.***

1996 This Project

Lembos waipio ***New record for Pearl Harbor.***

1996 This Project

Family: CAPRELLIDAE

Genus: *Caprella* ***Hawaiian name(s): `ami kai.***

Caprella scaura ***Templeton, 1836*** ***Introduced.***

1929 Spec - BPBM-S 5251

1929 Spec - BPBM-S 5252

1948 Ref - Edmondson & Mansfield, 1948

1973 Ref - Evans et al., 1974

Legacy Project - Species Report (Cont.)

Genus: ***Paracaprella***

Paracaprella pusilla ***Mayer, 1890***

1978	Ref - Grovhoug, 1979	

Family: COLOMASTIGIDAE

Genus: ***Colomastix***

Colomastix lunalilo ***New record for Pearl Harbor.***

1996	This Project	

Colomastix pusilla ***New record for Pearl Harbor.***

1996	This Project	

Family: COROPHIIDAE

Genus: ***Corophium***

Corophium ascherusicum ***Costa, 1857 Introduced.***

1973	Ref - Evans et al., 1974	Recorded as Corophium acherusicum.
1996	This Project	

Corophium baconi ***Shoemaker, 1934 Introduced.***

1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	
1996	This Project	

Corophium insidiosum ***Crawford, 1937 Introduced.***

1978	Ref - Grovhoug, 1979	
1996	This Project	

Genus: ***Ericthonius***

Ericthonius brasiliensis ***(Dana, 1853) Introduced.***

1938	Ref - Barnard, 1955	Recorded as Ericthonius brasilensis.
1938	Spec - BPBM-S 5947	Identified by J.L. Barnard.
1973	Ref - Evans et al., 1974	Recorded as Ericthonius brasilensis.
1978	Ref - Grovhoug, 1979	Recorded as Ericthonius brasilensis.
1996	This Project	

Family: GAMMARIDAE

Genus: ***Elasmopus***

Elasmopus diplonyx ***New record for Pearl Harbor.***

1996	This Project	

Elasmopus ecuadorensis hawaiensis ***Schellenberg, 1938***

1973	Ref - Evans et al., 1974	

Elasmopus molokai ***New record for Pearl Harbor.***

1996	This Project	

Elasmopus pectenicrus ***(Bate, 1862)***

1937	Ref - Barnard, 1955	Off Pearl Harbor. Recorded as Elasmopus pectinicrus.
1937	Spec - BPBM-S 5993	Identified by J.L. Barnard.
1944	Ref - Barnard, 1970	Off Pearl Harbor. Recorded as Elasmopus pectinicrus.
1948	Ref - Barnard, 1970	Recorded as Elasmopus pectinicrus.
1948	Spec - BPBM-S 5994	Identified by J.L. Barnard.
1948	Spec - BPBM-S 8717	Drydock. Identified by J.L. Barnard.
1948	Spec - BPBM-S 8718	Drydock. Identified by J.L. Barnard.
1948	Spec - BPBM-S 8719	Drydock. Identified by J.L. Barnard.
1950	Spec - BPBM-S 5995	Identified by J.L. Barnard.
1950	Spec - BPBM-S 6010	Identified by J.L. Barnard.

Elasmopus piikoi ***Barnard, 1970***

1978	Ref - Grovhoug, 1979	

Elasmopus rapax ***(Costa, 1853) Introduced.***

1948	Ref - Barnard, 1955	
1948	Ref - Barnard, 1970	

1948 Spec - BPBM-S 5989 Identified by J.L. Barnard.
1948 Spec - BPBM-S 5991 Identified by J.L. Barnard.
1950 Spec - BPBM-S 5990 Identified by J.L. Barnard.
1973 Ref - Evans et al., 1974
1978 Ref - Grovhoug, 1979
1996 This Project

Genus: *Eriopisa*

Eriopisa hamakua ***Barnard, 1970 New record for Pearl Harbor.***
1967 Spec - BPBM-S 7273 Off W end of Pearl Harbor.
1996 This Project

Genus: *Eriopisella*

Eriopisella sechellensis upolu ***New record for Pearl Harbor.***
1996 This Project

Genus: *Maera*

Maera kaiulani ***Barnard, 1970***
1967 Spec - BPBM-S 7276 Off W end of Pearl Harbor.

Maera pacifica ***New record for Pearl Harbor.***
1996 This Project

Family: HYALIDAE

Genus: *Hyale*

Hyale grandicornis bishopae ***New record for Pearl Harbor.***
1996 This Project

Family: ISAEIDAE

Genus: *Gammaropsis*

Gammaropsis alamoana ***New record for Pearl Harbor.***
1996 This Project

Genus: *Photis*

Photis hawaiiensis ***Barnard, 1955***
1973 Ref - Evans et al., 1974
1978 Ref - Grovhoug, 1979
1996 This Project

Family: LEUCOTHOIDAE

Genus: *Leucothoe*

Leucothoe sp.
1973 Ref - Evans et al., 1974

Leucothoe hyhelia ***Barnard, 1965***
1973 Ref - Evans et al., 1974
1978 Ref - Grovhoug, 1979
1996 This Project

Leucothoe tridens ***New record for Pearl Harbor.***
1996 This Project

Paraleucothoe flindersi ***Stebbing, 1888 New record for Hawaii. Cryptogenic.***
1996 This Project

Family: LILJEBORGIIDAE

Genus: *Liljeborgia*

Liljeborgia heeia ***New record for Pearl Harbor.***
1996 This Project

Family: PODOCERIDAE

Genus: *Podocerus*

Podocerus brasiliensis ***(Dana, 1853) Introduced.***
Unknown Spec - BPBM-S 5964 Identified by J.L. Barnard.
1938 Ref - Barnard, 1955

1938 Spec - BPBM-S 5959 Identified by J.L. Barnard.
1948 Ref - Barnard, 1955
1948 Spec - BPBM-S 5958 Identified by J.L. Barnard.
1948 Spec - BPBM-S 5960 Identified by J.L. Barnard.
1950 Spec - BPBM-S 5961 Identified by J.L. Barnard.
1951 Ref - Barnard, 1955
1973 Ref - Evans et al., 1974
1978 Ref - Grovhoug, 1979
1996 This Project

Podocerus talegus lawai ***New record for Pearl Harbor.***
1996 This Project

Family: STENOTHOIDAE

Genus: *Stenothoe*

Stenothoe cattai
1950 Spec - BPBM-S 5966 Identified by J.L. Barnard.

Stenothoe gallensis ***Walker, 1904*** ***Introduced.***
1937 Ref - Barnard, 1955
1944 Ref - Barnard, 1955 Off Pearl Harbor.
1948 Spec - BPBM-S 5965 Identified by J.L. Barnard.
1978 Ref - Grovhoug, 1979
1996 This Project

Stenothoe valida ***Dana, 1853*** ***Cryptogenic.***
1978 Ref - Grovhoug, 1979
1996 This Project

Order: DECAPODA

Unidentified Caridea
1996 This Project

Family: ALPHEIDAE

Unidentified Alpheidae
1979 Ref - AECOS, 1979 Off Pearl Harbor.
1996 This Project

Genus: *Alpheopsis*

Alpheopsis equalis ***Coutiere, 1896***
1973 Ref - Evans et al., 1974

Genus: *Alpheus*

Alpheus sp.
1973 Ref - Evans et al., 1974
1986 Ref - Lenihan, 1990
1996 This Project

Alpheus sp. 1
1987 Ref - Brewer & Assoc., 1987 Recorded as Alpheus sp. 1.

Alpheus brevipes ***New record for Pearl Harbor.***
1996 This Project

Alpheus collumianus ***New record for Pearl Harbor.***
1996 This Project

Alpheus crassimanus ***Heller, 1865***
1929 Spec - BPBM-S 8928 Identified by Banner.
1938 Spec - BPBM-S 6442 Identified by A.H. Banner.

Alpheus diadema ***Dana, 1852***
1973 Ref - Evans et al., 1974

Alpheus gracilipes ***Stimpson, 1860***
1973 Ref - Evans et al., 1974

1996 This Project

Alpheus gracilis simplex ***(Banner, 1953)***

1973 Ref - Evans et al., 1974

Alpheus heeia ***Banner & Banner, 1974***

1973 Ref - Evans et al., 1974

Alpheus lanceloti ***Coutiere, 1905***

1973 Ref - Evans et al., 1974

Alpheus lobidens ***New record for Pearl Harbor.***

1996 This Project

Alpheus lobidens polynesica ***Banner & Banner, 1974***

1973 Ref - Evans et al., 1974

Alpheus lottini ***New record for Pearl Harbor.***

1996 This Project

Alpheus mackayi ***Banner & Banner, 1974***

1973 Ref - Evans et al., 1974
1978 Ref - Grovhoug, 1979
1993 Ref - Brock, 1994
1994 Ref - Brock, 1995
1996 This Project

Alpheus pacificus

1947 Spec - BPBM-S 5302
1947 Spec - BPBM-S 5317
1948 Spec - BPBM-S 5337

Alpheus paracrinitus ***Miers, 1881***

1973 Ref - Evans et al., 1974
1996 This Project

Alpheus paralcyone ***Coutiere, 1905***

1973 Ref - Evans et al., 1974

Alpheus platyunguiculatus ***(Banner, 1953)***

1973 Ref - Evans et al., 1974

Alpheus rapacida ***deMan, 1911***

1973 Ref - Evans et al., 1974
1978 Ref - Grovhoug, 1979

Alpheus rapax ***Fabricius, 1798***

1973 Ref - Evans et al., 1974

Genus: *Leptalpheus*

Leptalpheus pacificus ***Banner & Banner, 1974***

1972 Spec - BPBM-S 8550
1973 Ref - Evans et al., 1974

Genus: *Metalpheus*

Metalpheus paragracilis ***New record for Pearl Harbor.***

1996 This Project

Genus: *Synalpheus*

Synalpheus bituberculatus ***deMan, 1911***

1973 Ref - Evans et al., 1974
1996 This Project

Synalpheus pachymeris ***Coutiere, 1905***

1973 Ref - Evans et al., 1974

Synalpheus paraneomeris ***New record for Pearl Harbor.***

1996 This Project

Synalpheus streptodactylus ***Coutiere***

1973 Ref - Evans et al., 1974

1996 This Project

Synalpheus thai ***Banner & Banner, 1966***

1973 Ref - Evans et al., 1974

1996 This Project

Unidentified Synalpheus

1996 This Project

Family: AXIIDAE

Genus: *Enoplometopus*

Enoplometopus occidentalis ***(Randall) Common name(s): Western Lobster; Hawaiian name(s): `opae; ula.***

1973 Ref - Evans et al., 1974

Family: CALAPPIDAE

Genus: *Calappa* ***Hawaiian name(s): pokipoki; papai pokipoki.***

Calappa gallus ***(Herbst, 1803)***

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Calappa hepatica ***(Linnaeus, 1767) Common name(s): Hepatic Box Crab; Hawaiian name(s): pokipoki; pokipoki `au moana; pokipoki kuapa`a; popoki.***

1973 Ref - Evans et al., 1974

Genus: *Cryptosoma*

Cryptosoma granulosum ***Alcock***

Unknown Spec - BPBM-S 1500

Family: CALLIANASSIDAE

Genus: *Callianassa*

Callianassa sp.

1996 This Project

Callianassa variabilis ***New record for Pearl Harbor.***

1996 This Project

Family: CHIROSTYLIDAE

Unidentified Chirostylidae

1982 Spec - BPBM-S 10099 Off Pearl Harbor.

Family: DIOGENIDAE

Genus: *Calcinus*

Calcinus latens ***(Randall, 1839)***

1973 Ref - Evans et al., 1974

Family: DROMIIDAE

Genus: *Cryptodromiopsis*

Cryptodromiopsis tridens ***Borradaile***

1950 Spec - BPBM-S 5626

Family: DYNOMENIDAE

Genus: *Dynomene*

Dynomene devaneyi ***Takeda, 1977***

1982 Spec - BPBM-S 10098 Off Pearl Harbor.

Family: GERYONIDAE

Genus: *Progeryon*

Progeryon guinotae ***Crosnier, 1976***

1977 Spec - BPBM-S 10626 3 miles off Pearl Harbor.

Family: GNATHOPHYLLIDAE

Genus: *Gnathophylloides*

Gnathophylloides mammillatus ***(Edmondson)***

1973 Ref - Evans et al., 1974 Recorded as Gnathophylloides mammalatus.

Legacy Project - Species Report (Cont.)

Family: GRAPSIDAE

Unidentified Grapsidae

1996 This Project

Genus: *Metapograpsus*

Metapograpsus messor

1929 Spec - BPBM-S 3157
1931 Spec - BPBM-S 3368 Middle Loch.
1939 Spec - BPBM-S 4427
1948 Spec - BPBM-S 5331

Metapograpsus thukuhar ***(Owen, 1839)***

1906 Ref - Rathbun , 1906
1973 Ref - Evans et al., 1974
1973 Ref - McCain, 1974
1973 Ref - McCain, 1975
1987 Ref - AECOS, 1987
1993 Ref - Brock, 1994 Recorded as M. messor.
1994 Ref - Brock, 1995 Recorded as M. messor.
1996 This Project

Genus: *Nanosesarma*

Nanosesarma minutum ***New record for Hawaii. Introduced.***

1996 This Project

Genus: *Plagusia*

Plagusia depressa tuberculata ***Lamarck, 1818***

1947 Spec - BPBM-S 5306
1973 Ref - Evans et al., 1974 Off Pearl Harbor. Recorded as Plagusia depressa tuberculata (Lameroux).

Family: CRYPTOCHIRIDAE

Genus: *Hapalocarcinus*

Hapalocarcinus marsupialis ***New record for Pearl Harbor.***

1996 This Project

Family: HIPPOLYTIDAE

Genus: *Hippolysmata*

Hippolysmata sp.

1948 Spec - BPBM-S 6079

Hippolysmata vittata

1936 Spec - BPBM-S 4222
1947 Spec - BPBM-S 5316
1948 Spec - BPBM-S 5330
1948 Spec - BPBM-S 5338
1948 Spec - BPBM-S 5572

Genus: *Leptodius*

Leptodius exaratus ***Milne Edwards***

1906 Ref - Rathbun , 1906

Leptodius sanguineus ***(H. Milne Edwards, 1834)***

1973 Ref - Evans et al., 1974

Genus: *Lysmata*

Lysmata acicula ***(Rathbun)***

1948 Spec - BPBM-S 5329
1973 Ref - Evans et al., 1974

Genus: *Saron*

Saron marmoratus ***(Olivier, 1811) Hawaiian name(s): `opae.***

1993 Ref - Brock, 1994
1994 Ref - Brock, 1995

Legacy Project - Species Report (Cont.)

Genus: ***Spirontocaris***

Spirontocaris marmoratus

1950 Spec - BPBM-S 5634

Family: HOMOLIDAE

Genus: ***Homola***

Homola ikedai

1976 Spec - BPBM-S 10637 Entrance to Pearl Harbor; 2.5 miles off Buoy 1.

Genus: ***Paromola***

Paromola japonica ***Parisi, 1915***

1976 Spec - BPBM-S 10811 Entrance to Pearl Harbor; 2.5 miles off Buoy 1. Identified by Guinot and Forges, 10 January 1990.

1982 Spec - BPBM-S 10072 Off Pearl Harbor dredge spoil site. Identified by Guinot and Forges.

Family: LEUCOSIIDAE

Genus: ***Randallia***

Randallia distincta ***Rathbun***

1983 Spec - BPBM-S 11187 Mamala Bay; Pearl Harbor disposal site. Identified by E.H. Chave.

Family: MAJIDAE

Genus: ***Hyastensus***

Hyastensus spinosus ***New record for Pearl Harbor.***

1996 This Project

Genus: ***Schizophroidea***

Schizophroidea hilensis ***Rathbun, 1906 New record for Pearl Harbor.***

1996 This Project

Genus: ***Schizophrys***

Schizophrys aspera ***H. Milne Edwards, 1834 Introduced.***

1950 Spec - BPBM-S 5620

1951 Ref - Edmondson, 1951

Family: OCYPODIDAE

Genus: ***Macrophthalmus***

Macrophthalmus telescopicus ***(Owen, 1839) Common name(s): Telescope-Eyed Ghost Crab; Hawaiian name(s): maka`aloa; `aloa; `ohiki makaloa.***

1930 Spec - BPBM-S 3476 Middle Loch.

1973 Ref - Evans et al., 1974

1996 This Project

Genus: ***Ocypode***

Ocypode ceratophthalma ***(Pallas, 1872) Common name(s): sand crab; Hawaiian name(s): `ohiki.***

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Ocypode laevis ***New record for Pearl Harbor.***

1996 This Project

Family: PALAEMONIDAE

Unidentified Palaemonidae

1996 This Project

Genus: ***Brachycarpus***

Brachycarpus biunguiculatus ***New record for Pearl Harbor.***

1996 This Project

Genus: ***Conchodytes***

Conchodytes tridacnae ***Peters, 1852***

1973 Ref - Evans et al., 1974 Off Pearl Harbor.

Genus: ***Harpiliopsis***

Harpiliopsis depressus ***New record for Pearl Harbor.***

1996 This Project

Genus: ***Leander***

Leander sp.

1973 Ref - Evans et al., 1974

Genus: ***Macrobrachium***

Macrobrachium grandimanus ***(Rand.)*** ***Hawaiian name(s): `opae `oeha`a.***

1922 Spec - BPBM-S 717

Genus: ***Palaemon***

Palaemon debelis

1934 Spec - BPBM-S 3833

Palaemon dibilis ***Dana, 1852***

1906 Ref - Rathbun , 1906

Palaemon pacificus ***(Simpson)***

1996 This Project

Palaemon pacificus? ***(Simpson)***

1978 Ref - Grovhoug, 1979

Genus: ***Palaemonella***

Palaemonella sp.

1973 Ref - Evans et al., 1974

1996 This Project

Palaemonella rotumana ***New record for Pearl Harbor.***

1996 This Project

Palaemonella tenuipes ***Dana, 1852***

1948 Spec - BPBM-S 5339

1987 Ref - AECOS, 1987 Recorded as Palaemonella tenuides.

1996 This Project

Palaemonella tenuipes? ***Dana, 1852***

1973 Ref - McCain, 1974 Recorded as Palaemonella tenuides.

1973 Ref - McCain, 1975 Recorded as Palaemonella tenuides.

Family: PALINURIDAE

Genus: ***Panulirus***

Panulirus marginatus ***(Quoy & Gaimard, 1825)***

1973 Ref - Evans et al., 1974 Off Pearl Harbor.

Panulirus penicillatus ***(Olivier, 1791)***

1973 Ref - Evans et al., 1974

Family: PANDALIDAE

Genus: ***Heterocarpus***

Heterocarpus sp.

1982 Spec - BPBM-S 10095 Off Pearl Harbor dredge spoil site. Identified by D.M. Devaney.

Heterocarpus ensifer ***Milne-Edwards***

1983 Spec - BPBM-S 11149 Mamala Bay; Pearl Harbor disposal site. Identified by R.M. Moffitt.

Genus: ***Plesionika***

Plesionika sp.

