



Benthic and Fish Communities on the USS Arizona and USS Utah

*World War II Valor in the Pacific National Monument
Pearl Harbor, O‘ahu, Hawai‘i, 2010-11*

Natural Resource Technical Report NPS/PACN/NRTR—2013/813



ON THE COVER

Number one gun turret on the USS Arizona

Photograph from: VALR 2D3D streaming video

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Steve L. Coles

Hawai‘i Institute of Marine Biology
P.O. Box 1346
Kāne‘ohe, HI 96744

Daniel Lager, Claire Lager, Paul L. Jokiel, Ku‘ulei Rodgers

Hawai‘i Institute of Marine Biology
P.O. Box 1346
Kāne‘ohe, HI 96744

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Executive Summary

Biological surveys on the USS Arizona and USS Utah, lying submerged on either side of Ford Island in Pearl Harbor, were conducted for the National Park Service in 2010-11. Using 117 reference points originally established on the deck and the hull of the Arizona during a previous survey in 1986 and 72 new reference points set on the deck and starboard side of the Utah during the present surveys, sediment quality and thickness, biofouling thickness, benthic taxa composition and cover, and fish species composition size and abundance were estimated by researchers for both vessels. Where data were available from the 1986 survey, comparisons were made with results of the previous study.

As determined in the 1986 survey, substantial sediment has accumulated on the horizontal surfaces on the fore deck of the USS Arizona. The USS Utah, because it came to lie on the bottom at about a 40° angle, has its entire port side and much of the port side of its deck buried in fine sediment. These sediments are fine grained silts which range up to 2 m thick on deck surfaces and have prohibited the settlement and development of macrofouling organisms on most of the fore deck of the Arizona and the port half of the deck on the USS Utah. Although the average depth of sediment on the Arizona was greater in 1986 than determined in 2010, the mean difference between paired values for the 55 deck sites was not significant.

Where surfaces of both ships are not covered by silt or by a combination of sand and shell rubble, the ships' surfaces support a rich assemblage of benthic fouling organisms dominated by sponges. These organisms are more prominent both by number of taxa and by percent cover of available space on the sides than on the decks of the vessels. Thickness of biofouling organisms on the sides of the Arizona ranged up to 11 cm, and the mean values were not significantly less by a paired comparison test than the mean minimum values for biofouling recorded in 1986.

A total of 45 taxa of megafauna and flora benthic organisms were identified in the field and their percent cover by taxa was quantified for all reference sites using point-count determinations of photo quadrats in the laboratory. By comparison, sixteen (35%) of the 2010-11 total were introduced or cryptogenic (i.e. of uncertain geographic origin) species, in good agreement with previous studies elsewhere on the Arizona and in Pearl Harbor. Frequency of occurrence and cover of benthic organisms generally decreased with depth and decreased with sediment or sand/shell cover on both vessels. The invasive orange keyhole sponge *Mycale grandis* was the dominant species found on both ships by both frequency and by percent cover, followed by the sponges *Haliclona S. caerulea* and *Biemna fistulosa*. Other frequently occurring organisms were the tube worms *Sabellastarte spectabilis* (21 deck, 32 vertical), the bryozoan *Schizoporella* sp. cf. *errata*, and, on one area of the mid-deck of the Arizona, the red alga *Dichotomaria marginata*. The *Branchiomma* sp. tubeworm was the most abundant organism reported on the Arizona for the 1986 survey, but it appeared to be less frequent and abundant in 2011, suggesting that lower organic particulate levels in Pearl Harbor water have diminished the food source for this and other organisms that rely on suspension feeding.

The most significant finding of this study was the establishment of an apparently thriving community of hard corals on both vessels, dominated by *Pocillopora damicornis* and *Leptastrea purpurea*, and including a few large colonies of *Porites compressa* and *Porites lobata*. Over 635 corals were counted and measured on the USS Arizona and 60 corals on the Utah, most of them

occurring on deck areas but also the ships' sides. No corals were reported on the Arizona in the 1986 survey or elsewhere in a comprehensive survey of Pearl Harbor in 1971-73. The first reports of small colonies of corals in Pearl Harbor were in 1996, and these records plus the present size class distributions of the corals on the Arizona and Utah indicate that coral settlement and growth in the vicinity of Ford Island began 15-20 years ago, and corals are accumulating rapidly on both vessels and elsewhere in Pearl Harbor. It is likely that this is a response to improved water quality and clarity that has been achieved in Pearl Harbor in the last 30 years.

The structures of the USS Arizona and USS Utah provide habitat for an attenuated community of reef fish that reside on or around the vessels. Twenty-one species of fish were identified on the Arizona in 2010, similar to the 18 recorded on the Utah at this time. The fishes on both vessels were dominated by herbivores, primarily two species of acanthurids, *Acanthurus xanthopterus* and *A. blochii*, and by a single pomacentrid zooplanktivore, *Abudefduf abdominalis*. Carnivores comprised of two species of *Caranx* were a minor proportion of the total, and carnivores were even more depleted on the vessels than in open ocean waters in Hawai'i. A single non-native species, *Lutjanus fulvus*, was a minor component of the total fish on both vessels. Species counts, mean density, biomass, species diversity and evenness were all lower for the USS Utah than the Arizona, but both ships were a small fraction of statewide values for these parameters. On both vessels, numbers and biomass decreased with depth and with decreasing spatial complexity on the ships' vertical surfaces due to the lack of three-dimensional structures. Although similar numbers of fish species were found on the Arizona in 2010 (21) as in the previous survey in 1986 (25) only eight species were found in common for the two studies, suggesting that the composition of the fish community has changed substantially in the last 25 years.

Acknowledgments

It has been 70 years since the USS Arizona and Utah were sunk at their moorings as part of the attack on Pearl Harbor. The memorials remain as reminders of that tragic day and the 1228 men who died on both ships and the 1102 men who still remain on the USS Arizona in their final resting place. It has been a rare privilege for us to conduct this study, and we dedicate the study to their memory. We wish to sincerely thank the National Park Service for providing the funding and motivation to do so. Special thanks are due to Mr. Scott Pawlowski of NPS for logistic and information support, to Dr. Eric Brown of NPS for orienting us in the field, and to Ms. Yuko Stender of Hawai'i Institute of Marine Biology for assistance with fish surveys.

Introduction

Historical Perspective

At 7:55 AM on December 7, 1941, the Japanese aerial attack on Pearl Harbor began, resulting in the USA entering WW II in both Europe and the Pacific. Twenty-one vessels were sunk in the attack, including the battleships USS Nevada, California, West Virginia, Oklahoma, Arizona, and Utah. All vessels but the USS Arizona and Utah were salvaged, and 18 were returned to service. The Arizona and the Utah were moored on the opposite sides of Ford Island, and both remain submerged as memorials to the men who died in this first battle of WW II. One thousand one hundred seventy of the USS Arizona's crew died in the attack, and 1,102 remain in the ship as their final resting place. Although a substantial amount of equipment and three of its four major gun assemblies were removed, it was decided in 1942 to abandon further attempts to salvage the ship. About 105 bodies had been removed, but the rest were considered too deteriorated to be identifiable and were considered buried at sea by the US Navy.

Fifty-eight men died on the USS Utah, which turned turtle after it was hit by two torpedoes. The number of deaths on the Utah would have been greater had three seamen that were trapped within the ship not been released by crew members cutting a hole in the ship's hull. A major attempt was made to right the USS Utah by deploying a series of 17 cables and winches, but the attempt was unsuccessful and salvage efforts stopped in March 1944 with the ship resting on its port side at a 38° angle.

Although the Pearl Harbor Naval Base was declared a National Historic Landmark (NHL) in 1965 and the USS Arizona Memorial Observation Center was opened in 1980, the USS Arizona and USS Utah were only mentioned in the initial NHL designation. They were subsequently designated NHL's themselves in May, 1989. This followed an intensive effort by the National Park Service (NPS) to survey and document all aspects of the ships that began with archeological diving surveys of the USS Arizona in 1983, and continued with similar surveys of the USS Utah and a preliminary biological biofouling/corrosion survey of the Arizona in 1986. The results of these surveys and a detailed history of the Pearl Harbor attack, including detailed diagrams of the USS Arizona and USS Utah are presented in Lenihan et al. (1990). A follow-up study of deterioration and corrosion of the hull of the USS Arizona was conducted in 1998-2000 (Johnson et al. 2002). It concluded that a hull collapse releasing an estimated 500,000 gallons of fuel oil remaining in the ship was not imminent.

The present study was requested by the NPS to evaluate the major biotic communities populating the USS Arizona and Utah, determine biofouling and sediment thicknesses on the ships' hulls and compare these findings with results determined from the biofouling and corrosion study that was conducted for the USS Arizona in 1986. Other tasks were to develop an annotated bibliography of a list of species reported from previous studies conducted in Pearl Harbor, in addition to the more limited information available from the 1986 surveys of the USS Arizona, and develop a photographic collection of major organisms and their habitats on the vessels.

Vessels and Location Description

USS Arizona

The 608 foot (185 m) long USS Arizona lies upright on the bottom of Pearl Harbor in its original position where it was sunk on December 7, 1941. The ship faces toward the Pearl Harbor entrance with its starboard side along the Ford Island dock. As indicated in the diagrams in Figure 1, the ship's hull is largely intact, except for the highly damaged forward section near the bow where the bomb that penetrated into the ship's forward powder magazine caused the explosion that sank the ship. The ship originally had four gun turrets, but turrets 2-4 were removed after the ship was sunk. Gun turret number one remained on the ship, which wasn't widely known before the ship's archeological survey in 1983.

The deck of the ship is littered with debris and largely covered by a thick layer of silt on the forward section and a mixed layer of shells and sand, along with a heavy growth of the red alga *Dichotomaria marginata*, on much of the mid-ship area. Various artifacts that were on the ship when it sunk are visible on the deck near the galley area in the mid-ship section. Sections of the original teak deck, in surprisingly good condition, are visible where the sediment layer is thin at various locations on the mid-ship and stern. Just adjacent to the number 3 gun turret barbette on the aft section of the ship is the location of the oil leak that continues to release oil at a rate of one globule about every 5-10 seconds, nearly 70 years after the ship was sunk.

As indicated in Figure 1, the remaining gun turret barbettes, superstructure and forward damaged area on the hull make up a complex three dimensional structure with the potential of providing habitat and cover for a variety of marine organisms in an area of Pearl Harbor where the normal environment is primarily deep silt bottom. A more highly detailed description of the physical aspects of the Arizona and the Utah can be found in the narrative and drawings provided in Lenihan et al. (1990).

USS Utah

Due to the fact that the USS Utah came to rest at an approximate 40° angle off center when it sank, only the formerly horizontal deck section, also referred to as "port" and the starboard vertical surface are above Pearl Harbor's silt bottom, and much of the port side of the deck is buried in the fine silt (Figure 2). The 522 foot (159 m) long ship is on the opposite side of Ford Island from the USS Arizona, about 75 m offshore, with its starboard side facing the shore. A large portion of the starboard side of the ship protrudes above the water and has been heavily corroded by salt air and wave action aggravated by passing boat traffic. Below the water surface, the hull is largely intact with less superstructure removed by salvage operations than is the case for the USS Arizona. Anchor chains, three 5 inch 38 caliber guns on turret mounts and other equipment are visible along its deck. The most prominent visible items are numerous thick cables that were used in the unsuccessful attempt to right the ship after its sinking.