1982 Spec - BPBM-S 10096 Off Pearl Harbor dredge spoil site; in vicinity of hard outcrop. Identified by D.M. Devaney.

Plesionika alcocki ***(Anderson)***

1983 Spec - BPBM-S 11150 Mamala Bay; Pearl Harbor disposal site.

Family: PARTHENOPIDAE

Genus: ***Parthenope***

Parthenope stellata ***Rathbun, 1906***

1982 Spec - BPBM-S 10097 Off Pearl Harbor dredge spoil site; in vicinity of hard outcrop. Identified by D.M. Devaney.

Parthenope whitei ***(Adams & White)***

1973 Ref - Evans et al., 1974

Family: PORTUNIDAE

Unidentified Portunidae

1996 This Project

Genus: *Charybdis*

Charybdis erythrodactyla ***(Lam.) Common name(s): Red-Legged Swimming Crab; Hawaiian name(s): papa`i ako`ako`a.***

1902 Spec - BPBM-S 4991

Charybdis hellerii ***(A. Milne Edwards) Introduced.***

1950 Spec - BPBM-S 5622

1950 Ref - Edmondson, 1954

Charybdis orientalis

1902 Spec - BPBM-S 4992

Genus: *Libystes*

Libystes nitidus ***A. Milne Edwards, 1868***

1973 Ref - Evans et al., 1974

Genus: *Podophthalmus*

Podophthalmus vigil ***(Weber, 1795) Common name(s): Long-Eyed Swimming Crab; Hawaiian name(s):***

1906 Ref - Rathbun , 1906

1973 Ref - Evans et al., 1974 Recorded as Podophthalmus vigil (Fabricus).

Genus: *Portunus* ***Hawaiian name(s): `ala`eke.***

Portunus longispinosus ***(Dana, 1852)***

1973 Ref - Evans et al., 1974 Recorded as Portunus longispinosus Rathbun.

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

Portunus sanguinolentus ***(Herbst, 1899) Common name(s): Blood-Spotted Swimming Crab; Hawaiian name(s): kuhonu; papa`i kuahonu; kuohonu.***

1973 Ref - Evans et al., 1974

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

Genus: *Scylla*

Scylla serrata ***(Forsskal, 1775) Introduced. Common name(s): Serrate Swimming Crab; Samoan Crab; Mangrove Crab; Red Crab.***

1973 Ref - Evans et al., 1974 Recorded as Scylla serrata de Man.

1987 Ref - Brewer & Assoc., 1987

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

1996 This Project

Genus: *Thalamita*

Thalamita admete ***(Herbst, 1803)***

1973 Ref - Evans et al., 1974

Thalamita crenata ***Latreille, 1900***

1973 Ref - Evans et al., 1974

1987 Ref - AECOS, 1987

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

1996 This Project

Thalamita crenata? ***Latreille, 1900***

1950 Spec - BPBM-S 5621

Thalamita edwardsi

1950 Spec - BPBM-S 5619

Thalamita edwardsi?

1948	Spec - BPBM-S 5335	

Thalamita integra ***Dana, 1852***

1915	Spec - BPBM-S 1590	
1916	Spec - BPBM-S 741	
1922	Spec - BPBM-S 1597	
1922	Spec - BPBM-S 718	
1922	Spec - BPBM-S 724	
1929	Spec - BPBM-S 3155	
1931	Spec - BPBM-S 3343	
1931	Spec - BPBM-S 3370	Middle Loch.
1938	Spec - BPBM-S 4418	
1938	Spec - BPBM-S 4478	
1939	Spec - BPBM-S 4426	
1947	Spec - BPBM-S 5305	
1947	Spec - BPBM-S 5312	
1948	Spec - BPBM-S 5322	
1948	Spec - BPBM-S 5332	
1948	Spec - BPBM-S 5334	
1950	Spec - BPBM-S 5618	
1973	Ref - Evans et al., 1974	
1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	
1978	Ref - Grovhoug, 1979	
1987	Ref - Brewer & Assoc., 1987	
1996	This Project	

Thalamita medipacifica

1923	Spec - BPBM-S 3210	

Thalamita quadridens

1950	Spec - BPBM-S 5623	

Unidentified Thalamita

1996	This Project	

Family: RANINIDAE

Genus: *Ranina*

Ranina serrata ***Common name(s): Kona crab, Red Frog Crab; Hawaiian name(s): papa`i kualoa;***

1902	Spec - BPBM-S 4993	

Family: SCYLLARIDAE

Genus: *Parribacus*

Parribacus antarcticus ***(Lund, 1793)*** ***Common name(s): Antarctic Slipper Lobster; Hawaiian name(s): ula***

1973	Ref - Evans et al., 1974	Off Pearl Harbor.

Genus: *Scyllarides*

Scyllarides squamosus ***(Milne Edwards, 1837)***

1973	Ref - Evans et al., 1974	
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	

Family: SERGESTIDAE

Genus: *Lucifer*

Lucifer sp.

1973	Ref - Evans et al., 1974	

Lucifer chacei ***Bowman, 1966***

1978	Ref - Grovhoug, 1979	

Legacy Project - Species Report (Cont.)

Family: STENOPODIDAE

Genus: *Stenopus*

Stenopus hispidus ***(Olivier, 1811)*** ***Hawaiian name(s): `opae huna.***

1973	Ref - Evans et al., 1974	
1996	This Project	

Family: XANTHIDAE

Unidentified Xanthidae

1979	Ref - AECOS, 1979	Off Pearl Harbor.
1996	This Project	

Genus: *Atergatopsis*

Atergatopsis immigrans ***(Edmondson, 1962)*** ***Introduced.***

1950	Ref - Edmondson, 1962	Recorded as Neoliomera immigrans.

Genus: *Carpilodes*

Carpilodes bellus ***(Dana, 1852)***

1916	Spec - BPBM-S 740	
1973	Ref - Evans et al., 1974	

Carpilodes ruber ***A. Milne Edwards, 1865***

1906	Ref - Rathbun , 1906	

Genus: *Chlorodiella*

Chlorodiella laevissima ***(Dana, 1852)***

1973	Ref - Evans et al., 1974	

Genus: *Etisus*

Etisus electra ***(Herbst, 1801)***

1937	Spec - BPBM-S 4382	
1973	Ref - Evans et al., 1974	

Etisus laevimanus ***(Randall, 1839)***

Unknown	Spec - BPBM-S 10394	
1906	Ref - Rathbun , 1906	
1929	Spec - BPBM-S 3276	
1931	Spec - BPBM-S 3342	
1931	Spec - BPBM-S 3369	Middle Loch.
1973	Ref - Evans et al., 1974	
1996	This Project	

Genus: *Glabropilumnus*

Glabropilumnus seminudus ***(Miers, 1884)*** ***Introduced.***

1950	Spec - BPBM-S 5640	Pearl Harbor drydock.
1950	Ref - Edmondson, 1952	Pearl Harbor drydock.
1962	Ref - Edmondson, 1962	
1973	Ref - Evans et al., 1974	

Genus: *Liocarpilodes*

Liocarpilodes binnguis ***New record for Pearl Harbor.***

1996	This Project	

Liocarpilodes integerrimus ***(Dana, 1852)***

1973	Ref - Evans et al., 1974	

Genus: *Lophozozymus*

Lophozozymus sp.

1987	Ref - Brewer & Assoc., 1987	

Lophozozymus dodone ***(Herbst, 1801)***

1973	Ref - Evans et al., 1974	

Genus: *Madaeus*

Madaeus simplex ***(A. Milne Edwards, 1873)***

1973	Ref - Evans et al., 1974	

Legacy Project - Species Report (Cont.)

Genus: ***Medaeus***

Medaeus simplex

1929	Spec - BPBM-S 3162	

Genus: ***Neoliomera***

Neoliomera immigrans ***Edmondson, 1962 Introduced.***

1950	Spec - BPBM-S 5625	
1962	Ref - Edmondson, 1962	

Genus: ***Neopanope***

Neopanope sp.

1929	Spec - BPBM-S 3437	

Genus: ***Panopeus***

Panopeus herbstii ***Milne-Edwards Introduced.***

1947	Spec - BPBM-S 5314	
1947	Ref - Edmondson, 1962	Recorded as Panopeus herpstii.

Panopeus pacificus ***(Edmondson, 1931) Introduced.***

1929	Spec - BPBM-S 3280	
1929	Spec - BPBM-S 3435	
1929	Ref - Edmondson, 1931	
1930	Spec - BPBM-S 5298	
1930	Ref - Edmondson, 1962	
1937	Spec - BPBM-S 4397	Identified by Takeda, Aug. 1979.
1947	Spec - BPBM-S 5304	Identified by Edmondson.
1948	Spec - BPBM-S 5325	
1948	Spec - BPBM-S 5333	
1948	Spec - BPBM-S 5336	
1948	Spec - BPBM-S 6135	
1949	Spec - BPBM-S 5578	Middle Loch.
1973	Ref - Evans et al., 1974	
1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	
1996	This Project	

Genus: ***Paramedeus***

Paramedeus simplex ***New record for Pearl Harbor.***

1996	This Project	

Genus: ***Phymodius***

Phymodius nitidus ***(Dana, 1852)***

1929	Spec - BPBM-S 3161	
1973	Ref - Evans et al., 1974	
1996	This Project	

Phymodius ungulatus ***New record for Pearl Harbor.***

1996	This Project	

Genus: ***Pilumnus***

Pilumnus longicornis ***Hilgend.***

1950	Spec - BPBM-S 5624	

Pilumnus minutus ***New record for Pearl Harbor.***

1996	This Project	

Pilumnus oahuensis ***Edmondson, 1931 Indigenous.***

1929	Spec - BPBM-S 3279	
1929	Spec - BPBM-S 3432	
1929	Ref - Edmondson, 1931	
1930	Ref - Edmondson, 1962	
1931	Spec - BPBM-S 3433	
1932	Spec - BPBM-S 3852	

1947 Spec - BPBM-S 5303
1948 Spec - BPBM-S 5324
1950 Spec - BPBM-S 5613
1950 Spec - BPBM-S 6131
1973 Ref - Evans et al., 1974
1973 Ref - McCain, 1974
1973 Ref - McCain, 1975
1987 Ref - Brewer & Assoc., 1987
1996 This Project

Genus: *Platypodia*

Platypodia eydouxii ***(A. Milne Edwards, 1865)***

1916 Spec - BPBM-S 735
1929 Spec - BPBM-S 3156
1931 Spec - BPBM-S 3344
1973 Ref - Evans et al., 1974 Recorded as Platypodia eydouxi.
1996 This Project

Platypodia semigranosa

1950 Spec - BPBM-S 5638

Unidentified Platypodia

1996 This Project

Genus: *Trapezia*

Trapezia guttata ***Ruppel, 1830***

1973 Ref - Evans et al., 1974 Off Pearl Harbor.

Trapezia intermedia ***New record for Pearl Harbor.***

1996 This Project

Trapezia wardi ***New record for Pearl Harbor.***

1996 This Project

Genus: *Xanthias*

Xanthias sp.

1973 Ref - Evans et al., 1974

Order: STOMATOPODA

Family: GONODACTYLIDAE

Genus: *Gonodactylus*

Gonodactylus falcatus ***(Forsskal, 1775)***

1973 Ref - Evans et al., 1974
1987 Ref - AECOS, 1987
1993 Ref - Brock, 1995 Recorded as Gonodactylus alohoa.
1996 This Project

Genus: *Pseudosquilla*

Pseudosquilla ciliata ***(Fabricus, 1787) Hawaiian name(s): aloalo.***

1938 Spec - BPBM-S 4567
1973 Ref - Evans et al., 1974 Recorded as Pseudosquilla ciliata Miers.
1996 This Project

Family: LYSIOSQUILLIDAE

Genus: *Lysiosquilla*

Lysiosquilla maculatus ***(Fabr.)***

1923 Spec - BPBM-S 2522

Family: SQUILLIDAE

Genus: *Squilla*

Squilla sp.

1986 Ref - Lenihan, 1990

Legacy Project - Species Report (Cont.)

Class: INSECTA
Order: COLLEMBOLA
Unidentified Collembola
1996 This Project

Phylum: SIPUNCULA
Class: SIPUNCULIDA
Unidentified Sipunculida
1996 This Project

Family: PHASCOLOSOMATIDAE
Genus: *Phascolosoma*
Phascolosoma perlucens ***Baird, 1868***
1973 Ref - Evans et al., 1974 Recorded as Phascolosoma dentigerum (Selenka, deMan & Bulo.

Phylum: BRYOZOA
Unidentified Bryozoa
Unknown Spec - BPBM-K 649
1975 Spec - BPBM-K 684
1976 Spec - BPBM-K 661 Hospital Point.
1976 Ref - Cooke et al., 1980

Class: GYMNOLAEMATA
Order: CTENOSTOMATA
Family: VESICULARIIDAE
Genus: *Amathia*
Amathia sp.
1950 Spec - BPBM-K 214
1972 Ref - Long, 1974 Off Pearl Harbor.

Amathia sp.?
1947 Spec - BPBM-K 234

Amathia distans ***Busk, 1886 Introduced.***
1948 Spec - BPBM-K 207
1948 Spec - BPBM-K 210
1973 Ref - Evans et al., 1974
1978 Ref - Grovhoug, 1979
1996 This Project

Amathia distans? ***Busk, 1886 Introduced.***
Unknown Spec - BPBM-K 455

Genus: *Bowerbankia*
Bowerbankia sp.
1972 Ref - Long, 1974 Off Pearl Harbor.

Genus: *Zoobotryon*
Unidentified Zoobotryon
1996 This Project

Zoobotryon verticillatum ***(Della Chiaje) Introduced.***
1921 Spec - BPBM-K 236
1940 Spec - BPBM-K 233
1940 Spec - BPBM-K 310
1948 Spec - BPBM-K 216
1948 Spec - BPBM-K 346
1975 Spec - BPBM-K 601 Merry Point; off Fuel Pier Array. Identified by J. Grovhoug.

Legacy Project - Species Report (Cont.)

Order: CYCLOSTOMATA

Family: LICHENOPORIDAE

Genus: *Lichenopora*

Lichenopora sp.

1972	Ref - Long, 1974	

Family: TUBULIPORIDAE

Genus: *Tubulipora*

Tubulipora sp.

1972	Ref - Long, 1974	Off Pearl Harbor.

Order: CHEILOSTOMATA

Family: AETEIDAE

Genus: *Aetea*

Aetea rufopuncta

1916	Spec - BPBM-S 736	

Aetea truncata ***(Landsborough, 1852) Introduced.***

1972	Ref - Long, 1974	Off Pearl Harbor.
1975	Ref - Grovhoug, 1976	
1996	This Project	

Family: BEANIIDAE

Genus: *Beania*

Beania discodermiae ***(Ortmann, 1890)***

1972	Ref - Long, 1974	Off Pearl Harbor.

Family: BUGULIDAE

Genus: *Bugula*

Bugula sp.

1929	Spec - BPBM-K 232	
1978	Ref - Grovhoug, 1979	
1996	This Project	

Bugula neritina ***(Linnaeus, 1758) Introduced.***

Unknown	Spec - BPBM-K 240	
1921	Spec - BPBM-K 235	
1921	Spec - BPBM-K 239	
1935	Spec - BPBM-K 217	
1935	Spec - BPBM-K 220	
1935	Ref - Edmondson, 1944	
1935	Ref - Ingram, 1937	
1940	Spec - BPBM-K 218	
1940	Spec - BPBM-K 219	
1940	Spec - BPBM-K 224	
1940	Spec - BPBM-K 225	
1940	Spec - BPBM-K 238	
1947	Spec - BPBM-K 237	
1948	Spec - BPBM-K 206	
1948	Spec - BPBM-K 215	
1950	Spec - BPBM-K 209	
1950	Spec - BPBM-K 211	
1950	Spec - BPBM-K 213	
1972	Ref - Long, 1974	
1973	Ref - Evans et al., 1974	
1975	Ref - Grovhoug, 1976	
1978	Ref - Grovhoug, 1979	
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
1996	This Project	

Legacy Project - Species Report (Cont.)

Bugula stolonifera ***Introduced.***

Unknown	Spec - BPBM-K 466	
1940	Spec - BPBM-K 223	
1940	Spec - BPBM-K 226	
1940	Spec - BPBM-K 230	
1946	Spec - BPBM-K 231	
1948	Spec - BPBM-K 208	
1948	Spec - BPBM-K 227	
1948	Spec - BPBM-K 229	
1950	Spec - BPBM-K 212	
1950	Spec - BPBM-K 228	
1972	Ref - Long, 1974	Off Pearl Harbor. Recorded as Bugula californica.
1973	Ref - Evans et al., 1974	Recorded as Bugula californica.
1975	Ref - Grovhoug, 1976	Recorded as Bugula californica.
1993	Ref - Brock, 1994	Recorded as Bugula californica.
1994	Ref - Brock, 1995	Recorded as Bugula californica.
1996	This Project	

Family: CELLEPORARIIDAE

Genus: *Celleporaria*

Celleporaria costazii ***(Audouin, 1826)***

1972	Ref - Long, 1974	Off Pearl Harbor.

Genus: *Holoporella*

Holoporella sp.

1975	Ref - Grovhoug, 1976	
1978	Ref - Grovhoug, 1979	

Family: CELLEPORIDAE

Genus: *Cellepora*

Cellepora vagans ***(Busk, 1855)***

1972	Ref - Long, 1974	Recorded as Celleporaria vagans.

Family: CRIBRILINIDAE

Genus: *Cribrilaria*

Cribrilaria radiata ***(Moll, 1803)***

1972	Ref - Long, 1974	Off Pearl Harbor.

Family: MICROPORELLIDAE

Genus: *Microporella*

Microporella ciliata ***(Pallas, 1766)***

1972	Ref - Long, 1974	

Family: MUCRONELLIDAE

Genus: *Parasmittina*

Parasmittina sp.

1972	Ref - Long, 1974	
1996	This Project	

Parasmittina spathulata ***(Smitt, 1873)***

1972	Ref - Long, 1974	Off Pearl Harbor.

Family: RETEPORIDAE

Genus: *Reteporellina*

Reteporellina denticulata ***(Busk, 1884)*** ***New record for Pearl Harbor.***

1972	Ref - Long, 1974	Off Pearl Harbor.
1996	This Project	

Genus: *Rhynchozoon*

Rhynchozoon sp.

1972	Ref - Long, 1974	Off Pearl Harbor.

Family: SAVIGNYELLIDAE

Genus: *Savignyella*

Savignyella lafontii ***(Audouin, 1826)***

1972	Ref - Long, 1974	
1996	This Project	

Family: SCHIZOPORELLIDAE

Genus: *Schizoporella*

Schizoporella errata ***(Waters, 1878) Introduced.***

Unknown	Spec - BPBM-K 253	
1973	Ref - McCain, 1974	Recorded as Schizoporella sp..
1973	Ref - McCain, 1975	Recorded as Schizoporella sp..
1985	Ref - Hurlbut, 1990	Recorded as S. unicornis (Johnston, 1847).
1986	Ref - Lenihan, 1990	
1996	This Project	

Schizoporella unicornis ***(Johnston, 1847) Introduced.***

1935	Ref - Edmondson, 1944	
1935	Ref - Ingram, 1937	
1972	Ref - Long, 1974	
1975	Ref - Grovhoug, 1976	
1993	Ref - Brock, 1994	Recorded as S. unicornis (Johnston, 1847).
1994	Ref - Brock, 1995	Recorded as S. unicornis (Johnston, 1847).
1996	This Project	

Unidentified Schizoporella

1996	This Project	

Family: SCRUPOCELLARIIDAE

Genus: *Scrupocellaria*

Scrupocellaria sinuosa ***Canu & Bassler, 1927***

1972	Ref - Long, 1974	Off Pearl Harbor.

Family: STEGANOPORELLIDAE

Genus: *Steganoporella*

Steganoporella sp.