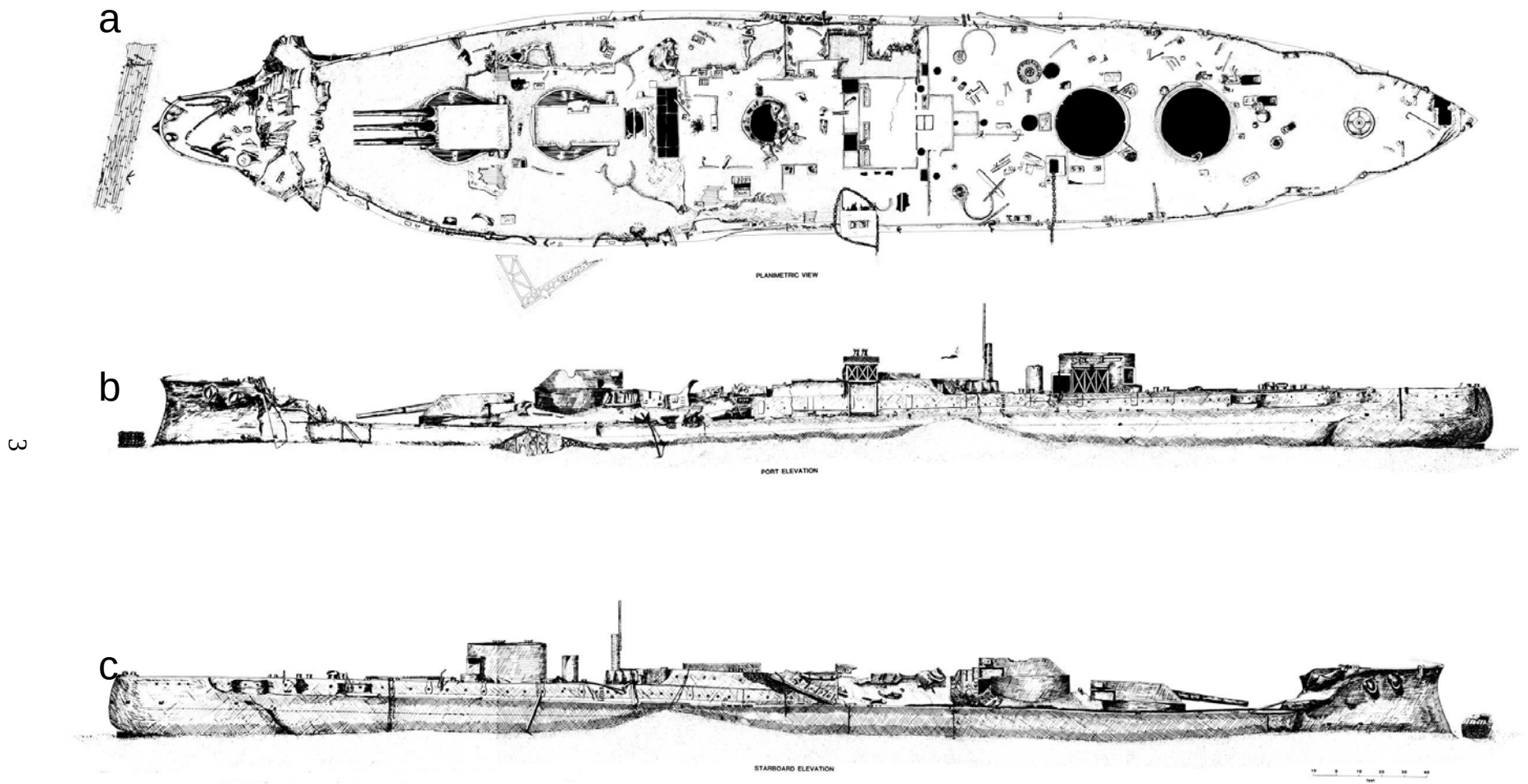


Figure 1. Horizontal (deck) (a), port (b) and starboard (c) views of USS Arizona.

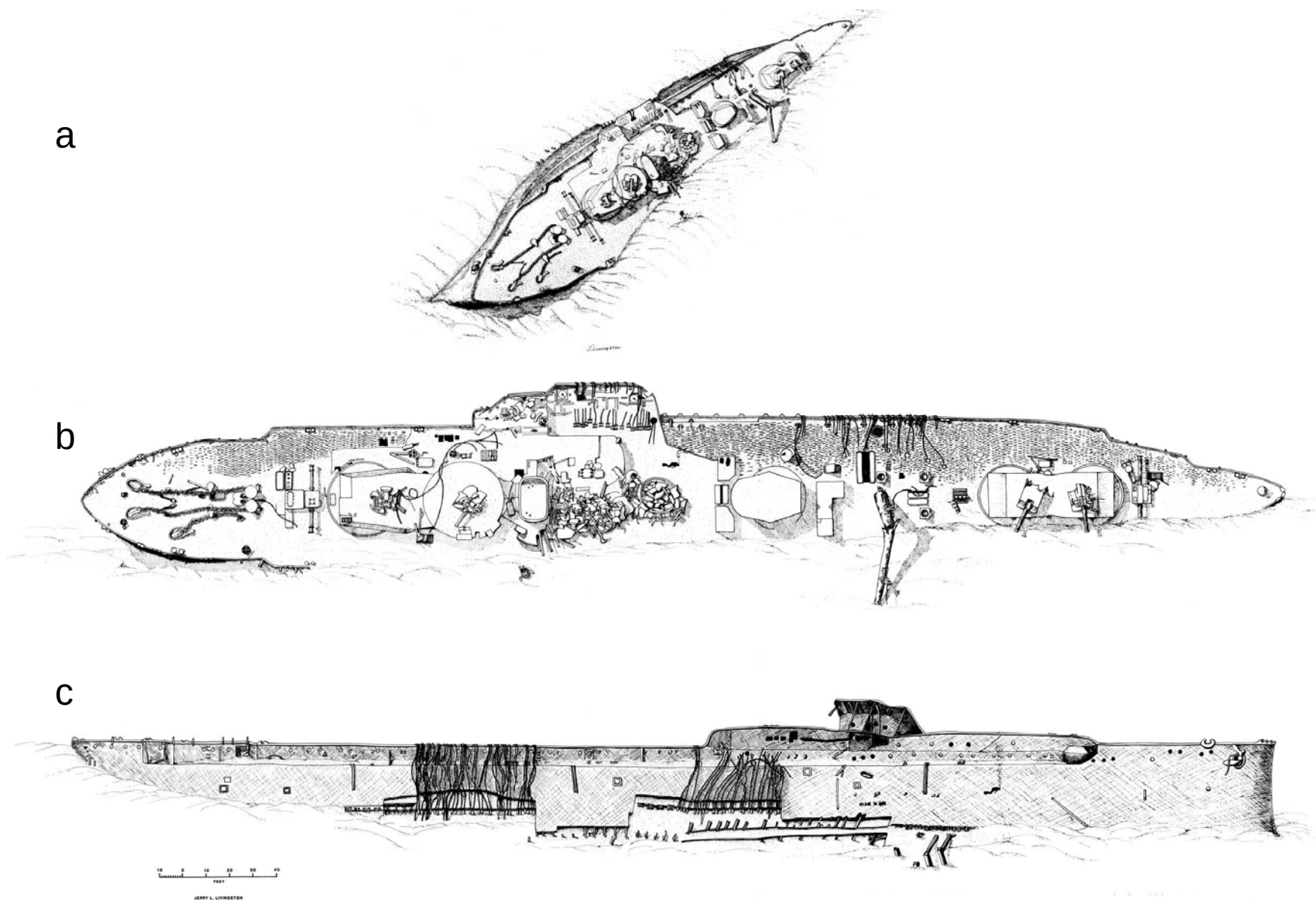


Figure 2. Oblique (a), horizontal (deck) (b) and starboard vertical (c) views of USS Utah.

Sampling Locations

USS Arizona

Using ship diagrams showing sampling locations for the 1986 survey of the USS Arizona (Lenihan et al. 1990) sampling site markers were deployed at 55 horizontal (deck) (Figure 3) and 62 vertical locations (Figures 4 and 5) on the Arizona's hull as close as feasible to the original 1986 sampling sites. These sites were surveyed for sediment or fouling thickness, benthic organisms, coral species and size class, and fish assemblages on the 13-15 Dec. 2010, 13-14 Apr. and 18 May 2011.