1972	Ref - Long, 1974	Off Pearl Harbor.

Family: THALAMOPORELLIDAE

Genus: *Thalamoporella*

Thalamoporella hawaiiana ***Soule & Soule, 1970***

1972	Ref - Long, 1974	Off Pearl Harbor.

Family: VITTATICELLIDAE

Genus: *Vittaticella*

Vittaticella elegans ***(Busk, 1852)***

1972	Ref - Long, 1974	Off Pearl Harbor.

Family: WATERISPORIDAE

Genus: *Waterispora*

Waterispora edmondsoni ***Soule & Soule, 1968 Introduced.***

1972	Ref - Long, 1974	
1975	Ref - Grovhoug, 1976	
1978	Ref - Grovhoug, 1979	
1996	This Project	

Phylum: ECHINODERMATA

Class: STELLEROIDEA

Order: PLATYASTERIDA

Family: LUIDIIDAE

Genus: *Luidia*

Luidia hystrix ***Fisher Hawaiian name(s): la kai; pe`a.***

1902	Spec - BPBM-W 1023	

1902 Spec - BPBM-W 654

Order: VALVATIDA

Family: GONIASTERIDAE

Genus: *Plinthaster*

Plinthaster ceramoidea ***(Fisher, 1906)***

1978 Spec - BPBM-W 3014 Off Pearl Harbor; dredge spoil site. Identified by D.M. Devaney.

Family: OPHIODIASTERIDAE

Genus: *Linckia*

Linckia multiflora ***(Lamarck)***

1972 Spec - BPBM-W 2010 150 yds NW from Buoy "1" at harbor entrance. Identified by D.M. Devaney.

Family: OREASTERIDAE

Genus: *Culcita* ***Hawaiian name(s): pe`a.***

Culcita novaeguineae f. arenosa

Unknown Spec - BPBM-W 627

1902 Spec - BPBM-W 1026

Culcita novaeguineae f. nesiotis ***Fisher***

Unknown Spec - BPBM-W 626

Order: FORCIPULATIDA

Family: ASTERIIDAE

Genus: *Distolasterias*

Distolasterias euplecta ***Fisher, 1906***

1982 Spec - BPBM-W 3028 Off Pearl Harbor; dredge spoil site. Identified by D.M. Devaney, 1982.

Order: OPHIURIDA

Family: AMPHIURIDAE

Genus: *Amphipholis*

Amphipholis squamata ***(Delle Chiaje, 1829)***

1972 Spec - BPBM-W 2480 On the N dolphin piling (wooden) near the sound measurement facility. Identified by D.M. Devaney.

1973 Ref - Evans et al., 1974

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Genus: *Ophionereis*

Ophionereis porrecta ***Lyman***

1967 Spec - BPBM-W 2579 Ewa End.

Family: OPHIACTIDAE

Genus: *Histampica*

Histampica cythera ***(A. H. Clark, 1949)***

1982 Spec - BPBM-W 3011 Off Pearl Harbor; dredge spoil site. Identified by D.M. Devaney. May 1982.

1982 Spec - BPBM-W 3052 Off Pearl Harbor; dredge spoil site. Identified by D.M. Devaney, 13 Oct 1982.

Genus: *Ophiactis*

Ophiactis sp.

1982 Spec - BPBM-W 3012 Off Pearl Harbor; dredge spoil site. Identified by D.M. Devaney. May 1982.

Ophiactis dyscrita ***Clark, 1911***

1949 Ref - Clark, 1949 USNM 6927.

Ophiactis modesta ***Brock, 1888***

1938 Spec - BPBM-W 1031

1942 Ref - Ely, 1942

Ophiactis savignyi ***(Muller & Troschel, 1842)***

Unknown Spec - BPBM-W 370

1929 Spec - BPBM-W 766

1933 Ref - Edmondson, 1933

1937 Spec - BPBM-W 957

1938 Spec - BPBM-W 965

1939 Spec - BPBM-W 969

1942 Ref - Ely, 1942
1949 Spec - BPBM-W 1180
1949 Ref - Clark, 1949
1973 Ref - Evans et al., 1974
1973 Ref - McCain, 1974
1973 Ref - McCain, 1975
1979 Ref - AECOS, 1979 Off Pearl Harbor.
1987 Ref - AECOS, 1987
1996 This Project

Family: OPHIOCOMIDAE
Genus: *Ophiocoma*
Ophiocoma sexradia ***(Duncan, 1887)***
1973 Ref - Evans et al., 1974

Family: OPHIOTHRICIDAE
Genus: *Macrophiothrix*
Macrophiothrix demessa ***(Lyman)***
1967 Spec - BPBM-W 2580 Ewa End.

Class: ECHINOIDEA
Order: CIDAROIDA
Family: CIDARIDAE
Genus: *Eucidaris*
Eucidaris metularia ***(Lamarck, 1816) Hawaiian name(s): ha`ue`ue; peni.***
1973 Ref - Evans et al., 1974

Order: DIADEMATOIDA
Family: DIADEMATIDAE
Genus: *Diadema*
Diadema paucispinum ***Agassiz, 1863***
1973 Ref - Evans et al., 1974
1996 This Project

Order: TEMNOPLEUROIDA
Family: TEMNOPLEURIDAE
Genus: *Mespilia*
Mespilia globulus ***(Linn., 1758)***
1950 Spec - BPBM-W 1200 From boat in dry dock.. Identified by D.M. Devaney.

Family: TOXOPNEUSTIDAE
Genus: *Pseudoboletia*
Pseudoboletia indiana ***(Michelin, 1863)***
1979 Ref - AECOS, 1979 Off Pearl Harbor.

Genus: *Tripneustes*
Tripneustes gratilla ***(Linnaeus, 1758) Hawaiian name(s): hawa`e; hawa`e maoli; hawa`e po`ohina.***
1973 Ref - Evans et al., 1974
1996 This Project

Order: ECHINOIDA
Family: ECHINOMETRIDAE
Genus: *Echinometra*
Echinometra mathaei ***(de Blainville, 1825) New record for Pearl Harbor.***
1979 Ref - AECOS, 1979 Off Pearl Harbor.
1996 This Project

Genus: *Heterocentrotus*
Heterocentrotus mammillatus ***(Linnaeus, 1758) Hawaiian name(s): ha`uke`uke iwi loloa; ha`ue`ue; `ina `ula;***
1973 Ref - Evans et al., 1974

Legacy Project - Species Report (Cont.)

Class: HOLOTHUROIDEA
Order: ASPIDOCHIROTIDA
Family: HOLOTHURIIDAE
Genus: *Actinopyga*

Actinopyga mauritiana ***(Quoy & Gaimard, 1833)*** ***New record for Pearl Harbor.***

1996	This Project	

Genus: *Holothuria*

Holothuria atra ***Jager, 1833*** ***New record for Pearl Harbor.***

1996	This Project	

Holothuria impatiens ***Forsskal, 1775***

1979	Ref - AECOS, 1979	Off Pearl Harbor.

Holothuria pervicax ***(Selenka, 1867)***

1973	Ref - Evans et al., 1974	

Order: APODIDA
Family: SYNAPTIDAE
Genus: *Ophiodesoma*

Ophiodesoma spectabilis ***Fisher, 1907*** ***Indigenous.***

1907	Ref - Fisher, 1907	USNM 21226.
1955	Spec - BPBM-W 1234	On beach.
1973	Ref - Evans et al., 1974	
1987	Ref - AECOS, 1987	
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
1996	This Project	

Phylum: CHAETOGNATHA
Class: SAGITTOIDEA
Order: APHRAGMOPHORA
Family: PTEROSAGITTIDAE
Genus: *Pterosagitta*

Pterosagitta sp.

1973	Ref - Evans et al., 1974	

Family: SAGITTIDAE
Genus: *Sagitta*

Sagitta sp.

1973	Ref - Evans et al., 1974	

Sagitta enflata ***Grassi, 1883***

1978	Ref - Grovhoug, 1979	

Sagitta regularis ***Aida, 1897***

1978	Ref - Grovhoug, 1979	

Phylum: CHORDATA

Unidentified Chordata

1921	Spec - BPBM-Y 121	
1924	Spec - BPBM-Y 112	
1929	Spec - BPBM-Y 128	
1929	Spec - BPBM-Y 129	
1929	Spec - BPBM-Y 130	
1942	Spec - BPBM-Y 111	
1947	Spec - BPBM-Y 167	
1948	Spec - BPBM-Y 171	
1948	Spec - BPBM-Y 172	
1948	Spec - BPBM-Y 174	
1948	Spec - BPBM-Y 176	
1948	Spec - BPBM-Y 177	

1948 Spec - BPBM-Y 178

Unidentified Urochordata

1996 This Project

Class: ASCIDIACEA

Unidentified Ascidiacea

1979 Ref - AECOS, 1979 Off Pearl Harbor.

1996 This Project

Order: APLOUSOBRANCHIA

Family: CLAVELINIDAE

Genus: *Clavelina*

Clavelina sp.

1973 Ref - Evans et al., 1974

Family: DIDEMNIDAE

Unidentified Didemnidae

1986 Ref - Lenihan, 1990

1996 This Project

Genus: *Didemnum*

Didemnum sp.

1972 Ref - Long, 1974

1985 Ref - Hurlbut, 1990

Didemnum candidum ***Savigny, 1816 Introduced.***

1985 Ref - Hurlbut, 1990

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

Didemnum edmondsoni ***Eldredge, 1966***

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

Genus: *Diplosoma*

Diplosoma listerianum ***(Milne-Edwards, 1841) Introduced.***

1975 Ref - Grovhoug, 1976 Recorded as Diplosoma macdonaldi.

1978 Ref - Grovhoug, 1979 Recorded as Diplosoma macdonaldi.

1985 Ref - Hurlbut, 1990

1987 Ref - Brewer & Assoc., 1987 Recorded as Diplosoma macdonaldi.

Genus: *Tridemnum*

Tridemnum savignyi ***(Herdman, 1886)***

1975 Ref - Grovhoug, 1976

Family: POLYCLINIDAE

Unidentified Polyclinidae

1947 Spec - BPBM-Y 168

1948 Spec - BPBM-Y 173

1948 Spec - BPBM-Y 175

Genus: *Polyclinum*

Polyclinum sp.

1975 Ref - Grovhoug, 1976

Polyclinum constellatum ***Savigny, 1816***

1973 Ref - McCain, 1974

1973 Ref - McCain, 1975

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

1996 This Project

Polyclinum vasculosum ***Pizon, 1908***

1920 Ref - Tokioka, 1967 USNM 11755.

1972 Ref - Long, 1974

Order: PHLEBOBRANCHIA

Family: ASCIDIIDAE

Genus: *Ascidia*

Ascidia n. sp. ***New record for Hawaii. Known only from Hawaii.***

1996 This Project

Ascidia sp.

Unknown Spec - BPBM-Y 205 Identified by D.P. Abbott, Nov 1980.

1973 Ref - Evans et al., 1974

1973 Ref - McCain, 1974

1973 Ref - McCain, 1975

1976 Spec - BPBM-Y 245 Identified by P. Ching.

1996 This Project

Ascidia sp. B ***New record for Pearl Harbor. Introduced.***

1996 This Project

Ascidia interrupta

1993 Ref - Brock, 1994 Recorded as Ascidia interrupta..

1994 Ref - Brock, 1995 Recorded as Ascidia interrupta..

Ascidia melanostoma ***(Sluiter, 1885)***

1972 Ref - Long, 1974

1996 This Project

Ascidia sydneiensis ***(Stimpson, 1855) Introduced.***

Unknown Spec - BPBM-Y 217 Scraped from bottom of U.S.S. Dobin. Identified by D.P. Abbott, Nov 1980.

1976 Spec - BPBM-Y 244 Pearl Harbor?. Identified by P. Ching.

1996 This Project

Genus: *Phallusia*

Phallusia nigra ***Savigny, 1816 Introduced.***

1985 Ref - Hurlbut, 1990

1993 Ref - Brock, 1994 Recorded as Ascidia nigra.

1994 Ref - Brock, 1995 Recorded as Ascidia nigra.

1996 This Project

Family: CIONIDAE

Genus: *Ciona*

Ciona intestinalis ***(Linnaeus, 1767) Introduced.***

Unknown Spec - BPBM-Y 218 Scraped from bottom of U.S.S. Dobin. Identified by D.P. Abbott, Nov 1980.

1975 Ref - Grovhoug, 1976

1976 Ref - Cooke et al., 1980

Family: PEROPHORIDAE

Genus: *Perophora*

Perophora sp.

1975 Ref - Grovhoug, 1976

Perophora annectens ***New record for Pearl Harbor.***

1996 This Project

Order: STOLIDOBRANCHIA

Family: PYURIDAE

Genus: *Herdmania*

Herdmania momus ***(Savigny, 1816) Introduced.***

1972 Ref - Long, 1974

1973 Ref - Evans et al., 1974

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

1996 This Project

Legacy Project - Species Report (Cont.)

Genus: ***Microsomus***

Microcosmus exasperatus ***New record for Pearl Harbor. Introduced.***

1996 This Project

Family: STYELIDAE

Genus: ***Botrylloides***

Botrylloides sp.

1996 This Project

Botrylloides sp. (grey) sp.

1973 Ref - McCain, 1974 Recorded as Botrylloides sp. (grey).

1973 Ref - McCain, 1975 Recorded as Botrylloides sp. (grey).

Botrylloides sp. (red) sp.

1973 Ref - McCain, 1974 Recorded as Botrylloides sp. (red).

1973 Ref - McCain, 1975 Recorded as Botrylloides sp. (red).

Botrylloides nigrum

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

Genus: ***Botryllus***

Botryllus sp. ***Introduced.***

1975 Ref - Grovhoug, 1976 Recorded as Botrylloides.

1978 Ref - Grovhoug, 1979 Recorded as Botrylloides.

1996 This Project

Genus: ***Polyandrocarpa***

Polyandrocarpa sp. A ***New record for Pearl Harbor.***

1996 This Project

Polyandrocarpa sp. B sp. ***New record for Pearl Harbor.***

1996 This Project

Genus: ***Styela***

Styela sp.

1973 Ref - Evans et al., 1974

Styela areoleata ***Heller, 1878***

1975 Ref - Grovhoug, 1976

Styela partita ***(Stimson, 1852)***

Unknown Spec - BPBM-Y 228 Scraped from bottom of U.S.S. Dobin. Identified by D.P. Abbott.

1975 Ref - Grovhoug, 1976

1976 Spec - BPBM-Y 239 Identified by P. Ching.

Styela partita? ***(Stimson, 1852)***

1929 Spec - BPBM-Y 102

Genus: ***Symplegma***

Symplegma sp. ***Tokioka, 1949***

1929 Spec - BPBM-Y 110

1996 This Project

Symplegma oceania ***Tokioka, 1961 Introduced.***

1975 Ref - Grovhoug, 1976 Recorded as Symplegma connectans.

1978 Ref - Grovhoug, 1979 Recorded as Symplegma connectans.

1996 This Project

Symplegma reptans ***New record for Hawaii. Introduced.***

1996 This Project

Legacy Project - Species Report (Cont.)

Class: THALIACEA
Order: DOLIOLIDA
Family: DOLIOLIDAE
Genus: *Dolioum*
Dolioum sp.

1973	Ref - Evans et al., 1974	

Class: APPENDICULARIA
Order: COPELATA
Family: OIKOPLEURIDAE
Genus: *Oikopleura*
Oikopleura sp.

1973	Ref - Evans et al., 1974	

Class: CHONDRICHTHYES
Order: LAMNIFORMES
Family: CARCHARHINIDAE
Genus: *Carcharhinus*
Carcharhinus limbatus ***(Valenciennes, 1841)***

1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	

Genus: *Glyphis*
Glyphis granifera ***Pease***

Unknown	Spec - BPBM-MO 64518	Ford Island. Catalogue V.

Family: SPHYRNIDAE
Genus: *Sphyrna*
Sphyrna lewini ***(Griffith & Smith, 1834)***

1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	
1987	Ref - Brewer & Assoc., 1987	

Order: RAJIFORMES
Family: MYLIOBATIDAE
Genus: *Aetobatus*
Aetobatus nana ***(Loman)***

1948	Spec - BPBM-S 7208	Identified by Koichiro Nakamura, 1985.
1948	Spec - BPBM-S 8788	Drydock.

Aetobatus narinari ***(Euphrasen, 1790)***

1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	
1987	Ref - Brewer & Assoc., 1987	

Class: ACTINOPTERYGII
Order: ELOPIFORMES
Family: ALBULIDAE
Genus: *Albula*
Albula vulpes ***(Linnaeus, 1758)***

1973	Ref - Evans et al., 1974	

Family: ELOPIDAE
Genus: *Elops*
Elops hawaiiensis ***Regan, 1909***

1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	

Order: ANGUILLIFORMES
Family: CONGRIDAE
Genus: *Conger*
Conger cinreus marginatus ***Valenciennes, 1841***

1973	Ref - Evans et al., 1974	Recorded as C. marginatus.
1978	Ref - Grovhoug, 1979	Recorded as C. cinreus.

Legacy Project - Species Report (Cont.)

Family: MURAENIDAE

Genus: *Gymnothorax*

Gymnothorax sp.

1979	Ref - AECOS, 1979	Off Pearl Harbor.
1986	Ref - Lenihan, 1990	
1996	This Project	

Gymnothorax flavimarginatus ***(Ruppell, 1828)***

1973	Ref - Evans et al., 1974	

Gymnothorax petelli ***(Bleeker, 1856)***

1973	Ref - Evans et al., 1974	

Gymnothorax undulatus ***(Lacepede, 1803)***

1973	Ref - Evans et al., 1974	
1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	
1978	Ref - Grovhoug, 1979	
1987	Ref - Brewer & Assoc., 1987	
1994	Ref - Brock, 1995	

Order: CLUPEIFORMES

Family: ENGRAULIDAE

Genus: *Encrasicholina*

Encrasicholina purpurea ***Fowler, 1900***

1961	Ref - Au, 1965	Recorded as Stolophorus purpureus.
1964	Spec - BPBM-I 25806	
1973	Ref - Evans et al., 1974	Recorded as Stolephorus purpureus Fowler.
1978	Ref - Grovhoug, 1979	Recorded as Stolephorus purpureus Fowler.
1986	Ref - Somerton et al., 1993	Recorded as Encrasicholina purpureus.
1987	Ref - AECOS, 1987	Recorded as Stolephorus purpureus Fowler.
1993	Ref - Brock, 1994	Recorded as Stolephorus purpureus.
1994	Ref - Brock, 1995	Recorded as Stolephorus purpureus.

Order: MYCTOPHIFORMES

Family: SYNODONTIDAE

Genus: *Saurida*

Saurida gracilis ***(Quoy & Gaimard, 1824)***

1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	
1993	Ref - Brock, 1994	

Saurida nebulosa ***Valenciennes, 1849***

1992	Spec - BPBM-I 35396	

Genus: *Synodus*

Synodus sp.

1996	This Project	

Synodus variegatus ***(Lacepede, 1803)***

1973	Ref - Evans et al., 1974	

Order: GONORYNCHIFORMES

Family: CHANIDAE

Genus: *Chanos*

Chanos sp. ***(Forsskal, 1775)***

1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	
1987	Ref - Brewer & Assoc., 1987	
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	

Legacy Project - Species Report (Cont.)

Order: LOPHIIFORMES

Family: ANTENNARIIDAE

Genus: *Antennarius*

Antennarius commersoni

1932	Spec - BPBM-I 3491	Near coral dock.

Antennarius pictus ***(Shaw & Nodder, 1974)***

1923	Spec - BPBM-I 5144	
1973	Ref - Evans et al., 1974	Recorded as chironectes Lacepede.

Genus: *Antennatus*

Antennatus tuberosus

1962	Spec - BPBM-I 25788	

Order: GADIFORMES

Family: CARAPODIDAE

Genus: *Carapus*

Carapus margaritiferae ***(Rendahl, 1921)***

1973	Ref - Evans et al., 1974	

Order: ATHERINIFORMES

Family: BELONIDAE

Genus: *Tylosurus*

Tylosurus crocodilus ***(Peron & LeSueur, 1821)***

1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	

Family: CYPRINODONTIDAE

Genus: *Fundulus*

Fundulus grandis ***Introduced.***

1905	Ref - Brock, 1960	
1905	Ref - Maciolek, 1984	
1907	Ref - Van Dine, 1907	
1987	Ref - Randall, 1987	

Family: HEMIRAMPHIDAE

Genus: *Hemiramphus*

Hemiramphus depauperatus ***Lay & Bennett, 1839***

1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	
1987	Ref - Brewer & Assoc., 1987	

Family: POECILIIDAE

Unidentified Poeciliidae

1996	This Project	

Genus: *Gambusia*

Gambusia affinis ***Introduced.***

1905	Ref - Brock, 1960	
1905	Ref - Maciolek, 1984	
1907	Ref - Van Dine, 1907	
1987	Ref - Randall, 1987	

Genus: *Poecilia*

Poecilia latipinna ***(LeSueur)*** ***Introduced.***

1905	Ref - Brock, 1960	Recorded as Mollienesia latipina.
1905	Ref - Maciolek, 1984	Recorded as Mollienesia latipina.
1907	Ref - Van Dine, 1907	Recorded as Poecilia latipina.
1973	Ref - Evans et al., 1974	
1987	Ref - Randall, 1987	Recorded as Poecilia latipina.

Legacy Project - Species Report (Cont.)

Order: POLYMIXIIFORMES

Family: HOLOCENTRIDAE

Genus: *Myripristis*

Myripristis berndti ***Jordan & Evermann, 1903***

1973	Ref - Evans et al., 1974	Recorded as murdjan (Forsskal).
1978	Ref - Grovhoug, 1979	Recorded as murdjan (Forsskal).
1996	This Project	

Genus: *Neoniphon*

Neoniphon sammara ***(Forsskal, 1775)***

1973	Ref - Evans et al., 1974	Recorded as Flammeo sammara (Forsskal).
1978	Ref - Grovhoug, 1979	Recorded as Flammeo sammara (Forsskal).

Genus: *Sargocentron*

Sargocentron diadema ***(Lacepede, 1802) Hawaiian name(s): 'ala 'ihi kalaloa.***

1996	Spec - BPBM-I 37326	NE side of West Loch channel.

Order: GASTEROSTEIFORMES

Family: AULOSTOMIDAE

Genus: *Aulostomus*

Aulostomus chinensis ***(Linnaeus, 1766)***

1973	Ref - Evans et al., 1974	
1996	This Project	

Family: SYNGNATHIDAE

Genus: *Doryrhamphus*

Doryrhamphus exisis ***Kaup, 1856 New record for Pearl Harbor.***

1996	This Project	

Genus: *Hippocampus*

Hippocampus kuda ***Bleeker, 1852***

1924	Spec - BPBM-I 3787	

Genus: *Micrognathus*

Micrognathus edmondsoni? ***(Pietschmann, 1930)***

1973	Ref - Evans et al., 1974	

Order: SCORPAENIFORMES

Family: SCORPAENIDAE

Genus: *Brachirus*

Brachirus barberi ***(Eschmeyer & Randall)***

1973	Ref - Evans et al., 1974	

Genus: *Scorpaenopsis*

Scorpaenopsis diabolus ***(Cuvier, 1829)***

1973	Ref - Evans et al., 1974	Recorded as S. diabolus (Eschmeyer & Anderson).

Scorpaenopsis gibbosa ***(Bloch & Snyder, 1801)***

1979	Ref - AECOS, 1979	Off Pearl Harbor. Recorded as S. gibbosus.

Genus: *Sebastapistes*

Sebastapistes coniorta ***(Jenkins, 1903)***

1973	Ref - Evans et al., 1974	Recorded as Scorpaena coniorta (Jenkins).

Order: PERCIFORMES

Family: ACANTHURIDAE

Genus: *Acanthurus*

Acanthurus blochi ***(Cuvier, 1829) New record for Pearl Harbor.***

1996	This Project	

Acanthurus dussumieri ***Cuvier & Valenciennes, 1835***

1973	Ref - Evans et al., 1974	
1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	
1978	Ref - Grovhoug, 1979	

1986 Ref - Lenihan, 1990

Acanthurus guttatus ***Bloch & Schneider, 1801 New record for Pearl Harbor.***

1996 This Project

Acanthurus mata ***(Cuvier, 1829)***

1973 Ref - Evans et al., 1974
1973 Ref - McCain, 1974
1973 Ref - McCain, 1975
1978 Ref - Grovhoug, 1979
1986 Ref - Lenihan, 1990

Acanthurus nigrofuscus ***(Forsskal, 1775) New record for Pearl Harbor.***

1996 This Project

Acanthurus olivaceus ***(Bloch & Schneider, 1801)***

1973 Ref - Evans et al., 1974

Acanthurus triostegus ***(Linnaeus, 1758)***

1973 Ref - Evans et al., 1974
1973 Ref - McCain, 1974
1973 Ref - McCain, 1975
1979 Ref - AECOS, 1979 Off Pearl Harbor. Recorded as A. trigostegus sandvicensis.
1996 This Project

Acanthurus xanthopterus ***Cuvier & Valenciennes, 1835***

1973 Ref - Evans et al., 1974
1973 Ref - McCain, 1974
1973 Ref - McCain, 1975
1978 Ref - Grovhoug, 1979
1986 Ref - Lenihan, 1990
1993 Ref - Brock, 1994
1994 Ref - Brock, 1995
1996 This Project

Genus: *Ctenochaetus*

Ctenochaetus strigosus ***(Bennett, 1828)***

1973 Ref - Evans et al., 1974
1996 This Project

Genus: *Naso*

Naso brevirostris ***(Valenciennes, 1835)***

1978 Ref - Grovhoug, 1979
1986 Ref - Lenihan, 1990
1996 This Project

Naso unicornis ***(Forsskal, 1775)***

1973 Ref - Evans et al., 1974
1986 Ref - Lenihan, 1990
1994 Ref - Brock, 1995
1996 This Project

Genus: *Zanclus*

Zanclus cornutus ***(Linnaeus, 1758)***

1973 Ref - Evans et al., 1974 Recorded as canescens (Linnaeus).
1978 Ref - Grovhoug, 1979
1993 Ref - Brock, 1994
1994 Ref - Brock, 1995
1996 This Project

Genus: *Zebrasoma*

Zebrasoma flavescens ***(Bennett, 1828)***

1973 Ref - Evans et al., 1974
1978 Ref - Grovhoug, 1979

1996 This Project

Zebrasoma veliferum ***(Bloch, 1797)***

1973 Ref - Evans et al., 1974

1986 Ref - Lenihan, 1990

Family: APOGONIDAE

Genus: *Apogon*

Apogon sp.

1986 Ref - Lenihan, 1990

Apogon kallopterus ***Bleeker, 1856***

1973 Ref - Evans et al., 1974 Recorded as snyderi, Jordan and Evermann.

1996 This Project

Apogon snyderi ***Jordan & Evermann, 1903***

1978 Ref - Grovhoug, 1979

Genus: *Foa*

Foa brachygramma ***(Jenkins, 1903) Hawaiian name(s): 'upapalu.***

1973 Ref - Evans et al., 1974 Recorded as brachygrammus (Jenkins).

1978 Ref - Grovhoug, 1979

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

1996 Spec - BPBM-I 37322 West Loch; Oyster Reef.

Family: BLENNIIDAE

Unidentified Blenniidae

1987 Ref - Brewer & Assoc., 1987

Genus: *Cirripectus*

Cirripectus vanderbilti ***(Fowler, 1938) New record for Pearl Harbor.***

1996 This Project

Genus: *Entomacrodus*

Entomacrodus marmoratus ***(Bennett, 1928)***

1973 Ref - Evans et al., 1974

Genus: *Exallias*

Exallias sp.

1994 Ref - Brock, 1995

Exallias brevis ***(Kner, 1868)***

1973 Ref - Evans et al., 1974

Genus: *Omobranchus*

Omobranchus elongatus ***(Peters, 1855)***

1973 Ref - Evans et al., 1974

1978 Ref - Grovhoug, 1979

1996 Spec - BPBM-I 37320 NE side of West Loch channel.

Family: CARANGIDAE

Genus: *Carangoides*

Carangoides gymnostethoides ***Bleeker, 1852***

1973 Ref - Evans et al., 1974

Genus: *Caranx*

Caranx sp.

1996 This Project

Caranx ignobilis ***(Forsskal, 1775)***

1973 Ref - Evans et al., 1974

1973 Ref - McCain, 1974

1973 Ref - McCain, 1975

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

Caranx mate ***Cuvier & Valenciennes, 1833***

1973	Ref - Evans et al., 1974	
1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	
1978	Ref - Grovhoug, 1979	

Caranx melampygus ***Cuvier & Valenciennes, 1833***

1973	Ref - Evans et al., 1974	
1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	
1978	Ref - Grovhoug, 1979	
1986	Ref - Lenihan, 1990	
1987	Ref - Brewer & Assoc., 1987	
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
1996	This Project	

Caranx sexfasciatus ***Quoy & Gaimard, 1825***

1973	Ref - Evans et al., 1974	
1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	
1978	Ref - Grovhoug, 1979	

Genus: ***Gnathanodon***

Gnathanodon speciosus ***(Forsskal, 1775)***

1973	Ref - Evans et al., 1974	
1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	
1978	Ref - Grovhoug, 1979	
1996	This Project	

Genus: ***Scomberoides***

Scomberoides laysan ***(Forsskal, 1775)***

1993	Ref - Brock, 1994	Recorded as Scrombroides laysan.
1994	Ref - Brock, 1995	Recorded as Scrombroides laysan.

Scomberoides sanct-petri ***(Cuvier, 1831)***

1973	Ref - Evans et al., 1974	

Family: CHAETODONTIDAE

Genus: ***Chaetodon***

Chaetodon auriga ***Forsskal, 1775***

1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	
1986	Ref - Lenihan, 1990	
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
1996	This Project	

Chaetodon ephippium ***Cuvier, 1831***

1978	Ref - Grovhoug, 1979	
1986	Ref - Lenihan, 1990	
1996	This Project	

Chaetodon lineolatus ***Cuvier, 1831***

1993	Ref - Brock, 1994	

Chaetodon lunula ***(Lacepede, 1802)***

1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	
1986	Ref - Lenihan, 1990	
1996	This Project	

Chaetodon miliaris ***Quoy & Gaimard, 1824***

1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	
1996	This Project	

Genus: *Forcipiger*

Forcipiger flavissimus ***Jordan & McGregor, 1898*** ***New record for Pearl Harbor.***

1996	This Project	

Genus: *Heniochus*

Heniochus diphreutes ***Jordan 1903***

1973	Ref - Evans et al., 1974	Recorded as acuminatus (Linnaeus).

Family: CICHLIDAE

Genus: *Oreochromis*

Oreochromis mossambicus ***(Peters, 1852)*** ***Introduced.***

1973	Ref - Evans et al., 1974	Recorded as Tilapia mossambica (Peters).
1973	Ref - McCain, 1974	Recorded as Tilapia mossambica.
1973	Ref - McCain, 1975	Recorded as Tilapia mossambica.
1987	Ref - AECOS, 1987	Recorded as Sarotherodon mossambica (Peters).
1994	Ref - Brock, 1995	Recorded as Tilapia mossambica (Peters).
1996	This Project	

Genus: *Sarotherodon*

Sarotherodon melanotheron

1987	Ref - Randall, 1987	Recorded as Tilapia melanotheron.
1996	Spec - BPBM-I 37324	Middle Loch; under hull of U.S.S. "Machinist" Floating Drydock.

Genus: *Tilapia*

Tilapia melanopleura ***(Ruppell, 1852)***

1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	

Family: GOBIIDAE

Unidentified Gobiidae

1996	This Project	

Genus: *Asterropteryx*

Asterropteryx semipunctatus ***Ruppell, 1821***

1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	
1986	Ref - Lenihan, 1990	
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
1996	Spec - BPBM-I 37315	Middle Loch; W side of Waiawa Peninsula; near pier (Pan Am Clipper Dock); along shoreline.
1996	Spec - BPBM-I 37316	W side of Middle Loch channel.

Genus: *Bathygobius*

Bathygobius cocosensis ***(Bleeker, 1854)*** ***Hawaiian name(s): 'o'opu 'ohune.***

1973	Ref - Evans et al., 1974	Recorded as fuscus (Ruppell).
1986	Ref - Lenihan, 1990	Recorded as B. fuscus (Ruppell).
1993	Ref - Brock, 1994	Recorded as B. fuscus.
1994	Ref - Brock, 1995	Recorded as B. fuscus.
1996	Spec - BPBM-I 37313	Rainbow Bay Marina; docks and shoreline.
1996	Spec - BPBM-I 37317	Sheet piling in thermal discharge from Hawaiian Electric Company (HECO) Waiau Plant.
1996	Spec - BPBM-I 37319	Middle Loch; on wooden pilings near U.S.S. "Machinist" Floating Drydock.
1996	Spec - BPBM-I 37321	Middle Loch; on hull of U.S.S. "Machinist" Floating Drydock.

Bathygobius cotticeps ***Steindachner, 1880***

1987	Ref - AECOS, 1987	

Legacy Project - Species Report (Cont.)

Genus: ***Ctenogobius***

Ctenogobius tongarevae ***(Fowler, 1927)***

1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	

Genus: ***Eviota***

Eviota epiphanes ***Jenkins, 1903***

1996	Spec - BPBM-I 37314	N side of entrance channel.

Genus: ***Gnatholepis***

Gnatholepis anjerensis ***Bleeker, 1850***

1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	

Genus: ***Mugilogobius***

Mugilogobius cavifrons ***(Weber, 1909)***

1991	Spec - BPBM-I 34997	Drainage area E of Blaisdell Park.

Mugilogobius parvus ***Introduced.***

1987	Ref - Randall et al., 1993	
1994	Ref - Eldredge, 1994	

Genus: ***Opua***

Opua nephodes ***Jordan, 1925***

1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	

Genus: ***Oxyurichthys***

Oxyurichthys lonchotus ***(Jenkins, 1903)***

1973	Ref - Evans et al., 1974	

Genus: ***Psilogobius***

Psilogobius mainlandi ***Baldwin, 1972***

1986	Ref - Lenihan, 1990	
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	

Family: KUHLIIDAE

Genus: ***Kuhlia***

Kuhlia sandvicensis ***(Steindachner, 1876)***

1973	Ref - Evans et al., 1974	
1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	
1978	Ref - Grovhoug, 1979	
1986	Ref - Lenihan, 1990	
1987	Ref - Brewer & Assoc., 1987	
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
1996	This Project	

Family: KYPHOSIDAE

Genus: ***Kyphosus***

Kyphosus bigibbus ***(Lacepede, 1802)***

1973	Ref - Evans et al., 1974	Recorded as cinerascens (Forsskal).

Genus: ***Microcanthus***

Microcanthus strigatus ***Cuvier & Valenciennes, 1831***

1973	Ref - Evans et al., 1974	
1996	This Project	

Family: LABRIDAE

Genus: ***Anampses***

Anampses cuvieri? ***Quoy & Gaimard, 1824***

1979	Ref - AECOS, 1979	Off Pearl Harbor.

Legacy Project - Species Report (Cont.)

Genus: ***Cheilinus***

Cheilinus bimaculatus ***Valenciennes, 1840***

1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	

Genus: ***Cheilio***

Cheilio inermis ***(Forsskal, 1775)***

1973	Ref - Evans et al., 1974	
1986	Ref - Lenihan, 1990	

Genus: ***Coris***

Coris flavovita ***Bennett, 1929 New record for Pearl Harbor.***

1996	This Project	

Genus: ***Gomphosus***

Gomphosus varius ***Lacepede, 1801 New record for Pearl Harbor.***

1996	This Project	

Genus: ***Labroides***

Labroides phthirophagus ***Randall, 1958***

1973	Ref - Evans et al., 1974	
1996	This Project	

Genus: ***Stethojulis***

Stethojulis balteata ***(Quoy & Gaimard, 1824)***

1973	Ref - Evans et al., 1974	Recorded as balteatus (Quoy and Gaimard).
1978	Ref - Grovhoug, 1979	
1996	This Project	

Genus: ***Thalassoma***

Thalassoma duperrey ***(Quoy & Gaimard, 1824) New record for Pearl Harbor.***

1996	This Project	

Thalassoma umbrostigma ***(Ruppell, 1838)***

1979	Ref - AECOS, 1979	Off Pearl Harbor.

Family: LUTJANIDAE

Genus: ***Lutjanus***

Lutjanus fulvus ***(Bloch & Schneider) Introduced.***

1973	Ref - Evans et al., 1974	
1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
1996	Spec - BPBM-I 37323	West Loch; Oyster Reef.
1996	This Project	

Family: MUGILIDAE

Genus: ***Chelon***

Valamugil engli ***(Bleeker, 1858)***

1993	Ref - Brock, 1994	Recorded as Chelon engli.
1994	Ref - Brock, 1995	Recorded as Chelon engli.

Genus: ***Mugil***

Mugil cephalus ***Linnaeus, 1758***

1973	Ref - Evans et al., 1974	
1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	
1978	Ref - Grovhoug, 1979	
1986	Ref - Lenihan, 1990	
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
1996	This Project	

Legacy Project - Species Report (Cont.)

Family: MULLIDAE

Genus: *Mulloidichthys*

Mulloidichthys auriflamma ***Forsskal, 1775***

1973 Ref - Evans et al., 1974

Mulloidichthys flavolineatus ***(Lacepede, 1801)***

1973 Ref - Evans et al., 1974 Recorded as samoensis (Gunther).

1978 Ref - Grovhoug, 1979 Recorded as samoensis (Gunther).

1986 Ref - Lenihan, 1990 Recorded as M. samoensis (Gunther).

1996 This Project

Mulloidichthys vanicolensis ***Valenciennes, 1831 New record for Pearl Harbor.***

1996 This Project

Genus: *Parupeneus*

Parupeneus mutifasciatus ***Quoy & Gaimard, 1824 New record for Pearl Harbor.***

1996 This Project

Parupeneus pleurostigma ***(Bennett, 1830)***

1973 Ref - Evans et al., 1974

1978 Ref - Grovhoug, 1979

Parupeneus porphyreus ***Jenkins, 1903***

1973 Ref - Evans et al., 1974

1973 Ref - McCain, 1974

1973 Ref - McCain, 1975

1978 Ref - Grovhoug, 1979

1996 This Project

Genus: *Upeneus*

Upeneus arge ***Jordan & Evermann, 1903***

1973 Ref - Evans et al., 1974

1973 Ref - McCain, 1974

1973 Ref - McCain, 1975

1978 Ref - Grovhoug, 1979

1986 Ref - Lenihan, 1990

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

Upeneus taeniopterus ***(Cuvier, 1829) Hawaiian name(s): weke pahulu; weke pueo.***

1996 Spec - BPBM-I 37325 NE side of West Loch channel.

Upeneus vittatus ***(Forsskal, 1775)***

1992 Spec - BPBM-I 35395

1993 Spec - BPBM-I 37064

Family: POLYNEMIDAE

Genus: *Polydactylus*

Polydactylus sexfilis ***(Cuvier & Valenciennes, 1831)***

1973 Ref - Evans et al., 1974

1978 Ref - Grovhoug, 1979

Family: POMACENTRIDAE

Genus: *Abudefduf*

Abudefduf abdominalis ***(Quoy & Gaimard, 1824)***

1973 Ref - Evans et al., 1974

1978 Ref - Grovhoug, 1979

1986 Ref - Lenihan, 1990

1994 Ref - Brock, 1995

1996 This Project

Abudefduf sordidus ***(Forsskal, 1775)***

1973 Ref - Evans et al., 1974

1986 Ref - Lenihan, 1990

Genus: *Dascyllus*

Dascyllus albisella ***Gill, 1862***

1973 Ref - Evans et al., 1974
1978 Ref - Grovhoug, 1979
1996 This Project

Family: PRIACANTHIDAE

Genus: *Heteropriacanthus*

Heteropriacanthus cruentatus ***(Lacepede, 1801)***

1973 Ref - Evans et al., 1974 Recorded as Priacanthus cruentatus (Lacepede).
1986 Ref - Lenihan, 1990 Recorded as Priacanthus cruentatus (Lacepede).