USS Utah

Forty-two sampling sites were marked on the port or horizontal (deck) side of the USS Utah (Figure 6) and 30 sites on its starboard vertical surface (Figure 7). The USS Utah was surveyed on the 14-15 Apr. 2011 for the same parameters as were done for the USS Arizona.

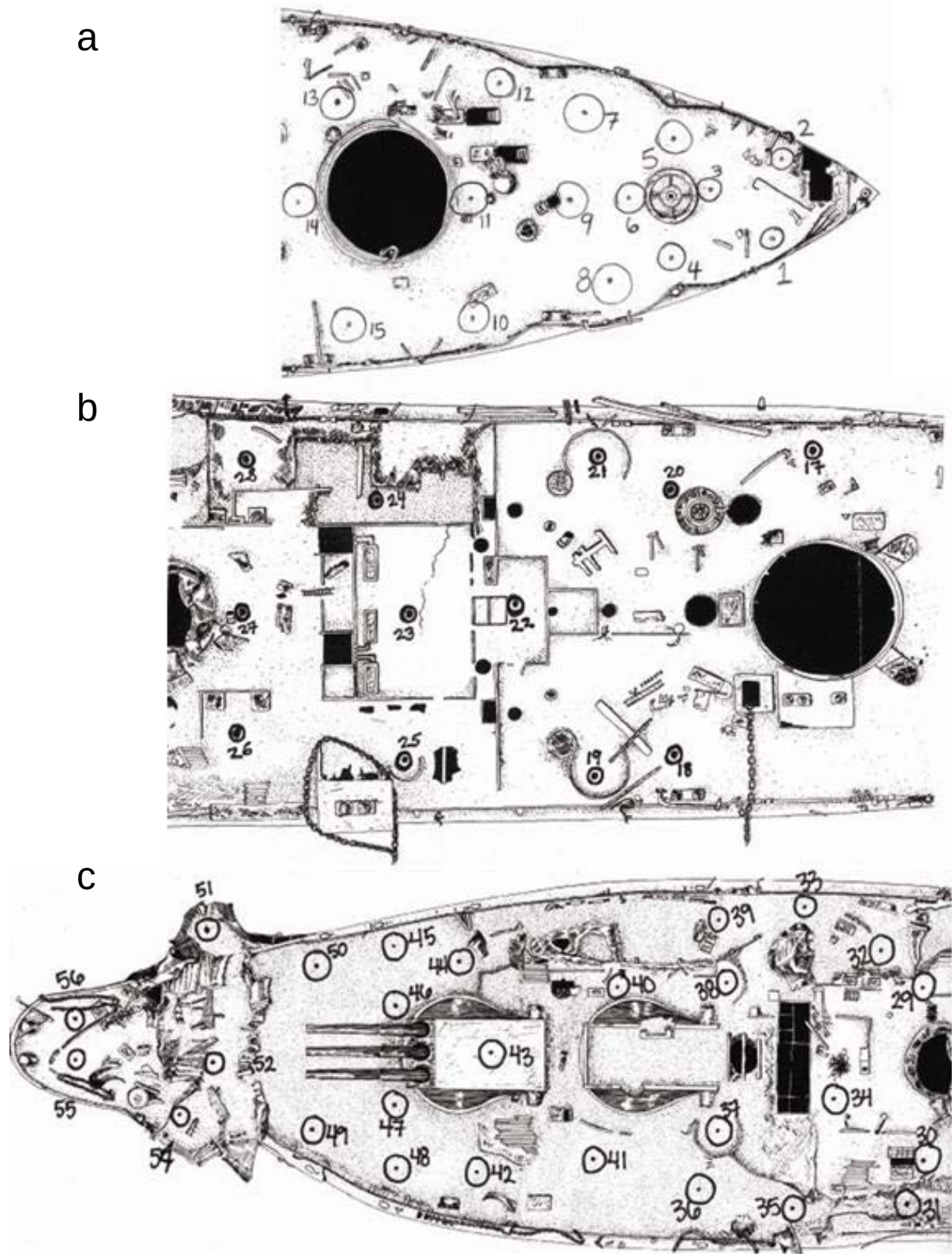
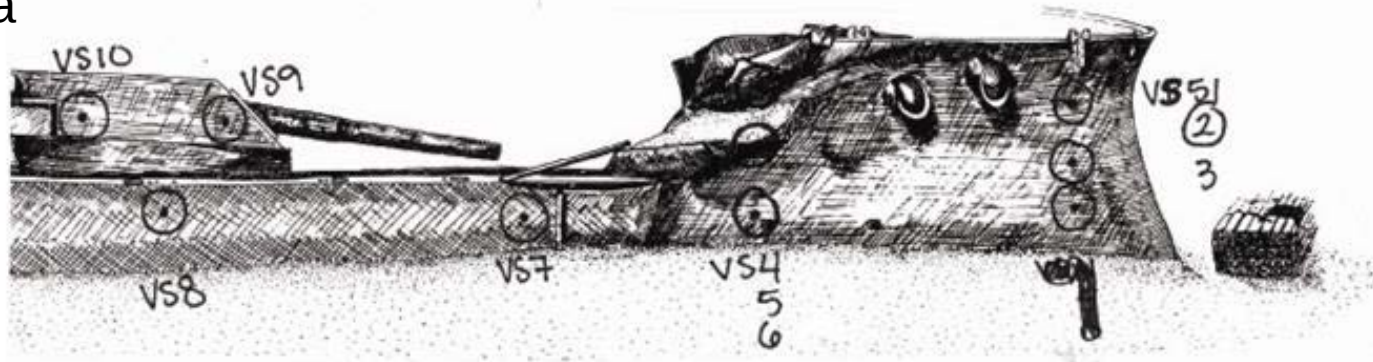
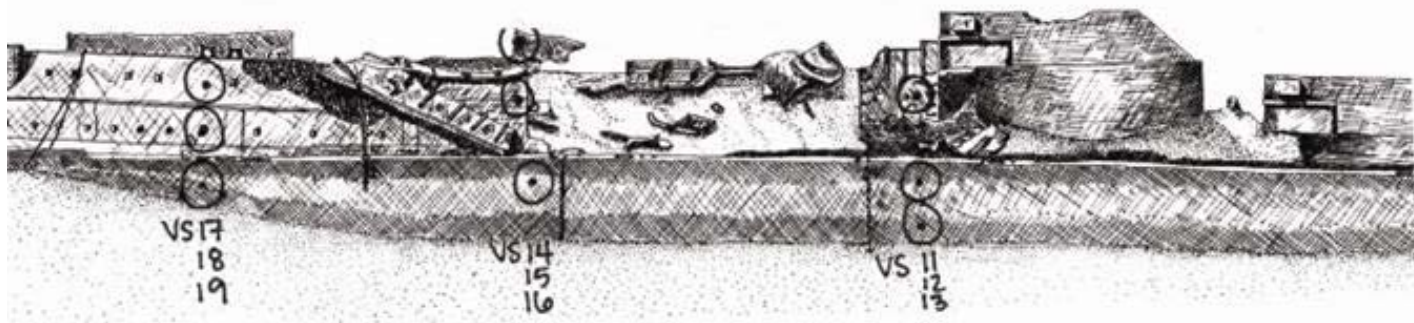