Family: SCARIDAE

Genus: *Calotomus*

Calotomus spinidens ***(Quoy & Gaimard, 1824)***

1973 Ref - Evans et al., 1974
1978 Ref - Grovhoug, 1979

Genus: *Chlorurus*

Chlorurus psittacus ***(Forsskal, 1775)***

1996 Spec - BPBM-I 37327 NE of Ford Island.

Genus: *Scarus*

Scarus sp.

1973 Ref - Evans et al., 1974 juvenile.
1986 Ref - Lenihan, 1990
1996 This Project

Scarus sordidus ***Forsskal, 1775 Hawaiian name(s): uhu.***

1973 Ref - Evans et al., 1974 Recorded as Scarus sordidus Forsskal.
1993 Ref - Brock, 1994
1994 Ref - Brock, 1995

Family: SPHYRAENIDAE

Genus: *Sphyraena*

Sphyraena barracuda ***(Walbaum, 1792)***

1973 Ref - Evans et al., 1974
1973 Ref - McCain, 1974
1973 Ref - McCain, 1975
1978 Ref - Grovhoug, 1979
1987 Ref - AECOS, 1987
1993 Ref - Brock, 1994
1994 Ref - Brock, 1995
1996 This Project

Order: PLEURONECTIFORMES

Family: BOTHIDAE

Genus: *Bothus*

Bothus pantherinus ***(Ruppell, 1830)***

1973 Ref - Evans et al., 1974

Order: TETRAODONTIFORMES

Family: DIODONTIDAE

Genus: *Diodon*

Diodon holocanthus ***Linnaeus, 1758***

1973 Ref - Evans et al., 1974

Diodon hystrix ***Linnaeus, 1758***

1973 Ref - Evans et al., 1974
1978 Ref - Grovhoug, 1979
1979 Ref - AECOS, 1979 Off Pearl Harbor. Recorded as D. hysterix.
1996 This Project

Legacy Project - Species Report (Cont.)

Family: MONACANTHIDAE

Genus: *Pervagor*

Pervagor spilosoma ***(Lay & Bennett, 1839)***

1973 Ref - Evans et al., 1974

Family: OSTRACIIDAE

Genus: *Lactoria*

Lactoria fornasini ***(Bianconi, 1846)*** ***New record for Pearl Harbor.***

1996 This Project

Genus: *Ostracion*

Ostracion meleagris camurum ***(Jenkins, 1901)***

1973 Ref - Evans et al., 1974

1978 Ref - Grovhoug, 1979

1996 This Project

Family: TETRAODONTIDAE

Genus: *Arothron*

Arothron sp. ***Hawaiian name(s): makimaki.***

1949 Spec - BPBM-I 25886

1996 Spec - BPBM-I 37318 Sheet piling in thermal discharge from Hawaiian Electric Company (HECO) Waiau Plant.

Arothron hispidus ***(Linnaeus, 1758)***

1973 Ref - Evans et al., 1974

1973 Ref - McCain, 1974

1973 Ref - McCain, 1975

1978 Ref - Grovhoug, 1979

1986 Ref - Lenihan, 1990

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

1996 This Project

Genus: *Canthigaster*

Canthigaster coronata ***(Vaillant & Sauvage, 1875)***

1973 Ref - Evans et al., 1974 Canthigaster coronatus (Randall, P.C.).

Canthigaster jactator ***(Jenkins, 1901)***

1973 Ref - Evans et al., 1974

APPENDIX D

Species by Station Records for Non-Sediment Invertebrates and Fishes
Sampled or Observed in pearl Harbor
Legacy Project Surveys, 1996

			Station														
Phylum	**Family**	**Genus and Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CYANOPHYCOTA	OSCILLATORIACEAE	*Lyngbya*	1													1	1
CHLOROPHYCOTA	CLADOPHORACEAE	*Cladophora*							1								
CHLOROPHYCOTA	CLADOPHORACEAE	*Cladophora n. sp.*														1	1
CHLOROPHYCOTA	CAULERPACEAE	*Caulerpa sertularioides*															1
CHLOROPHYCOTA	CODIACEAE	*Chlorodesmis caespitosa*														1	1
CHLOROPHYCOTA	VALONIACEAE	*Boodlea composita*							1								
CHLOROPHYCOTA	VALONIACEAE	*Dictyosphaeria versluysii*	1														1
PHAEOPHYCOPHYTA	DICTYOTACEAE	*Lobophora variegata*											1				
RHODOPHYCOTA	GELIDIELLACEAE	*Gelidiella sp. 1*	1														
RHODOPHYCOTA	GELIDIELLACEAE	*Gelidiella sp. 2*	1														
RHODOPHYCOTA	GELIDIELLACEAE	*Gelidiella myrocladia*	1														
RHODOPHYCOTA	GRACILARIACEAE	*Gracilaria salicornia*							1	1							1
RHODOPHYCOTA	HYPNEACEAE	*Hypnea spinella*							1								
RHODOPHYCOTA	HYPNEACEAE	*Hypnea valentiae*	1	1					1								
RHODOPHYCOTA	CORALLINACEAE	*Porolithon onkodes*	1						1								
RHODOPHYCOTA	CHAMPIACEAE	*Champia parvula*	1														
RHODOPHYCOTA	CERAMIACEAE	*Aglaothamnion sp. 1*	1														
RHODOPHYCOTA	CERAMIACEAE	*Aglaothamnion sp. 2*	1														
RHODOPHYCOTA	CERAMIACEAE	*Anotricium*	1														
RHODOPHYCOTA	CERAMIACEAE	*Anotricium secundum*		1													
RHODOPHYCOTA	CERAMIACEAE	*Centroceras clavulatum*		1													
RHODOPHYCOTA	CERAMIACEAE	*Centrocerus*	1		1												
RHODOPHYCOTA	CERAMIACEAE	*Ceramium*	1							1							
RHODOPHYCOTA	CERAMIACEAE	*Ceramium n. sp.*														1	1
RHODOPHYCOTA	CERAMIACEAE	*Ceramium sp. 1*	1	1												1	1
RHODOPHYCOTA	CERAMIACEAE	*Ceramium sp. 2*	1														
RHODOPHYCOTA	CERAMIACEAE	*Ceramium clarionense*							1								
RHODOPHYCOTA	CERAMIACEAE	*Griffitsia heteromorpha*	1														
RHODOPHYCOTA	CERAMIACEAE	*Tolypiocladia*							1								
RHODOPHYCOTA	CERAMIACEAE	*Tolypiocladia glomerulata*		1					1								
RHODOPHYCOTA	RHODOMELACEAE	*Acanthophora spicifera*							1								
RHODOPHYCOTA	RHODOMELACEAE	*Laurencia brachyclados*							1								
RHODOPHYCOTA	RHODOMELACEAE	*Polysiphonia*	1		1												
RHODOPHYCOTA	RHODOMELACEAE	*Polysiphonia scopulorum*		1													
RHODOPHYCOTA	GELIDIACEAE	*Gelidium*							1								
RHODOPHYCOTA	GELIDIACEAE	*Gelidium arenaria*	1														
RHODOPHYCOTA	GELIDIACEAE	*Gelidium pusillum*	1		1												
RHODOPHYCOTA	PEYSONNELIACEAE	*Peysonnelia*															1
MAGNOLIOPHYTA	RHIZOPHORACEAE	*Rhizophora mangel*			1	1	1			1	1	1				1	1
PORIFERA	LEUCOSOLENIIDAE	*Leuconia n. sp.*	1													1	1
PORIFERA	HETEROPIIDAE	*Heteropia glomerosa*	1														1
PORIFERA	SPONGIIDAE	*Hyatella intestinalis*											1	1			
PORIFERA	APLYSELLIDAE	*Aplysilla cf. rosea*				1			1								1
PORIFERA	APLYSELLIDAE	*Chelonaplysilla violacea*	1	1				1	1								
PORIFERA	DYSIDEIDAE	*Dysidea n. sp. 1*							1								1

			Station														
Phylum	**Family**	**Genus and Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
PORIFERA	DYSIDEIDAE	*Dysidea n. sp. 2*	1														
PORIFERA	DYSIDEIDAE	*Dysidea n. sp. 3*		1	1					1			1				
PORIFERA	DYSIDEIDAE	*Dysidea avara*	1					1						1			
PORIFERA	DYSIDEIDAE	*Dysidea cf. arenaria*							1	1							1
PORIFERA	DICTYODEDRILLIDAE	*Dictyodendrilla n. sp.*		1							1	1	1	1			
PORIFERA	CALLYSPONGIIDAE	*Callyspongia diffusa*											1		1		1
PORIFERA	HALICLONIDAE	*Gellius n. sp.*		1				1					1				
PORIFERA	CHALINIDAE	*Toxiclona n. sp.*	1	1	1				1	1	1	1	1	1		1	1
PORIFERA	NIPHATIDAE	*Gelliodes fibrosa*	1	1	1						1		1	1	1		
PORIFERA	ADOCIIDAE	*Adociidae n. gen. n. sp.*	1		1			1	1	1	1	1	1	1	1	1	1
PORIFERA	ADOCIIDAE	*Sigmadocia cf. caerulea*	1	1	1				1	1	1		1	1	1	1	1
PORIFERA	AMPHILECTIDAE	*Biemna fistulosa*	1						1		1			1			
PORIFERA	MICROCIONIDAE	*Clathria (Microciona) n. sp.*				1											1
PORIFERA	MYCALIDAE	*Mycale (Aegogropila) armata*	1	1				1	1	1	1	1	1	1	1	1	1
PORIFERA	MYCALIDAE	*Mycale (Carmia) cecilia*								1	1	1				1	1
PORIFERA	MYCALIDAE	*Mycale (Carmia) contarenii*									1		1				1
PORIFERA	MYCALIDAE	*Mycale (Carmia) maunakea*		1	1	1											1
PORIFERA	MYCALIDAE	*Zygomycale parishii*															1
PORIFERA	MYXILLIDAE	*Tedania reticulata*				1				1	1		1			1	1
PORIFERA	RASPAILIIDAE	*Echinodictyum asperum*	1					1			1				1		1
PORIFERA	HALICHONDRIIDAE	*Amorphinopsis n. sp.*		1		1	1			1							1
PORIFERA	HALICHONDRIIDAE	*Halichondria melanadocia*			1	1											
PORIFERA	HALICHONDRIIDAE	*Topsentia sp.*	1	1				1	1	1	1	1	1	1	1	1	1
PORIFERA	CLIONIDAE	*Cliona sp.*	1	1	1			1	1	1				1	1	1	1
PORIFERA	SUBERITIDAE	*Prosuberites oleteira*		1							1	1					
PORIFERA	SUBERITIDAE	*Suberites cf. zeteki*			1	1	1		1	1	1		1	1	1	1	1
PORIFERA	STELLETTIDAE	*Stelletta n. sp. (cf. purpurea)*						1									
CNIDARIA	HALOCORDYLIDAE	*Pennaria (=Halocordyle) disticha*	1					1			1	1	1	1		1	1
CNIDARIA	?HYDROZOA	*Hydrozoa*	1			1				1	1	1	1		1		1
CNIDARIA	TELESTIDAE	*Carijoa (Telestea) riisei*	1					1				1	1		1	1	
CNIDARIA	AIPTASIIDAE	*Aiptasia pulchella*		1					1							1	
CNIDARIA	ACROPORIDAE	*Montipora patula*	1														
CNIDARIA	FAVIIDAE	*Leptastrea purpurea*						1	1				1	1		1	1
CNIDARIA	POCILLOPORIDAE	*Pocillopora damicornis*	1	1				1					1				
CNIDARIA	POCILLOPORIDAE	*Pocillopora meandrina*	1														
CNIDARIA	PORITIDAE	*Porites compressa*		1													
CNIDARIA	?CNIDARIA	*Cnidaria*															1
PLATYHELMINTHES	?PLATYHELMINTHES	*Platyhelminthes*									1					1	
NEMATODA	?NEMATODA	*Nematoda*				1					1				1		1
ANNELIDA	AMPHINOMIDAE	*Eurythoe complanata*		1					1								1
ANNELIDA	ARABELLIDAE	*Arabella*						1					1				
ANNELIDA	CAPITELLIDAE	*Capitellidae*			1						1						
ANNELIDA	CHAETOPTERIDAE	*Chaetopteridae*						1	1							1	
ANNELIDA	CHAETOPTERIDAE	*Chaetopterus sp.*	1	1	1			1	1	1	1	1	1	1	1	1	1
ANNELIDA	CIRRATULIDAE	*Cirriformia punctata*	1	1	1			1	1	1	1	1	1		1		

			Station														
Phylum	**Family**	**Genus and Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
ANNELIDA	DORVILLEIDAE	*Dorvilleidae*														1	
ANNELIDA	EUNICIDAE	*Eunice*		1													
ANNELIDA	EUNICIDAE	*Eunice australis*									1		1	1	1	1	1
ANNELIDA	EUNICIDAE	*Eunice cariboea*		1				1				1	1	1		1	
ANNELIDA	EUNICIDAE	*Eunice filamentosa*	1	1				1	1			1		1			
ANNELIDA	EUNICIDAE	*Lysidice ninetta*	1	1				1									
ANNELIDA	EUNICIDAE	*Marphysa sanguinea*									1						
ANNELIDA	EUNICIDAE	*Nematonereis unicornis*	1	1				1		1		1	1			1	1
ANNELIDA	EUNICIDAE	*Palola siciliensis*												1		1	1
ANNELIDA	HESIONIDAE	*Syllidia armata*	1		1	1	1	1				1	1				
ANNELIDA	LUMBRINERIDAE	*Lumbrineris*		1						1		1	1		1	1	
ANNELIDA	NEREIDAE	*Nereidae*															1
ANNELIDA	OPHELIIDAE	*Armandia*					1										
ANNELIDA	PHYLLODOCIDAE	*Eulalia*											1				1
ANNELIDA	PHYLLODOCIDAE	*Eulalia sanguinea*									1	1	1			1	1
ANNELIDA	PHYLLODOCIDAE	*Eumida*										1					
ANNELIDA	PHYLLODOCIDAE	*Phyllodoce*	1		1					1	1		1	1	1	1	1
ANNELIDA	POLYNOIDAE	*Paralepidonotus ampulliferus*			1												
ANNELIDA	POLYNOIDAE	*Polynoidae*	1														
ANNELIDA	SABELLIDAE	*Branchiomma nigromaculata*	1	1	1				1	1	1	1	1	1	1		1
ANNELIDA	SABELLIDAE	*Potamilla*	1	1				1		1	1	1	1	1	1	1	1
ANNELIDA	SABELLIDAE	*Sabellastarte sanctijosephi*	1	1	1			1	1	1	1	1	1	1	1	1	1
ANNELIDA	SERPULIDAE	*Hydroides dirampha*		1	1	1					1						
ANNELIDA	SERPULIDAE	*Hydroides elegans*		1						1	1	1	1		1		1
ANNELIDA	SERPULIDAE	*Pomatoleios kraussii*															1
ANNELIDA	SERPULIDAE	*Salmacina dysteri*						1	1	1	1	1	1		1	1	1
ANNELIDA	SERPULIDAE	*Serpula vermicularis*														1	
ANNELIDA	SERPULIDAE	*Serpula sp.*				1											1
ANNELIDA	SERPULIDAE	*Simplicaria pseudomilitaris*		1													1
ANNELIDA	SPINTHERIDAE	*Spinther japonicus*								1	1	1					
ANNELIDA	SPIONIDAE	*Spionidae*					1										
ANNELIDA	SPIRORBIDAE	*Spirorbidae*								1		1					
ANNELIDA	SYLLIDAE	*Autolytus*	1		1						1	1	1			1	1
ANNELIDA	SYLLIDAE	*Branchiosyllis exilis*	1	1	1	1		1	1	1	1	1	1	1	1	1	1
ANNELIDA	SYLLIDAE	*Brania rhopalophora*										1					1
ANNELIDA	SYLLIDAE	*Exogone verugera*						1			1	1	1	1	1	1	1
ANNELIDA	SYLLIDAE	*Haplosyllis spongicola*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
ANNELIDA	SYLLIDAE	*Langerhansia cornuta*										1					
ANNELIDA	SYLLIDAE	*Myrianida crassicirrata*		1						1						1	
ANNELIDA	SYLLIDAE	*Syllidae*		1	1	1	1	1			1	1		1		1	1
ANNELIDA	SYLLIDAE	*Syllis gracilis*		1		1					1	1	1			1	1
ANNELIDA	SYLLIDAE	*Trypanosyllis zebra*	1	1	1	1		1	1	1	1		1	1	1	1	
ANNELIDA	SYLLIDAE	*Typosyllis*	1	1				1	1		1	1	1	1		1	1
ANNELIDA	SYLLIDAE	*Typosyllis hawaiiensis*									1						
ANNELIDA	SYLLIDAE	*Typosyllis hyalina*	1	1	1			1		1	1		1	1		1	1

			Station														
Phylum	**Family**	**Genus and Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
ANNELIDA	SYLLIDAE	*Typosyllis prolifera*			1			1			1		1				1
ANNELIDA	TEREBELLIDAE	*Thelepus setosus*		1	1					1	1			1	1	1	
ANNELIDA	GLYCERIDAE	*Glycera tesselata*												1			
MOLLUSCA	FISSURELLIDAE	*Diodora granifera*							1							1	
MOLLUSCA	FISSURELLIDAE	*Diodora octogona*		1					1	1	1					1	
MOLLUSCA	FISSURELLIDAE	*Diodora ruppelli*							1							1	
MOLLUSCA	TROCHIDAE	*Trochus intextus*		1													
MOLLUSCA	TURBINIDAE	*Leptothyra candida*						1									
MOLLUSCA	TURBINIDAE	*Leptothyra rubricincta*	1														
MOLLUSCA	CALYPTRAEIDAE	*Crepidula aculeata*	1	1	1			1	1	1	1	1		1	1	1	1
MOLLUSCA	CALYPTRAEIDAE	*Crucibulum spinosum*	1														1
MOLLUSCA	CERITHIIDAE	*Bittium zebrum*	1	1	1			1	1					1	1		
MOLLUSCA	CERITHIIDAE	*Cerithiopsis sp. A*		1	1				1			1					
MOLLUSCA	CERITHIIDAE	*Finella pupoides*		1	1			1	1								
MOLLUSCA	CYMATIIDAE	*Cymatium intermedius*							1								
MOLLUSCA	CYMATIIDAE	*Cymatium nicobaricum*		1										1			
MOLLUSCA	CYPRAEIDAE	*Cypraea childreni*	1														
MOLLUSCA	EULIMIDAE	*Balcis*			1												
MOLLUSCA	HIPPONICIDAE	*Hipponix*	1		1			1	1			1					
MOLLUSCA	HIPPONICIDAE	*Hipponix imbricatus*	1					1	1			1		1			
MOLLUSCA	HIPPONICIDAE	*Hipponix pilosus*	1						1								
MOLLUSCA	LITTORINIDAE	*Littoraria pintado*		1													
MOLLUSCA	LITTORINIDAE	*Littoraria scabra*		1					1	1	1	1			1	1	1
MOLLUSCA	RISSOIDAE	*Rissoina miltozona*	1														
MOLLUSCA	RISSOIDAE	*Rissoina turricula*							1								
MOLLUSCA	RISSOIDAE	*Zebina tridentata*	1														
MOLLUSCA	TRIPHORIDAE	*Triphora {Triphoridae}*	1	1	1												
MOLLUSCA	VERMETIDAE	*Dendropoma*	1									1		1			
MOLLUSCA	VERMETIDAE	*Eualetes tulipa (=Vermetus alii)*	1	1				1	1	1	1		1	1	1	1	1
MOLLUSCA	COLUMBELLIDAE	*Euplica varians*	1														
MOLLUSCA	COLUMBELLIDAE	*Seminella*			1			1									
MOLLUSCA	FASCIOLARIIDAE	*Peristernia chlorostoma*	1														
MOLLUSCA	MURICIDAE	*Morula dermosa*	1														
MOLLUSCA	PYRAMIDELLIDAE	*Hinemoa indica*	1		1			1	1						1		
MOLLUSCA	PYRAMIDELLIDAE	*Odostomia stearnsiella*	1		1			1	1								
MOLLUSCA	PYRAMIDELLIDAE	*Pyramidella*	1		1			1									
MOLLUSCA	PYRAMIDELLIDAE	*Pyrgulina oodes*						1	1					1			
MOLLUSCA	TURRIDAE	*Kermia*												1			
MOLLUSCA	BULLIDAE	*Bulla vernicosa*						1									
MOLLUSCA	HAMINOEIDAE	*Atys kuhnsi*						1									
MOLLUSCA	SIPHONARIIDAE	*Siphonaria normalis*		1	1					1	1	1	1			1	1
MOLLUSCA	SIPHONARIIDAE	*Williamia cf. radiata*												1			
MOLLUSCA	PUPILLIDAE	*Gastrocopta servilis*						1									
MOLLUSCA	CALIPHYLLIDAE	*Cyerce elegans*															1
MOLLUSCA	UMBRACULIDAE	*Umbraculum*			1												

			Station														
Phylum	**Family**	**Genus and Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
MOLLUSCA	?NUDIBRANCHIA	*Nudibranchia*															1
MOLLUSCA	DORIDIDAE	*Hypselodoris infucata*			1				1								1
MOLLUSCA	CAECIDAE	*Caecum sepimentum*	1														
MOLLUSCA	CEPHALASPIDAE	*Cephalaspidae*						1									
MOLLUSCA	DIALIDAE	*Cerithidium perparvalum*	1														
MOLLUSCA	DIALIDAE	*Diala varia*			1												
MOLLUSCA	EATONIELLIDAE	*Eatoniella*	1					1									
MOLLUSCA	ANOMIIDAE	*Anomia nobilis*			1					1	1	1	1		1	1	
MOLLUSCA	ISOGNOMONIDAE	*Isognomon legumen*	1														
MOLLUSCA	MYTILIDAE	*Brachidontes crebristriatus*								1							
MOLLUSCA	MYTILIDAE	*Lithophaga fasciola*	1														
MOLLUSCA	OSTREIDAE	*Crassostrea*		1	1	1	1			1	1						1
MOLLUSCA	OSTREIDAE	*Crassostrea virginica*		1	1	1	1			1	1					1	1
MOLLUSCA	OSTREIDAE	*Dendrostrea sandvichensis*		1				1	1	1	1	1	1		1	1	1
MOLLUSCA	OSTREIDAE	*Ostrea*	1	1	1	1		1		1		1		1	1		
MOLLUSCA	OSTREIDAE	*Ostreidae*	1		1		1				1						
MOLLUSCA	OSTREIDAE	*Saccostrea cucullata*				1		1		1	1	1	1		1	1	1
MOLLUSCA	PTERIIDAE	*Pinctada margaritifera*	1								1						
MOLLUSCA	PTERIIDAE	*Pinctada radiata*									1						
MOLLUSCA	CHAMIDAE	*Chama*	1													1	1
MOLLUSCA	CHAMIDAE	*Chama macerophylla (=C. elatensis)*		1						1	1						
MOLLUSCA	CHAMIDAE	*Chama fibula*								1	1			1		1	1
MOLLUSCA	CHAMIDAE	*Chama lazarus*														1	
MOLLUSCA	CHAMIDAE	*Chama pacifica*		1							1						
MOLLUSCA	LUCINIDAE	*Ctena bella*			1			1	1					1	1		
MOLLUSCA	LUCINIDAE	*Pillucina spaldingi*													1		
MOLLUSCA	SEMELIDAE	*Abra sp. A*												1			
MOLLUSCA	TELLINIDAE	*Tellina*			1												
MOLLUSCA	TELLINIDAE	*Tellina sp. A*	1				1									1	
MOLLUSCA	TELLINIDAE	*Tellinidae*						1									
MOLLUSCA	VENERIDAE	*Lioconcha hieroglyphica*						1	1					1			
MOLLUSCA	VENERIDAE	*Venerupis (Ruditapes) phillipinarum*					1										
MOLLUSCA	HIATELLIDAE	*Hiatella arctica*	1	1	1			1	1					1	1		
MOLLUSCA	MYIDAE	*Sphenia coreanica?*		1	1	1	1	1		1	1	1	1			1	1
MOLLUSCA	PHOLADIDAE	*Martesia striata*		1													1
MOLLUSCA	TEREDINIDAE	*Teredinidae*		1													1
MOLLUSCA	TEREDINIDAE	*Teredo bartschi*							1								
MOLLUSCA	?BIVALVIA	*Bivalvia*		1			1	1	1					1			
MOLLUSCA	EURYCYNIDAE	*Eurycynidae*	1		1												
ARTHROPODA	ENDEIDAE	*Endeis procera*													1		
ARTHROPODA	PYCNOGONIDAE	*Anoplodactylus californicus*							1	1	1				1	1	
ARTHROPODA	PYCNOGONIDAE	*Anoplodactylus pyncnosoma*		1													
ARTHROPODA	PYCNOGONIDAE	*Pigrogromitus timsanus*														1	
ARTHROPODA	?PYCNOGONIDA	*Pycnogonida*													1		

			Station														
Phylum	**Family**	**Genus and Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
ARTHROPODA	BALANIDAE	*Balanus*		1					1	1	1				1	1	1
ARTHROPODA	BALANIDAE	*Balanus amphitrite amphitrite*		1	1	1	1			1		1	1		1	1	1
ARTHROPODA	BALANIDAE	*Balanus eburneus*		1	1	1	1			1	1	1	1				
ARTHROPODA	BALANIDAE	*Balanus reticulatus*		1	1	1	1			1	1	1	1				1
ARTHROPODA	CHTHAMALIDAE	*Chthamalus proteus*		1		1			1	1	1	1	1			1	1
ARTHROPODA	?CUMACEA	*Cumacea*	1					1	1								1
ARTHROPODA	APSEUDIDAE	*Apseudes sp. A*	1	1				1	1								
ARTHROPODA	APSEUDIDAE	*Apseudes tropicalis*		1	1	1											
ARTHROPODA	APSEUDIDAE	*Parapseudes neglectus*	1			1											
ARTHROPODA	APSEUDIDAE	*Parapseudes pedispinis*	1			1											
ARTHROPODA	PSEUDOZEUXIDAE	*Leptochelia dubia*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
ARTHROPODA	TANAIDAE	*Anatanais insularis*		1				1			1						1
ARTHROPODA	ANTHURIDAE	*Mesanthura sp. A*						1	1		1						1
ARTHROPODA	JANIRIDAE	*Carpias*	1														
ARTHROPODA	JANIRIDAE	*Cerpias algicola*	1														
ARTHROPODA	LIMNORIIDAE	*Limnoria*								1							
ARTHROPODA	LIMNORIIDAE	*Limnoria lignorum*							1					1			
ARTHROPODA	LIMNORIIDAE	*Limnoria tripunctata*				1						1					
ARTHROPODA	MUNNIDAE	*Munna acarina*	1						1								
ARTHROPODA	SCYPHACIDAE	*Armadilloniscus litoralis*							1								
ARTHROPODA	SPHAEROMATIDAE	*Exosphaeroma sp. A*										1					
ARTHROPODA	SPHAEROMATIDAE	*Sphaeroma*								1			1			1	
ARTHROPODA	AMPHILOCHIDAE	*Amphilochus kailua*	1	1													1
ARTHROPODA	AMPHILOCHIDAE	*Amphilochus likelike*						1						1			1
ARTHROPODA	AMPHILOCHIDAE	*Gitanopsis pele*															1
ARTHROPODA	AMPITHOIDAE	*Ampithoe waialua*	1	1												1	
ARTHROPODA	AMPITHOIDAE	*Paragrubia vorax*	1														
ARTHROPODA	AORIDAE	*Grandidierella bispinosa*														1	
ARTHROPODA	AORIDAE	*Grandidierella japonica*					1							1			
ARTHROPODA	AORIDAE	*Lembos macromanus*	1	1				1	1	1				1		1	
ARTHROPODA	AORIDAE	*Lembos pualani*	1		1				1								1
ARTHROPODA	AORIDAE	*Lembos waipio*	1														
ARTHROPODA	COLOMASTIGIDAE	*Colomastix lunalilo*	1	1	1			1	1	1	1	1	1	1	1	1	1
ARTHROPODA	COLOMASTIGIDAE	*Colomastix pusilla*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
ARTHROPODA	COROPHIIDAE	*Corophium ascherusicum*		1		1	1						1				
ARTHROPODA	COROPHIIDAE	*Corophium baconi*			1									1	1	1	1
ARTHROPODA	COROPHIIDAE	*Corophium insidiosum*				1	1										
ARTHROPODA	COROPHIIDAE	*Ericthonius brasiliensis*	1		1	1	1	1	1		1		1			1	
ARTHROPODA	GAMMARIDAE	*Elasmopus diplonyx*				1										1	
ARTHROPODA	GAMMARIDAE	*Elasmopus molokai*		1													
ARTHROPODA	GAMMARIDAE	*Elasmopus rapax*		1					1								
ARTHROPODA	GAMMARIDAE	*Eriopisa hamakua*						1									
ARTHROPODA	GAMMARIDAE	*Eriopisella sechellensis upolu*		1				1	1					1			
ARTHROPODA	GAMMARIDAE	*Maera pacifica*	1	1	1	1		1	1	1	1			1		1	1
ARTHROPODA	HYALIDAE	*Hyale grandicornis bishopae*							1								

			Station														
Phylum	**Family**	**Genus and Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
ARTHROPODA	ISAEIDAE	*Gammaropsis alamoana*														1	
ARTHROPODA	ISAEIDAE	*Photis hawaiiensis*	1														
ARTHROPODA	LEUCOTHOIDAE	*Leucothoe hyhelia*	1	1	1			1	1		1	1	1	1		1	1
ARTHROPODA	LEUCOTHOIDAE	*Leucothoe tridens*	1	1	1			1	1	1	1	1	1	1	1	1	1
ARTHROPODA	LEUCOTHOIDAE	*Paraleucothoe flindersi*									1				1		1
ARTHROPODA	LILJEBORGIIDAE	*Liljeborgia heeia*						1				1	1				
ARTHROPODA	PODOCERIDAE	*Podocerus brasiliensis*												1		1	
ARTHROPODA	PODOCERIDAE	*Podocerus talegus lawai*	1														
ARTHROPODA	STENOTHOIDAE	*Stenothoe gallensis*														1	
ARTHROPODA	STENOTHOIDAE	*Stenothoe valida*						1								1	
ARTHROPODA	ALPHEIDAE	*Alpheidae*	1											1		1	
ARTHROPODA	ALPHEIDAE	*Alpheus*			1			1				1		1			1
ARTHROPODA	ALPHEIDAE	*Alpheus brevipes*	1														
ARTHROPODA	ALPHEIDAE	*Alpheus collumianus*	1														
ARTHROPODA	ALPHEIDAE	*Alpheus gracilipes*								1							
ARTHROPODA	ALPHEIDAE	*Alpheus lobidens*								1		1					
ARTHROPODA	ALPHEIDAE	*Alpheus lottini*	1														
ARTHROPODA	ALPHEIDAE	*Alpheus mackayi*												1			
ARTHROPODA	ALPHEIDAE	*Alpheus paracrinitus*						1									
ARTHROPODA	ALPHEIDAE	*Metalpheus paragracilis*	1					1									
ARTHROPODA	ALPHEIDAE	*Synalpheus*		1						1			1				
ARTHROPODA	ALPHEIDAE	*Synalpheus bituberculatus*	1	1				1		1	1	1	1	1	1	1	1
ARTHROPODA	ALPHEIDAE	*Synalpheus paraneomeris*	1	1				1		1			1	1	1	1	
ARTHROPODA	ALPHEIDAE	*Synalpheus streptodactylus*	1	1						1		1	1	1		1	1
ARTHROPODA	ALPHEIDAE	*Synalpheus thai*		1						1		1		1	1	1	
ARTHROPODA	CALLIANASSIDAE	*Callianassa*			1												
ARTHROPODA	CALLIANASSIDAE	*Callianassa variabilis*		1													
ARTHROPODA	GRAPSIDAE	*Grapsidae*							1								1
ARTHROPODA	GRAPSIDAE	*Metapograpsus thukuhar*			1		1										1
ARTHROPODA	GRAPSIDAE	*Nanosesarma minutum*							1	1						1	1
ARTHROPODA	HAPALOCARCINIDAE	*Hapalocarcinus marsupialis*	1														
ARTHROPODA	MAJIDAE	*Hyastensus spinosus*													1		1
ARTHROPODA	MAJIDAE	*Schizophroidea hilensis*	1														
ARTHROPODA	OCYPODIDAE	*Macrophthalmus telescopicus*														1	
ARTHROPODA	OCYPODIDAE	*Ocypode laevis*	1														
ARTHROPODA	PALAEMONIDAE	*Brachycarpus biunguiculatus*															1
ARTHROPODA	PALAEMONIDAE	*Harpiliopsis depressus*	1					1									
ARTHROPODA	PALAEMONIDAE	*Palaemon pacificus*					1										
ARTHROPODA	PALAEMONIDAE	*Palaemonella*	1													1	
ARTHROPODA	PALAEMONIDAE	*Palaemonella rotumana*										1			1		
ARTHROPODA	PALAEMONIDAE	*Palaemonella tenuipes*		1	1		1	1	1	1	1		1	1		1	1
ARTHROPODA	PALAEMONIDAE	*Palaemonidae*	1	1	1				1	1					1	1	
ARTHROPODA	PORTUNIDAE	*Portunidae*							1								1
ARTHROPODA	PORTUNIDAE	*Thalamita*					1										
ARTHROPODA	PORTUNIDAE	*Thalamita crenata*					1										

			Station														
Phylum	**Family**	**Genus and Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
ARTHROPODA	PORTUNIDAE	*Thalamita integra*		1	1	1	1	1	1	1	1	1			1	1	1
ARTHROPODA	PORTUNIDAE	*Scylla serrata*									1						
ARTHROPODA	STENOPODIDAE	*Stenopus hispidus*	1						1							1	
ARTHROPODA	XANTHIDAE	*Etisus laevimanus*						1									
ARTHROPODA	XANTHIDAE	*Liocarpilodes binnguis*	1														
ARTHROPODA	XANTHIDAE	*Panopeus pacificus*			1	1	1		1	1							1
ARTHROPODA	XANTHIDAE	*Paramedeus simplex*	1		1												
ARTHROPODA	XANTHIDAE	*Phymodius nitidus*	1														
ARTHROPODA	XANTHIDAE	*Phymodius ungulatus*	1						1	1			1				
ARTHROPODA	XANTHIDAE	*Pilumnus minutus*															1
ARTHROPODA	XANTHIDAE	*Pilumnus oahuensis*	1	1	1			1	1	1	1	1	1	1	1	1	1
ARTHROPODA	XANTHIDAE	*Platypodia*	1														
ARTHROPODA	XANTHIDAE	*Platypodia eydouxii*	1						1								
ARTHROPODA	XANTHIDAE	*Trapezia intermedia*	1					1									
ARTHROPODA	XANTHIDAE	*Trapezia wardi*	1														
ARTHROPODA	XANTHIDAE	*Xanthidae*	1		1	1	1	1		1				1	1	1	1
ARTHROPODA	?CARIDEA	*Caridea*	1														
ARTHROPODA	GONODACTYLIDAE	*Gonodactylus mutatus (=G. falcatus & G. aloha)*	1	1					1	1						1	
ARTHROPODA	GONODACTYLIDAE	*Pseudosquilla ciliata*							1								
ARTHROPODA	?COPEPODA	*Copepoda*	1	1	1	1	1	1	1		1			1		1	1
ARTHROPODA	?OSTRACODA	*Ostracoda*	1		1				1					1	1	1	1
ARTHROPODA	?COLLEMBOLA	*Collembola*		1					1								
SIPUNCULA	?SIPUNCULIDA	*Sipunculida*				1											
BRYOZOA	VESICULARIIDAE	*Amathia distans*						1			1						1
BRYOZOA	VESICULARIIDAE	*Zoobotryon*											1				
BRYOZOA	AETEIDAE	*Aetea truncata*							1								
BRYOZOA	BUGULIDAE	*Bugula*							1								
BRYOZOA	BUGULIDAE	*Bugula neritina*	1		1					1	1	1	1		1		
BRYOZOA	BUGULIDAE	*Bugula stolonifera*										1					
BRYOZOA	MUCRONELLIDAE	*Parasmittina*											1				
BRYOZOA	RETEPORIDAE	*Reteporellina denticulata*	1					1				1	1				1
BRYOZOA	SAVIGNYELLIDAE	*Savignyella lafontii*	1														
BRYOZOA	SCHIZOPORELLIDAE	*Schizoporella*												1			
BRYOZOA	SCHIZOPORELLIDAE	*Schizoporella sp. (=S. errata)*	1	1	1			1	1	1	1	1	1	1	1	1	1
BRYOZOA	SCHIZOPORELLIDAE	*Schizoporella unicornis*									1	1				1	
BRYOZOA	WATERISPORIDAE	*Waterispora edmondsoni*						1									
ECHINODERMATA	OPHIACTIDAE	*Ophiactis savignyi*	1	1	1			1	1	1	1	1	1	1	1	1	1
ECHINODERMATA	DIADEMATIDAE	*Diadema paucispinum*	1														
ECHINODERMATA	TOXOPNEUSTIDAE	*Tripneustes gratilla*						1									
ECHINODERMATA	ECHINOMETRIDAE	*Echinometra mathaei*	1														
ECHINODERMATA	HOLOTHURIIDAE	*Actinopyga mauritiana*	1														
ECHINODERMATA	HOLOTHURIIDAE	*Holothuria atra*	1														
ECHINODERMATA	SYNAPTIDAE	*Ophiodesoma spectabilis*	1		1												1
CHORDATA	DIDEMNIDAE	*Didemnidae*	1														
CHORDATA	POLYCLINIDAE	*Polyclinum constellatum*															1