Figure 3. Sampling sites on USS Arizona horizontal (deck) stern (a), mid ships (b) and bow-foredeck (c) (from Lenihan et al 1990).

a



b



c

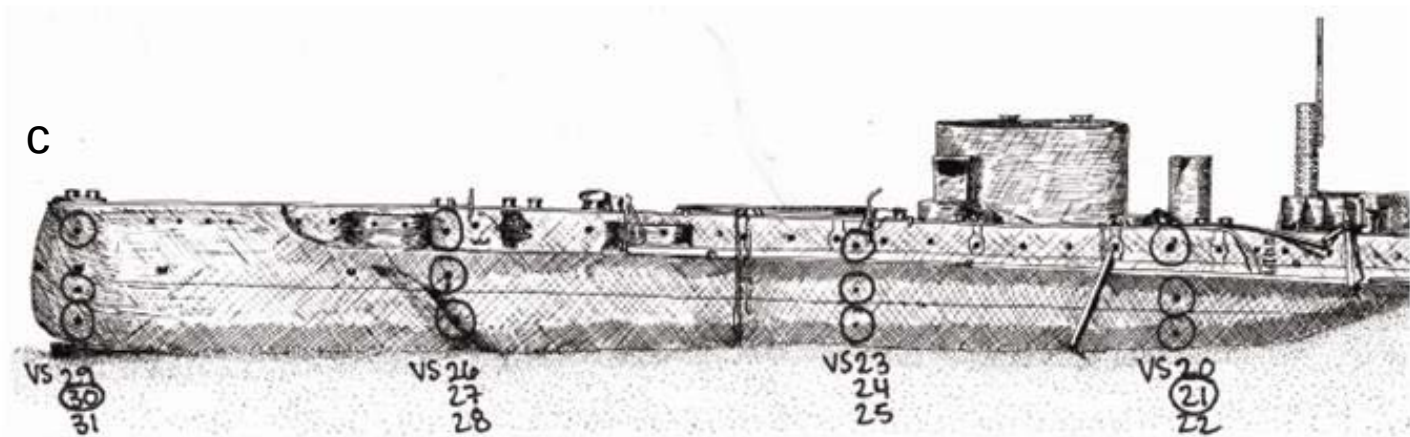
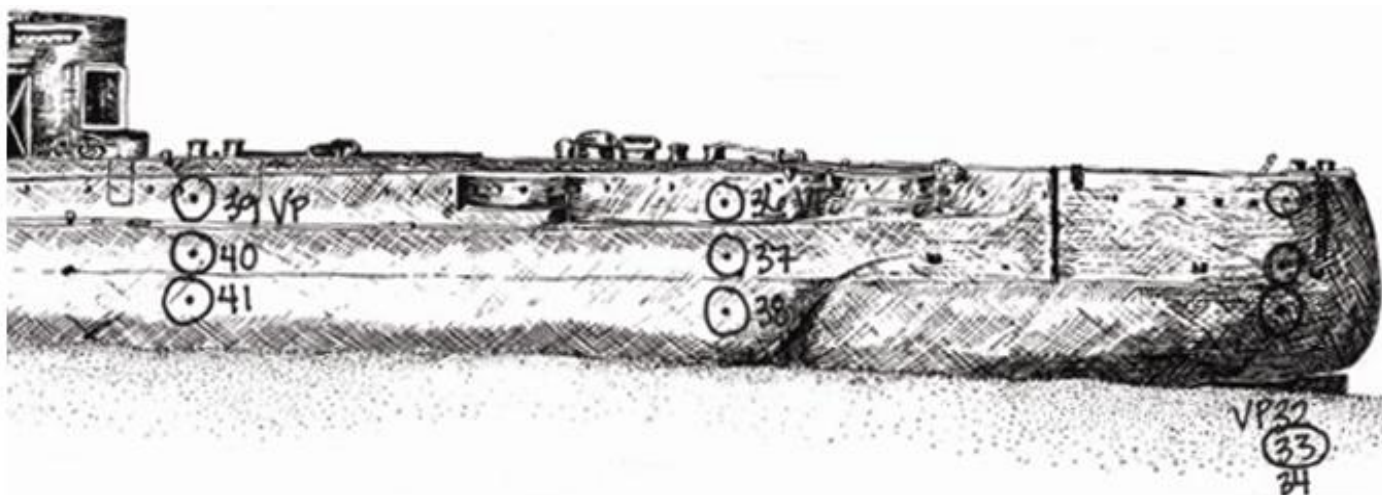
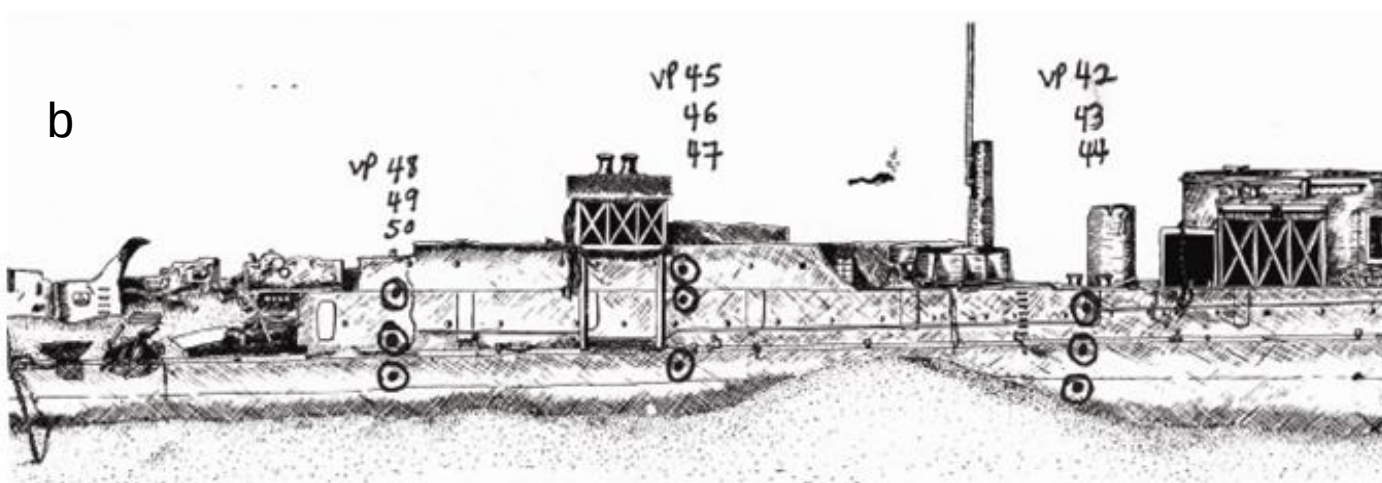


Figure 4. Sampling sites on USS Arizona starboard bow-foredeck (a), mid ships (b) and stern (c) (from Lenihan et al. 1990).

a



b



c

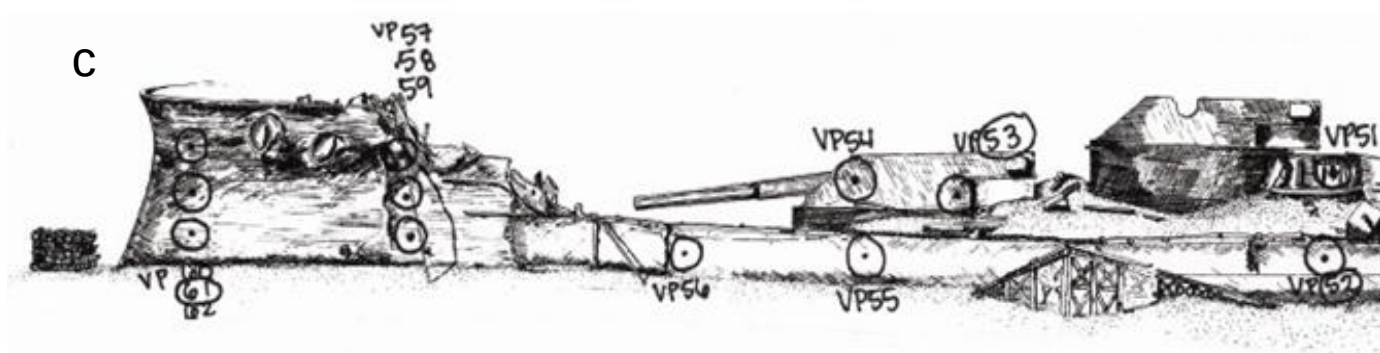


Figure 5. Sampling sites on USS Arizona port stern (a), mid ships (b) and bow-foredeck (c) (from Lenihan et al. 1990).

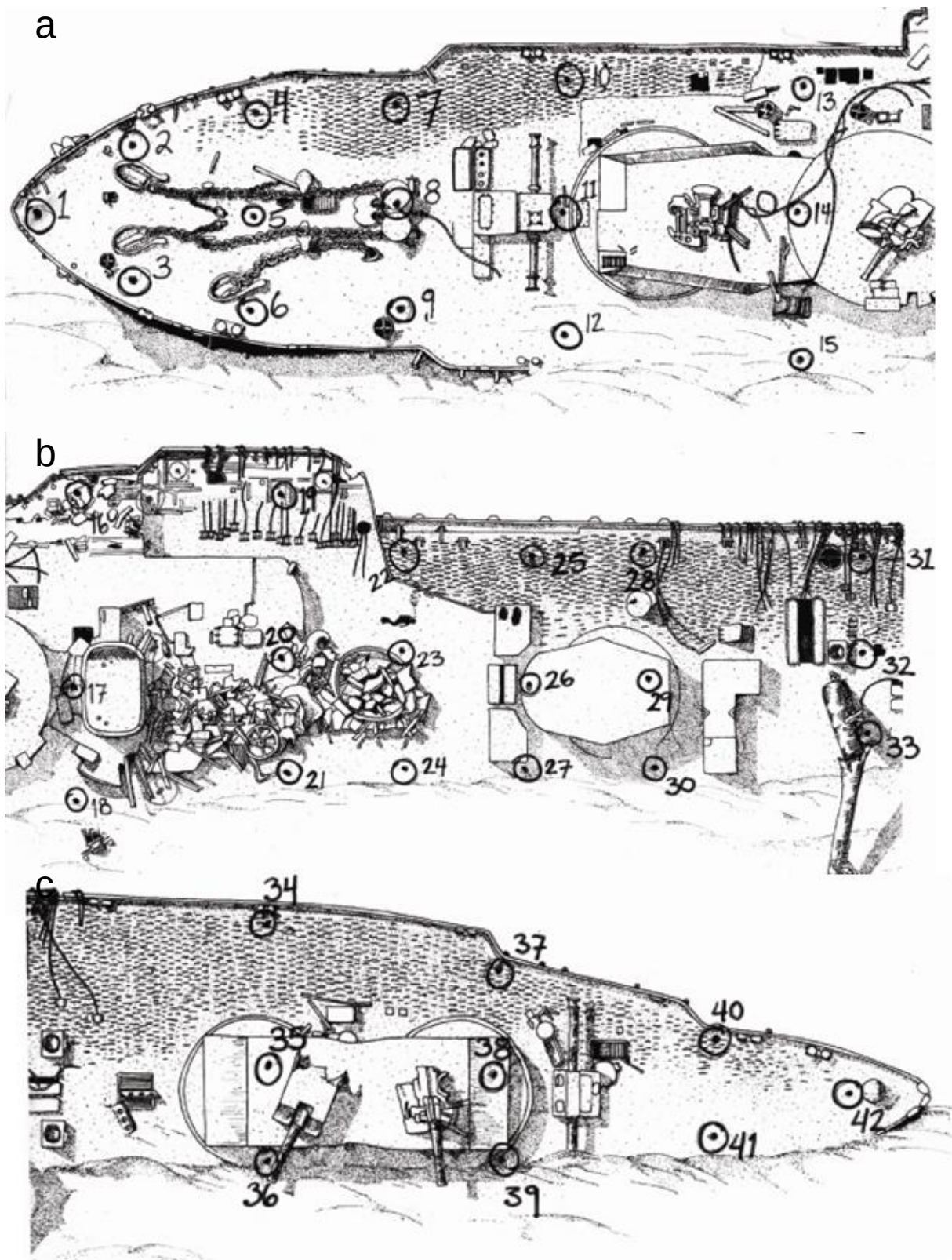


Figure 6. Sampling sites on USS Utah horizontal (deck) bow-foredeck (a), mid ships (b) and stern (c) (from Lenihan et al. 1990).