			Station														
Phylum	**Family**	**Genus and Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CHORDATA	ASCIDIIDAE	*Ascidia*															1
CHORDATA	ASCIDIIDAE	*Ascidia n. sp.*											1				
CHORDATA	ASCIDIIDAE	*Ascidia sp. B*															1
CHORDATA	ASCIDIIDAE	*Ascidia melanostoma*							1	1							
CHORDATA	ASCIDIIDAE	*Ascidia sydneiensis*	1	1	1			1		1		1	1		1		1
CHORDATA	ASCIDIIDAE	*Phallusia nigra*	1	1	1			1	1	1	1		1	1	1	1	1
CHORDATA	PEROPHORIDAE	*Perophora annectens*	1					1									
CHORDATA	PYURIDAE	*Herdmania momus*	1	1	1			1	1	1	1	1	1	1	1	1	1
CHORDATA	PYURIDAE	*Microcosmus exasperatus*	1							1				1			1
CHORDATA	STYELIDAE	*Botrylloides*															1
CHORDATA	STYELIDAE	*Botryllus (=Botrylloides) sp/spp.*			1				1	1	1		1				1
CHORDATA	STYELIDAE	*Polyandrocarpa sp. A*															1
CHORDATA	STYELIDAE	*Polyandrocarpa sp. B*			1						1		1				1
CHORDATA	STYELIDAE	*Symplegma*															1
CHORDATA	STYELIDAE	*Symplegma brekenhelmi (=S. oceania)*								1	1		1		1		1
CHORDATA	STYELIDAE	*Symplegma reptans*									1						
CHORDATA	?ASCIDIACEA	*Ascidiacea*							1								1
CHORDATA	MURAENIDAE	*Gymnothorax*						1									
CHORDATA	SYNODONTIDAE	*Synodus*	1											1		1	
CHORDATA	POECILIIDAE	*Poecilia cf. Latipinna*														1	
CHORDATA	HOLOCENTRIDAE	*Myripristis berndti*						1									
CHORDATA	HOLOCENTRIDAE	*Sargocentron diadema*	1														
CHORDATA	AULOSTOMIDAE	*Aulostomus chinensis*	1					1									
CHORDATA	SYNGNATHIDAE	*Doryrhamphus exisis*							1								
CHORDATA	ACANTHURIDAE	*Acanthurus blochi*						1		1							
CHORDATA	ACANTHURIDAE	*Acanthurus guttatus*						1						1		1	
CHORDATA	ACANTHURIDAE	*Acanthurus nigrofuscus*	1						1								
CHORDATA	ACANTHURIDAE	*Acanthurus triostegus*	1					1	1							1	
CHORDATA	ACANTHURIDAE	*Acanthurus xanthopterus*	1	1				1		1	1	1	1	1		1	1
CHORDATA	ACANTHURIDAE	*Ctenochaetus strigosus*	1						1					1			
CHORDATA	ACANTHURIDAE	*Naso brevirostris*						1									
CHORDATA	ACANTHURIDAE	*Naso unicornis*	1					1									
CHORDATA	ACANTHURIDAE	*Zanclus cornutus*	1	1				1		1				1			
CHORDATA	ACANTHURIDAE	*Zebrasoma flavescens*	1					1	1								
CHORDATA	APOGONIDAE	*Apogon kallopterus*						1									
CHORDATA	APOGONIDAE	*Foa brachygramma*				1											
CHORDATA	BLENNIIDAE	*Cirripectus vanderbilti*	1														
CHORDATA	BLENNIIDAE	*Omobranchus elongatus*		1													
CHORDATA	CARANGIDAE	*Caranx*														1	
CHORDATA	CARANGIDAE	*Caranx melampygus*						1		1							
CHORDATA	CARANGIDAE	*Gnathanodon speciosus*								1							
CHORDATA	CHAETODONTIDAE	*Chaetodon auriga*	1	1				1	1		1			1			
CHORDATA	CHAETODONTIDAE	*Chaetodon ephippium*								1							
CHORDATA	CHAETODONTIDAE	*Chaetodon lunula*	1	1				1									

			Station														
Phylum	**Family**	**Genus and Species**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CHORDATA	CHAETODONTIDAE	*Chaetodon miliaris*	1														
CHORDATA	CHAETODONTIDAE	*Forcipiger flavissimus*	1														
CHORDATA	CICHLIDAE	*Oreochromis mossambicus*									1					1	1
CHORDATA	CICHLIDAE	*Sarotherodon melanotheron*									1						
CHORDATA	GOBIIDAE	*Asterropteryx semipunctatus*							1	1							
CHORDATA	GOBIIDAE	*Bathygobius cocosensis*									1					1	1
CHORDATA	GOBIIDAE	*Eviota epiphanes*	1														
CHORDATA	GOBIIDAE	*Gobiidae*		1							1		1				
CHORDATA	KUHLIIDAE	*Kuhlia sandvicensis*						1		1	1						1
CHORDATA	KYPHOSIDAE	*Microcanthus strigatus*	1														
CHORDATA	LABRIDAE	*Coris flavovita*	1														
CHORDATA	LABRIDAE	*Gomphosus varius*						1									
CHORDATA	LABRIDAE	*Labroides phthirophagus*	1														
CHORDATA	LABRIDAE	*Stethojulis balteata*	1					1	1								
CHORDATA	LABRIDAE	*Thalassoma duperrey*	1					1									
CHORDATA	LUTJANIDAE	*Lutjanus fulvus*				1		1	1					1		1	
CHORDATA	MUGILIDAE	*Mugil cephalus*				1											
CHORDATA	MULLIDAE	*Mulloidichthys flavolineatus*						1									
CHORDATA	MULLIDAE	*Mulloidichthys vanicolensis*	1	1				1	1								
CHORDATA	MULLIDAE	*Parupeneus mutifasciatus*						1	1								
CHORDATA	MULLIDAE	*Parupeneus porphyreus*	1					1	1					1			
CHORDATA	MULLIDAE	*Upeneus taeniopterus*		1													
CHORDATA	POMACENTRIDAE	*Abudefduf abdominalis*	1					1	1	1	1	1	1	1		1	1
CHORDATA	POMACENTRIDAE	*Dascyllus albisella*	1	1				1									
CHORDATA	SCARIDAE	*Chlorurus psittacus*												1			
CHORDATA	SCARIDAE	*Scarus*	1	1				1	1				1	1			
CHORDATA	SPHYRAENIDAE	*Sphyraena barracuda*															1
CHORDATA	DIODONTIDAE	*Diodon hystrix*	1														
CHORDATA	OSTRACIIDAE	*Lactoria fornasini*	1														
CHORDATA	OSTRACIIDAE	*Ostracion meleagris camurum*	1														
CHORDATA	TETRAODONTIDAE	*Arothron*														1	
CHORDATA	TETRAODONTIDAE	*Arothron hispidus*	1	1				1	1	1	1	1	1	1	1		
CHORDATA	?UROCHORDATA	*Urochordata*															1

APPENDIX E

Report by Dr. E Allison Kay on Micromolluscs Sampled in
1996 Pearl Harbor Legacy Study

(Not Available)

APPENDIX F

Introduced or Cryptogenic Species Collected in Pearl Harbor in 1996
Status: NR = New Record for Hawaii, PR = Previously Recorded
I = Introduced, CR = Cryptogenic

Phylum	Family or Higher	Genus and Species	Status	Authority	1st P. H. Rept.	Source &/or Comment
RHODOPHYTA	RHODOLOMAEAE	*Acanthophora spicifera*	PR, I	Doty, 1962	1952	Introduced into Pearl Harbor on barge fouling
PORIFERA	HETEROPIIDAE	*Heteropia glomerosa*	NR, C	Kelly-Borges & Defelice, ms	1996	This study
PORIFERA	SPONGIIDAE	*Hyatella intestinalis*	NR, C	Kelly-Borges & Defelice, ms	1996	This study
PORIFERA	DYSIDEIDAE	*Dysidea cf. avara*	PR, C	Kelly-Borges & Defelice, ms	1996	1948 in Kaneohe Bay (de Laubenfels, 1950)
PORIFERA	DYSIDEIDAE	*Dysidea cf. arenaria*	NR, C	Kelly-Borges & Defelice, ms	1996	This study
PORIFERA	CALLYSPONGIIDAE	*Callyspongia cf. diffusa*	PR, C	Kelly-Borges & Defelice, ms	1996	1948 in Kaneohe Bay (de Laubenfels, 1950)
PORIFERA	NIPHATIDAE	*Gelliodes fibrosa*	NR, I	Kelly-Borges & Defelice, ms	1996	This study
PORIFERA	ADOCIIDAE	*Sigmadocia caerulea*	NR, I	Kelly-Borges & Defelice, ms	1996	Poss. introduced if really *S. caerula*
PORIFERA	AMPHILECTIDAE	*Biemna fistulosa*	NR, C	Kelly-Borges & Defelice, ms	1996	This study
PORIFERA	MYCALIDAE	*Mycale (Aegogropila) armata*	NR, C	Kelly-Borges & Defelice, ms	1996	This study
PORIFERA	MYCALIDAE	*Mycale (Carmia) cecilia*	PR, I	Kelly-Borges & Defelice, ms	1973	McCain (1975), 1947 in Kaneohe Bay (de Laubenfels, 1950)
PORIFERA	MYCALIDAE	*Zygomycale parishii*	PR, I	Kelly-Borges & Defelice, ms	1947	1947 in Kaneohe Bay (de Laubenfels, 1950)
PORIFERA	MYXILLIDAE	*Tedania reticulata*	NR, C	Kelly-Borges & Defelice, ms	1947	1947 in Kaneohe Bay (de Laubenfels, 1950) as *T. ignis*
PORIFERA	HALICHONDRIIDAE	*Halochondria melanodocia*	PR, I	Kelly-Borges & Defelice, ms	1993	Brock, 1994
PORIFERA	HALICHONDRIIDAE	*Topsentia* sp.	NR, C	Kelly-Borges & Defelice, ms	1996	This study
PORIFERA	SUBERITIDAE	*Suberites cf. zeteki*	PR, I	Kelly-Borges & Defelice, ms	1948	1947 in Kaneohe Bay (de Laubenfels, 1950)
PORIFERA	RASPAILIIDAE	*Echinodictyum asperum*	NR, C	Kelly-Borges & Defelice, ms	1996	This study
PORIFERA	CLIONIDAE	*Cliona* sp.	PR, C	Kelly-Borges & Defelice, ms	1947	1947 in Kan. Bay as *C. vastifica* (de Laubenfels, 1950)
CNIDARIA	HALOCORDYLIDAE	*Halocordyle disticha*	PR, I	Carlton & Eldredge, ms	1929	BPBM Spec D-183
CNIDARIA	TELESTIDAE	*Carijoa (=Telesto) riisei*	PR, I	Carlton & Eldredge, ms	1972	BPBM Spec D-454
ANNELIDA	CHAETOPTERIDAE	*Chaetopterus* sp.	PR, C	Carlton & Eldredge, ms	1976	Grovhoug and Rastetter(1980) as *C. variopedatus*
ANNELIDA	PHYLLODOCIDAE	*Eulalia sanguinea*	PR, C	Carlton & Eldredge, ms	1996	Hartmann (1966)
ANNELIDA	SABELLIDAE	*Branchiomma nigromaculata*	PR, C	Carlton & Eldredge, ms	1966	Hartmann (1966)
ANNELIDA	SABELLIDAE	*Sabellastarte sanctijosephi*	PR, C	Carlton & Eldredge, ms	1976	Grovhoug and Rastetter(1980)
ANNELIDA	SERPULIDAE	*Hydroides dirampha*	PR, I	Carlton & Eldredge, ms	1929	BPBM Spec D-1083 as *H. lunulifera*
ANNELIDA	SERPULIDAE	*Hydroides elegans*	PR, I	Carlton & Eldredge, ms	1929	BPBM Spec D-1101 as *H. norvegica*
ANNELIDA	SERPULIDAE	*Pomatoleios kraussii*	PR, I	Carlton & Eldredge, ms	1976	Grovhoug and Rastetter(1980)
ANNELIDA	SERPULIDAE	*Salmacina dysteri*	PR, I	Carlton & Eldredge, ms	1972	Long (1974)
ANNELIDA	SERPULIDAE	*Serpula* sp.	PR, C	Carlton & Eldredge, ms	1938	Staughan (1969) as *S. vermicularis*
Phylum	**Family or Higher**	**Genus and Species**	**Status**	**Authority**	**1st P. H. Rept.**	**Source &/or Comment**

Phylum	Family or Higher	Genus and Species	Status	Authority	1st P. H. Rept.	Source &/or Comment
ANNELIDA	SPINTHERIDAE	*Spinther japonicus*	PR, C	Carlton & Eldredge, ms	1976	Grovhoug and Rastetter(1980)
MOLLUSCA	FISSURELLIDAE	*Diodora ruppelli*	PR, I	Carlton & Eldredge, ms	1962	Kay (1979)
MOLLUSCA	CALYPTRAEIDAE	*Crepidula aculeata*	PR, I	Carlton & Eldredge, ms	1915	BPBM Spec MO-231366
MOLLUSCA	CALYPTRAEIDAE	*Crucibulum spinosum*	PR, I	Carlton & Eldredge, ms	1950	1946 in Honolulu Harb. (Edmondson, 1946)
MOLLUSCA	VERMETIDAE	*Vermetus alii*	PR, I	Carlton & Eldredge, ms	1973	Evans et al. (1974)
MOLLUSCA	PYRAMIDELLIDAE	*Hinemoa indica*	PR, C	Carlton & Eldredge, ms	1973	Evans et al. (1974)
MOLLUSCA	ANOMIIDAE	*Anomia nobilis*	PR, C	Carlton & Eldredge, ms	1912	BPBM Spec MO-68170
MOLLUSCA	OSTREIDAE	*Crassostrea virginica*	PR, I	Carlton & Eldredge, ms	1866	Kay (1979)
MOLLUSCA	OSTREIDAE	***Saccostrea cucullata***	NR, I	Paulay, pers. comm.	1996	*O. cucullata* planted in Kalihi in 1928-29
MOLLUSCA	CHAMIDAE	***Chama* cf. *elatensis***	NR, I	Paulay, pers. comm.	1996	This study
MOLLUSCA	CHAMIDAE	*Chama fibula*	PR, I	Carlton & Eldredge, ms	1920	Dall, et al. 1938
MOLLUSCA	CHAMIDAE	*Chama lazarus*	PR, I	Paulay, 1996.	1950	USNM Spec. 699558
MOLLUSCA	CHAMIDAE	*Chama pacifica*	PR, I	Paulay, 1996.	1950	USNM Spec. 699565
MOLLUSCA	SEMELIDAE	***Abra* sp.**	NR, I	Paulay, pers. comm.	1996	This study
MOLLUSCA	VENERIDAE	*Venerupis (Ruditapes) philippinarum*	PR, I	Carlton & Eldredge, ms	1918	Dall et al. (1938)
MOLLUSCA	MYIDAE	***Sphenia* sp. A**	NR, I	Paulay, pers. comm.	1996	This study
MOLLUSCA	PHOLADIDAE	*Martesia striata*	PR, I	Carlton & Eldredge, ms	1920	Dall et al. (1938)
MOLLUSCA	TEREDINIDAE	*Teredo bartschi*	PR, I	Carlton & Eldredge, ms	1935	Edmondson (1942)
PYCNOGONIDA		***Pigrogromoitus timsanus***	NR, I	Child, pers. comm.	1996	This study
ARTHROPODA	BALANIDAE	*Balanus amphitrite amphitrite*	PR, I	Carlton & Eldredge, ms	1913	Pilsbry (1928)
ARTHROPODA	BALANIDAE	*Balanus eburneus*	PR, I	Carlton & Eldredge, ms	1929	BPBM Spec. B-271
ARTHROPODA	BALANIDAE	*Balanus reticulatus*	PR, I	Carlton & Eldredge, ms	1915	Henry & McClaughlin (1975)
ARTHROPODA	CTHAMALIDAE	***Chthamalus proteus***	NR, I	Southward et al., in press	1996	This study
ARTHROPODA	PSEUDOZEUXIDAE	*Leptochelia dubia*	PR, C	Carlton & Eldredge, ms	1973	McCain (1975), 1938 at Black Point (BPBM Spec)
ARTHROPODA	PSEUDOZEUXIDAE	***Parapseudes pedispinis***	NR, I	Muir, 1997	1996	This study
ARTHROPODA	ANTHURIDAE	*Mesanthura* sp.	NR, C	Muir, pers. comm	1996	This study
ARTHROPODA	LEUCOTHOIDAE	*Paraleucothoe ?flindersi*	NR, C	Muir, 1997	1996	This study
ARTHROPODA	LIMNORIIDAE	*Limnoria tripunctata*	PR, I	Carlton & Eldredge, ms	1973	1945 in Honolulu Harb. (BPBM Spec S-5722)
ARTHROPODA	SPHAEROMATIDAE	*Exosphaeroma* sp.	NR, C	Muir, pers. comm	1996	This study
ARTHROPODA	COROPHIIDAE	*Corophium ascherusicum*	PR, I	Carlton & Eldredge, ms	1973	1943 at Waikiki (Barnard, 1955)
ARTHROPODA	COROPHIIDAE	*Corophium baconi*	PR, I	Carlton & Eldredge, ms	1973	1967 in Kaneohe Bay (Barnard, 1970)
ARTHROPODA	COROPHIIDAE	*Corophium insidiosum*	PR, I	Carlton & Eldredge, ms	1978	1959 at Hilo (Barnard, 1970)
ARTHROPODA	COROPHIIDAE	*Ericthonius brasiliensis*	PR, I	Carlton & Eldredge, ms	1938	Barnard (1955)
ARTHROPODA	COROPHIIDAE	*Grandidierella bispinosa*	NR, C	Muir, 1997	1996	This study
ARTHROPODA	COROPHIIDAE	*Grandidierella japonica*	NR, I	Muir, 1997	1996	This study (See also Carlton & Eldredge, ms)
ARTHROPODA	GAMMARIDAE	*Elasmopus rapax*	PR, I	Carlton & Eldredge, ms	1948	1937 in Kaneohe Bay (Barnard, 1955)
ARTHROPODA	PODOCERIDAE	*Podocerus brasiliensis*	PR, I	Carlton & Eldredge, ms	1938	1935 in Kaneohe Bay (Barnard, 1955)
ARTHROPODA	STENOTHOIDAE	*Stenothoe gallensis*	PR, I	Carlton & Eldredge, ms	1937	1935 in Kaneohe Bay (Barnard, 1955)
ARTHROPODA	STENOTHOIDAE	*Stenothoe valida*	PR, C	Carlton & Eldredge, ms	1978	1967 on east coast Oahu (Barnard, 1970)
ARTHROPODA	PORTUNIDAE	*Scylla serrata*	PR, I	Brock, 1960	1972	Int. to Hawaii in 1932 (Brock, 1960)
ARTHROPODA	GRAPSIDAE	***Nanosesarma minutum***	NR, I	Carlton & Eldredge, ms	1996	This study
ARTHROPODA	XANTHIDAE	*Panopeus pacificus*	PR, I	Carlton & Eldredge, ms	1929	BPBM Spec. S-3435