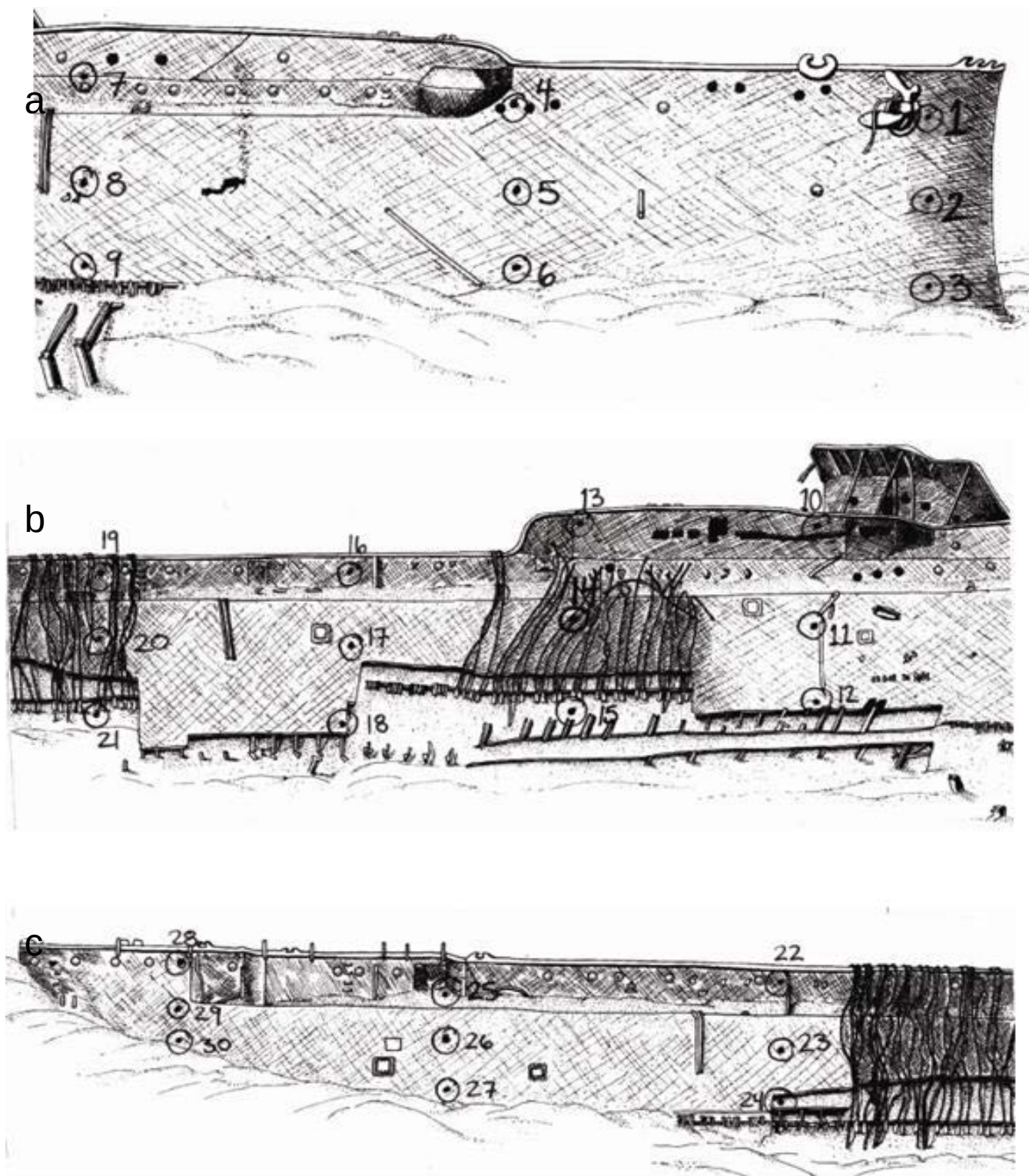


Figure 7. Sampling sites on USS Utah vertical bow (a), mid ships (b) and stern (c) (from Lenihan et al. 1990).

Methods

Sedimentation and Biofouling of Hull Surfaces

Sediment depths were determined on former deck surfaces for each ship (horizontal for Arizona, port for Utah) using a probe that was inserted into the sediment to its point of maximum penetration at each site previously surveyed in 1986 (Lenihan et al. 1990). Depth of fouling on vertical surfaces (port and starboard for Arizona, starboard for Utah) was determined using a pointed nail driven by a small hammer at the previously surveyed 1986 sites (Lenihan et al. 1990). Depths of penetration were recorded in centimeters for both sediments and biofouling.

Benthic Communities

The benthic cover of the USS Arizona and Utah was surveyed at the sites shown and on the dates listed for the sediment and fouling thickness surveys. Observations during preliminary dives were made to assess the overall composition of megafauna that dominates vessel hull surfaces, and voucher specimens of the most abundant sponges were sampled and analyzed in the laboratory to verify field identifications. Two types of measurement were utilized in determining the dominant taxa present at each survey site. Using a Canon D10 digital camera held 30 cm above the substratum on a PVC frame with an image area 16 cm x 25 cm, three quadrat photos were taken at each site within 0.5 m of the marker that had been deployed to indicate the best estimate of the location of the site previously surveyed in 1986 (Lenihan et al. 1990). Simultaneous observations were made by the photographer of the benthic megafauna present within 2 m of the site marker and the organisms present were recorded to the lowest taxa feasible under the given condition of water clarity. This combined method is effective for determining the presence and percent cover of organisms greater than 1 cm in dimension that can be identified under field conditions by a researcher familiar with the dominant benthic organisms that occur in Pearl Harbor. Minute or cryptic organisms such as small mollusks, pericarids, polychaetes or most decapods are not detectable by this method, but it is effective for quantifying the dominant benthic cover at a site.

Quadrat photos were cropped to a standard 16 cm x 25 cm (0.04 m² area) and digitally enhanced where necessary to maximize clarity, color and resolution. Images were then analyzed using Coral Point-Count with Excel Extension (CPCe) software available from the National Coral Reef Initiative (Kohler and Gill 2006). Percent coverage was recorded for each taxa occurring under 33 random points per image, for a total of 99 points analyzed for the three quadrats at each site, except for sites where poor image quality prevented analysis of any of the three quadrats photographed. Where a taxon was visible in the quadrat but insufficiently abundant to occur under a random point, it was recorded as present. These data were combined with the observation made in the field of organisms present at the site for a listing of all recognizable taxa occurring at all sites. Following the zonation approach used in Lenihan et al. (1990) the horizontal (deck) sites for the Arizona were grouped according to their location on the deck, i.e. Stern: sites 1-22; Mid-ships: Sites 23-38, Foredeck and Bow: sites 39-56. USS Arizona starboard and port vertical sites were grouped according to depth on the hull. Since the USS Utah lies at an angle and depth of its deck sites increase rapidly with from starboard to port, these were also grouped according to depth, as were sites on the starboard side of the hull.