ARTHROPODA	GONODACTYLIDAE	*Gonodactylus aloha*	PR, I	Carlton & Eldredge, ms	1973	1963 at Waikiki (Kinzie, 1968) as *G. falcatus*
BRYOZOA	VESICULARIIDAE	*Amathia distans*	PR, I	Carlton & Eldredge, ms	1948	1935 in Kaneohe Bay (Edm .& Ing. 1939)
BRYOZOA	AETEIDAE	*Aetea truncata*	PR, I	Carlton & Eldredge, ms	1972	1935 in Kaneohe Bay (Edm .& Ing. 1939)
BRYOZOA	BUGULIDAE	*Bugula neritina*	PR, I	Carlton & Eldredge, ms	1921	BPBM Spec K-235
BRYOZOA	BUGULIDAE	*Bugula stolonifera*	PR, I	Carlton & Eldredge, ms	1940	BPBM Spec K-223, 226, 230
BRYOZOA	SAVIGNYELLIDAE	*Savignyella lafontii*	PR, I	Carlton & Eldredge, ms	1972	1935 in Kaneohe Bay (Edm .& Ing. 1939)
BRYOZOA	SCHIZOPORELLIDAE	*Schizoporella errata*	PR, I	Carlton & Eldredge, ms	1973	Poss. pre 1933 (Edmondson, 1933)
BRYOZOA	SCHIZOPORELLIDAE	*Schizoporella unicornis*	PR, I	Carlton & Eldredge, ms	1935	Ingram (1937)
BRYOZOA	WATERISPORIDAE	*Waterispora edmondsoni*	PR, I	Carlton & Eldredge, ms	1972	1966 in Ala Wai (Soule and Soule, 1968)
CHORDATA	ASCIDIIDAE	*Ascidia sydneiensis*	PR, I	Carlton & Eldredge, ms	1976	BPBM Spec Y-244
CHORDATA	ASCIDIIDAE	*Ascidia* sp. B	PR, I	Carlton & Eldredge, ms	1996	Abbott et al. (in press), date unspec.
CHORDATA	ASCIDIIDAE	Botryllus (=Botrylloides sp.)	PR, I	Carlton & Eldredge, ms	1973	McCain, 1975
CHORDATA	PYURIDAE	*Herdmania momus*	PR, I	Carlton & Eldredge, ms	1972	Long (1974)
CHORDATA	PYURIDAE	*Microcosmus exasperatus*	PR, I	Carlton & Eldredge, ms	1996	Abbott et al. (in press), date unspec.
CHORDATA	STYELIDAE	*Phallusia nigra*	PR, I	Carlton & Eldredge, ms	1985	Hurlbut (1990)
CHORDATA	STYELIDAE	*Polyandrocarpa* sp.	PR, I	Carlton & Eldredge, ms	1996	This study
CHORDATA	STYELIDAE	*Polyclinum constellatum*	PR, I	Carlton & Eldredge, ms		McCain, 1975
CHORDATA	STYELIDAE	*Symplegma brakenhielmi*	PR, I	Carlton & Eldredge, ms	1975	Grovhoug (1976) as *S. oceania*
CHORDATA	STYELIDAE	***Symplegma reptans***	NR, I	Lambert, pers. comm.	1996	This study
CHORDATA	POECILIIDAE	*Poecilia* cf. *latipinna*	PR, I	Brock, 1960	1905	*P. lattipina* introduced in 1905
CHORDATA	CICHLIDAE	*Oreochromis mossambicus*	PR, I	Brock, 1960	1973	Introduced in 1952 around Oahu
CHORDATA	CICHLIDAE	*Sarotherodon melanotheron*	PR, I	Maciolek, 1984; Randall, 1987	1987	Introduced in 1970 around Oahu
CHORDATA	LUTJANIDAE	*Lutjanus fulvus*	PR, I	Maciolek, 1984; Randall, 1987	1973	Introduced in 1956 & '59 in Kaneohe Bay

APPENDIX G

Genera and Species not Previously Reported in Pearl Harbor
that were Collected or Observed in 1996

										Station							
Phylum	**Family or Higher**	***Genus and Species***	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
CHLOROPHYCOTA	CODIACEAE	*Chlorodesmis caespitosa*														1	1
CHLOROPHYCOTA	VALONIACEAE	*Dictyosphaeria versluysii*	1														1
PHAEOPHYCOPHYTA	DICTYOTACEAE	*Lobophora variegata*											1				
RHODOPHYCOTA	GELIDIELLACEAE	*Gelidiella sp. 1*	1														
RHODOPHYCOTA	GELIDIELLACEAE	*Gelidiella sp. 2*	1														
RHODOPHYCOTA	GELIDIELLACEAE	*Gelidiella myrocladia*	1														
RHODOPHYCOTA	GRACILARIACEAE	*Gracilaria salicornia*							1	1							1
RHODOPHYCOTA	HYPNEACEAE	*Hypnea spinella*							1								
RHODOPHYCOTA	HYPNEACEAE	*Hypnea valentiae*	1	1					1								
RHODOPHYCOTA	CORALLINACEAE	*Porolithon onkodes*	1						1								
RHODOPHYCOTA	CHAMPIACEAE	*Champia parvula*	1														
RHODOPHYCOTA	CERAMIACEAE	*Aglaothamnion sp. 1*	1														
RHODOPHYCOTA	CERAMIACEAE	*Aglaothamnion sp. 2*	1														
RHODOPHYCOTA	CERAMIACEAE	*Anotricium secundum*		1													
RHODOPHYCOTA	CERAMIACEAE	*Ceramium sp. 1*	1	1												1	1
RHODOPHYCOTA	CERAMIACEAE	*Ceramium sp. 2*	1														
RHODOPHYCOTA	CERAMIACEAE	*Ceramium clarionense*							1								
RHODOPHYCOTA	CERAMIACEAE	*Griffitsia heteromorpha*	1														
RHODOPHYCOTA	CERAMIACEAE	*Tolypiocladia glomerulata*		1					1								
RHODOPHYCOTA	RHODOMELACEAE	*Laurencia brachyclados*							1								
RHODOPHYCOTA	RHODOMELACEAE	*Polysiphonia scopulorum*		1													
RHODOPHYCOTA	GELIDIACEAE	*Gelidium arenaria*	1														
RHODOPHYCOTA	GELIDIACEAE	*Gelidium pusillum*	1		1												
MAGNOLIOPHYTA	RHIZOPHORACEAE	*Rhizophora mangel*			1	1	1			1	1	1				1	1
PORIFERA	LEUCOSOLENIIDAE	*Leuconia n. sp.*	1													1	1
PORIFERA	HETEROPIIDAE	*Heteropia glomerosa*	1														1
PORIFERA	SPONGIIDAE	*Hyatella intestinalis*											1	1			
PORIFERA	APLYSELLIDAE	*Aplysilla cf. rosea*				1			1								1
PORIFERA	APLYSELLIDAE	*Chelonaplysilla violacea*	1	1				1	1								
PORIFERA	DYSIDEIDAE	*Dysidea n. sp. 1*							1								1
PORIFERA	DYSIDEIDAE	*Dysidea n. sp. 2*	1														
PORIFERA	DYSIDEIDAE	*Dysidea n. sp. 3*		1	1					1			1				
PORIFERA	DYSIDEIDAE	*Dysidea avara*	1					1						1			
PORIFERA	DYSIDEIDAE	*Dysidea cf. arenaria*							1	1							1
PORIFERA	DICTYODEDRILLIDAE	*Dictyodendrilla n. sp.*		1							1	1	1	1			
PORIFERA	HALICLONIDAE	*Gellius n. sp.*		1				1					1				
PORIFERA	CHALINIDAE	*Toxiclona n. sp.*	1	1	1				1	1	1	1	1	1		1	1
PORIFERA	NIPHATIDAE	*Gelliodes fibrosa*	1	1	1						1		1	1	1		
PORIFERA	ADOCIIDAE	*Adociidae n. gen. n. sp.*	1		1			1	1	1	1	1	1	1	1	1	1
PORIFERA	ADOCIIDAE	*Sigmadocia cf. caerulea*	1	1	1				1	1	1		1	1	1	1	1
PORIFERA	AMPHILECTIDAE	*Biemna fistulosa*	1						1		1			1			
PORIFERA	MICROCIONIDAE	*Clathria (Microciona) n. sp.*				1											1
PORIFERA	MYCALIDAE	*Mycale (Aegogropila) armata*	1	1				1	1	1	1	1	1	1	1	1	1
PORIFERA	MYCALIDAE	*Mycale (Carmia) contarenii*									1		1				1
PORIFERA	MYCALIDAE	*Mycale (Carmia) maunakea*		1	1	1											1
PORIFERA	MYXILLIDAE	*Tedania reticulata*				1				1	1		1			1	1
PORIFERA	RASPAILIIDAE	*Echinodictyum asperum*	1					1			1				1		1
PORIFERA	HALICHONDRIIDAE	*Amorphinopsis n. sp.*		1		1	1			1							1
PORIFERA	HALICHONDRIIDAE	*Topsentia cf. halichondrioides*	1	1				1	1	1	1	1	1	1	1	1	1
PORIFERA	SUBERITIDAE	*Prosuberites oleteira*		1							1	1					
PORIFERA	STELLETTIDAE	*Stelletta n. sp. (cf. purpurea)*						1									
CNIDARIA	ACROPORIDAE	*Montipora patula*	1														
CNIDARIA	POCILLOPORIDAE	*Pocillopora damicornis*	1	1				1					1				
CNIDARIA	POCILLOPORIDAE	*Pocillopora meandrina*	1														
CNIDARIA	PORITIDAE	*Porites compressa*		1													

										Station							
Phylum	**Family or Higher**	***Genus and Species***	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
ANNELIDA	EUNICIDAE	*Eunice cariboea*		1				1				1	1	1		1	
ANNELIDA	HESIONIDAE	*Syllidia armata*	1		1	1	1	1				1	1				
ANNELIDA	SERPULIDAE	*Simplicaria pseudomilitaris*		1													1
ANNELIDA	SYLLIDAE	*Branchiosyllis exilis*	1	1	1	1		1	1	1	1	1	1	1	1	1	1
ANNELIDA	SYLLIDAE	*Brania rhopalophora*										1					1
ANNELIDA	SYLLIDAE	*Exogone verugera*						1			1	1	1	1	1	1	1
ANNELIDA	SYLLIDAE	*Myrianida crassicirrata*		1						1						1	
ANNELIDA	SYLLIDAE	*Syllis gracilis*		1		1					1	1	1			1	1
ANNELIDA	SYLLIDAE	*Typosyllis hawaiiensis*									1						
ANNELIDA	SYLLIDAE	*Typosyllis hyalina*	1	1	1			1		1	1		1	1		1	1
ANNELIDA	SYLLIDAE	*Typosyllis prolifera*			1			1			1		1				1
ANNELIDA	GLYCERIDAE	*Glycera tesselata*												1			
MOLLUSCA	FISSURELLIDAE	*Diodora octogona*		1					1	1	1					1	
MOLLUSCA	TURBINIDAE	*Leptothyra candida*						1									
MOLLUSCA	CYPRAEIDAE	*Cypraea childreni*	1														
MOLLUSCA	LITTORINIDAE	*Littoraria pintado*		1													
MOLLUSCA	COLUMBELLIDAE	*Euplica varians*	1														
MOLLUSCA	SIPHONARIIDAE	*Williamia cf. radiata*												1			
MOLLUSCA	CALIPHYLLIDAE	*Cyerce elegans*															1
MOLLUSCA	DORIDIDAE	*Hypselodoris infucata*			1				1								1
MOLLUSCA	CAECIDAE	*Caecum sepimentum*	1														
MOLLUSCA	DIALIDAE	*Cerithidium perparvalum*	1														
MOLLUSCA	DIALIDAE	*Diala varia*			1												
MOLLUSCA	ISOGNOMONIDAE	*Isognomon legumen*	1														
MOLLUSCA	MYTILIDAE	*Lithophaga fasciola*	1														
MOLLUSCA	OSTREIDAE	*Saccostrea cucullata*				1		1		1	1	1	1		1	1	1
MOLLUSCA	CHAMIDAE	*Chama sp. A*		1						1	1						
MOLLUSCA	SEMELIDAE	*Abra sp. A*												1			
MOLLUSCA	TELLINIDAE	*Tellina sp. A*	1				1									1	
MOLLUSCA	MYIDAE	*Sphenia sp. A*		1	1	1	1	1		1	1	1	1			1	1
ARTHROPODA	ENDEIDAE	*Endeis procera*													1		
ARTHROPODA	PYCNOGONIDAE	*Anoplodactylus californicus*							1	1	1				1	1	
ARTHROPODA	PYCNOGONIDAE	*Anoplodactylus pyncnosoma*		1													
ARTHROPODA	PYCNOGONIDAE	*Pigrogromitus timsanus*														1	
ARTHROPODA	CHTHAMALIDAE	*Chthamalus proteus*		1		1			1	1	1	1	1			1	1
ARTHROPODA	APSEUDIDAE	*Apseudes sp. A*	1	1				1	1								
ARTHROPODA	APSEUDIDAE	*Apseudes tropicalis*		1	1	1											
ARTHROPODA	APSEUDIDAE	*Parapseudes neglectus*	1			1											
ARTHROPODA	APSEUDIDAE	*Parapseudes pedispinis*	1			1											
ARTHROPODA	ANTHURIDAE	*Mesanthura sp. A*						1	1		1						1
ARTHROPODA	JANIRIDAE	*Cerpias algicola*	1														
ARTHROPODA	LIMNORIIDAE	*Limnoria lignorum*							1					1			
ARTHROPODA	MUNNIDAE	*Munna acarina*	1						1								
ARTHROPODA	SCYPHACIDAE	*Armadilloniscus litoralis*							1								
ARTHROPODA	SPHAEROMATIDAE	*Exosphaeroma sp. A*										1					
ARTHROPODA	AMPHILOCHIDAE	*Amphilochus kailua*	1	1													1
ARTHROPODA	AMPHILOCHIDAE	*Amphilochus likelike*						1						1			1
ARTHROPODA	AMPHILOCHIDAE	*Gitanopsis pele*															1
ARTHROPODA	AMPITHOIDAE	*Ampithoe waialua*	1	1												1	
ARTHROPODA	AMPITHOIDAE	*Paragrubia vorax*	1														
ARTHROPODA	AORIDAE	*Grandidierella bispinosa*														1	
ARTHROPODA	AORIDAE	*Grandidierella japonica*					1							1			
ARTHROPODA	AORIDAE	*Lembos pualani*	1		1				1								1
ARTHROPODA	AORIDAE	*Lembos waipio*	1														
ARTHROPODA	COLOMASTIGIDAE	*Colomastix lunalilo*	1	1	1			1	1	1	1	1	1	1	1	1	1
ARTHROPODA	COLOMASTIGIDAE	*Colomastix pusilla*	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
ARTHROPODA	GAMMARIDAE	*Elasmopus diplonyx*				1										1	

										Station							
Phylum	**Family or Higher**	***Genus and Species***	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
ARTHROPODA	GAMMARIDAE	*Elasmopus molokai*		1													
ARTHROPODA	GAMMARIDAE	*Eriopisa hamakua*						1									
ARTHROPODA	GAMMARIDAE	*Eriopisella sechellensis upolu*		1				1	1					1			
ARTHROPODA	GAMMARIDAE	*Maera pacifica*	1	1	1	1		1	1	1	1			1		1	1
ARTHROPODA	HYALIDAE	*Hyale grandicornis bishopae*							1								
ARTHROPODA	ISAEIDAE	*Gammaropsis alamoana*														1	
ARTHROPODA	LEUCOTHOIDAE	*Leucothoe tridens*	1	1	1			1	1	1	1	1	1	1	1	1	1
ARTHROPODA	LEUCOTHOIDAE	*Paraleucothoe flindersi*									1				1		1
ARTHROPODA	LILJEBORGIIDAE	*Liljeborgia heeia*						1				1	1				
ARTHROPODA	PODOCERIDAE	*Podocerus talegus lawai*	1														
ARTHROPODA	ALPHEIDAE	*Alpheus brevipes*	1														
ARTHROPODA	ALPHEIDAE	*Alpheus collumianus*	1														
ARTHROPODA	ALPHEIDAE	*Alpheus lobidens*								1		1					
ARTHROPODA	ALPHEIDAE	*Alpheus lottini*	1														
ARTHROPODA	ALPHEIDAE	*Metalpheus paragracilis*	1					1									
ARTHROPODA	ALPHEIDAE	*Synalpheus paraneomeris*	1	1				1		1			1	1	1	1	
ARTHROPODA	CALLIANASSIDAE	*Callianassa variabilis*		1													
ARTHROPODA	GRAPSIDAE	*Nanosesarma minutum*							1	1						1	1
ARTHROPODA	HAPALOCARCINIDAE	*Hapalocarcinus marsupialis*	1														
ARTHROPODA	MAJIDAE	*Hyastensus spinosus*													1		1
ARTHROPODA	MAJIDAE	*Schizophroidea hilensis*	1														
ARTHROPODA	OCYPODIDAE	*Ocypode laevis*	1														
ARTHROPODA	PALAEMONIDAE	*Brachycarpus biunguiculatus*															1
ARTHROPODA	PALAEMONIDAE	*Harpiliopsis depressus*	1					1									
ARTHROPODA	PALAEMONIDAE	*Palaemonella rotumana*										1			1		
ARTHROPODA	XANTHIDAE	*Liocarpilodes binnguis*	1														
ARTHROPODA	XANTHIDAE	*Paramedeus simplex*	1		1												
ARTHROPODA	XANTHIDAE	*Phymodius ungulatus*	1						1	1			1				
ARTHROPODA	XANTHIDAE	*Pilumnus minutus*															1
ARTHROPODA	XANTHIDAE	*Trapezia intermedia*	1					1									
ARTHROPODA	XANTHIDAE	*Trapezia wardi*	1														
BRYOZOA	RETEPORIDAE	*Reteporellina denticulata*	1					1				1	1				1
ECHINODERMATA	ECHINOMETRIDAE	*Echinometra mathaei*	1														
ECHINODERMATA	HOLOTHURIIDAE	*Actinopyga mauritiana*	1														
ECHINODERMATA	HOLOTHURIIDAE	*Holothuria atra*	1														
CHORDATA	ASCIDIIDAE	*Ascidia n. sp.*											1				
CHORDATA	ASCIDIIDAE	*Ascidia sp. B*															1
CHORDATA	PEROPHORIDAE	*Perophora annectens*	1					1									
CHORDATA	PYURIDAE	*Microcosmus exasperatus*	1							1				1			1
CHORDATA	STYELIDAE	*Polyandrocarpa sp. A*															1
CHORDATA	STYELIDAE	*Polyandrocarpa sp. B*			1						1		1				1
CHORDATA	STYELIDAE	*Symplegma reptans*									1						
CHORDATA	SYNGNATHIDAE	*Doryrhamphus exisis*							1								
CHORDATA	ACANTHURIDAE	*Acanthurus blochi*						1		1							
CHORDATA	ACANTHURIDAE	*Acanthurus guttatus*						1						1		1	
CHORDATA	ACANTHURIDAE	*Acanthurus nigrofuscus*	1						1								
CHORDATA	BLENNIIDAE	*Cirripectus vanderbilti*	1														
CHORDATA	CHAETODONTIDAE	*Forcipiger flavissimus*	1														
CHORDATA	LABRIDAE	*Coris flavovita*	1														
CHORDATA	LABRIDAE	*Gomphosus varius*						1									
CHORDATA	LABRIDAE	*Thalassoma duperrey*	1					1									
CHORDATA	MULLIDAE	*Mulloidichthys vanicolensis*	1	1				1	1								
CHORDATA	MULLIDAE	*Parupeneus mutifasciatus*						1	1								
CHORDATA	OSTRACIIDAE	*Lactoria fornasini*	1														
		Total Species not prev. reported	82	44	23	18	7	40	40	30	33	24	33	28	18	34	52

APPENDIX H.

List of Authors, Taxonomic Consultants and Acknowledgments of Assistance for the Pearl Harbor Legacy Study

This study was conducted through the facilities of the Bernice Pauahi Bishop Museum Department of Natural Sciences-Invertebrate Zoology by:

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Sponges: Dr. Michelle Kelly-Borges, Natural History Museum, London

Polychaetes: Dr. Julie Bailey-Brock, University of Hawaii

Pycnogonids: Dr. C. Allan Child, Smithsonian Institution

Amphipods, Isopods and Tanaids: Dr. David Muir, Bernice P. Bishop Museum (Affiliate)

Isopods: Dr. Richard Brusca, College of Charleston

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Gastropods: Dr. Robert Cowie and Ms. Regie Kawamoto, Bernice P. Bishop Museum

Bivalves: Dr. Gustav Paulay, University of Guam Marine Laboratory

Ascidians: Dr. Gretchen Lambert, California State University at Fullerton

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