Coral Surveys

Because hard corals were not found on the USS Arizona in 1986 (Lenihan et al. 1990) but were a major component of the benthos on the present surveys, a study focused on determining the abundance and size distributions of the corals was conducted. On May 18-19, 2011, quantitative surveys of coral using SCUBA were conducted at 115 sites on the USS Arizona and 72 sites were surveyed on April 14-15 on the USS Utah.

The location of each station was determined from landmark structures and/or previously marked flagging tape, using detailed waterproof maps of each ship for reference. Coral were identified to species, and measurements to the nearest cm were obtained with the use of a reference line or ruler. At each station, corals within a 7 m diameter were counted and measured. Data was recorded on underwater datasheets and entered into an Excel spreadsheet. This methodology provides widespread coverage to allow for future comparisons and detection of temporal and spatial change.

In addition, photographs were taken using a Canon D10 or an Olympus 5050 zoom digital cameras with an Olympus PT050 underwater housing to provide a cataloged archive, baseline photographic data, and for presentation purposes. Photographic methods allow for archiving and data verification, which is critical in addressing further questions, and in quality control. In addition to the National Park Service's archive, all data and images will be archived with the National Oceanographic and Atmospheric Administration's National Oceanographic Data Center which stores and provides public access to oceanographic and coastal data.

Fish Surveys

Fish populations are highly variable, requiring numerous sites to quantify parameters of fish communities. Spatial and temporal variability can reduce statistical power by increasing standard deviations.

Fish populations were quantified using a timed stationary point-count method. A diver using SCUBA gear recorded species, quantity and total fish length within a 7 m diameter circle for five minutes. This method was chosen because there were pre-existing sample stations on the ship from prior surveys and the complex structure of the ships would not be conducive for running transects. All fishes were identified to the lowest taxon practicable. To eliminate observer variability, the two surveyors conducting the observations had normalized their data on prior surveys.

Total length was estimated to the nearest centimeter in the field and converted to biomass estimates, tons per hectare (t/ha) using length-weight fitting parameters obtained from the Hawai'i Cooperative Fishery Research Unit (HCFRU). Fitting parameters not available from HCFRU were obtained from Fishbase (www.fishbase.org) using length-weight relationships derived from over 1,000 references. A congener of similar shape within the genus was used in rare cases lacking information.

To convert between recorded total lengths (TL) and other length types (e.g. fork length (FL)) contained in databases, linear regressions and ratios from Fishbase linking length types were used. A predictive linear regression of logW vs. logL was used in most cases to estimate the fitting parameters of the length-weight relationship. Visual length estimates were converted to

weight using the formula $W = a N L^b$ where W =weight in grams, L =standard length in mm, a and b are fitting parameter constants.

Any anomalous values were detected by calculating a rough estimate for a given body type. The general trend for a 10 cm fish of the common fusiform shape should be approximately 10 grams. Gross deviations were replaced with values from the alternate source.

Trophic levels for fish species were determined using published Fishbase data. The trophic categories included: piscivores, herbivores, detritivores, mobile and sessile invertebrate feeders, and zooplanktivores. These were further merged into four main feeding guilds: piscivores, herbivores, invertebrate feeders, and zooplanktivores.

On the USS Arizona a total of 115 fish sites were surveyed. These sites were surveyed by two individuals that previously normalized their fish surveys as to minimize observer variability. On the USS Utah a total of 72 sites were surveyed by one person.

Results

Sedimentation and Biofouling of Hull Surfaces

USS Arizona

Sediment Thickness

Water depth at each site for the horizontal surface (deck) of the USS Arizona is in Table 1, along with sediment thickness at each of the 55 sites surveyed. Sediment thickness for each site is compared in Figure 8 with 1986 data for the same sites available from Lenihan et al. (1989). Sediment thickness in 2010-11 ranged from 1 to >120 cm and was distinctly related to position along the ship's deck. Sites located on the stern and mid-ship sections of the ship had substantially less sediment depth than on the forward or bow section, where most sites had sediment of 80 to >120 cm deep. This is probably related to the bow sites generally being deeper, except at the two most forward sites, ranging 3.6-9.1 m water depth, partly due to the explosion and collapse of this section when the ship was sunk in 1941.

The increased sediment depth on bow surfaces was also the case when the ship was surveyed in 1986, although sediment thickness on the bow at that time was generally less than in 2010 (Figure 8). However, overall sediment thickness was greater in 1986 (mean=31.2 cm) than in 2010 (mean=25.8) but the mean difference between paired values for the 55 sites was not significant based on a two-tailed t test ($t=-1.64$, $p=0.11$).

Biofouling

Fouling thickness determined in 2010-11 at the 56 USS Arizona vertical sites for which data are available (Tables 2 and 3) are compared with data for 1986 (Lenihan et al. 1990) in Figure 14. Results in Lenihan et al. (1989) are presented as ranges of fouling thickness for each site, so values shown in Figure 8 are the minimum for each site to determine whether 2010-11 results indicate a significant or substantial decrease from 1986. Results in 2010-11 ranged less than 6 cm at all except for three sites, which were all on the port side of the ship and ranged 8-11 cm. The largest of these was on the stern section at 9.1 m water depth near the harbor bottom, and the nail actually appeared to penetrate the hull, suggesting that hull has degraded substantially at this location. Comparing 1986 and 2010-11 overall data, minimum fouling thickness in 1986 (mean=2.20 cm) was actually less than 2010 (mean=2.75 cm), but the mean difference between site paired values was not significant based on a two-tailed test ($t=1.78$, $p=0.08$). Using the same comparison for the maximum fouling thicknesses for 1986 the mean difference two-tailed test between paired values sites was highly significant ($t=-14.1$, $p<0.001$).

USS Utah

Sediment Thickness

Water depth at each site for the horizontal surface (deck) sites of the USS Utah is shown with sediment and fouling thickness in Table 4 for the 55 horizontal sites surveyed in 2010-11. No comparative data are available for the USS Utah from the 1986 survey. Since the ship lies on its port side, the deck is steeply angled from the surface to >12 m depth and the sediment data for the "port" (deck) surface have been arranged by depth in Figure 9. Sediment thicknesses ranged 0-200 cm with all but one of the thicker deposits occurring at the deep port sites at >9.5 m. Characteristics of sediment grain size and composition with location on the ships are described in Appendix A.

Biofouling

Fouling thickness (Table 5, Figure 9) on the starboard surface ranged 0.5-6 cm with all of the thicker layers of 3-6 cm occurring at depths >7.5 m. Overall fouling on the starboard side of the Utah was significantly less (mean=1.71 cm) than on the Arizona (mean=2.77 cm) by a t test assuming unequal variances ($t=-2.38$, two tailed $p=0.020$).

Table 1. Depths and sediment thickness at USS Arizona horizontal (deck) sampling locations. (HS= Horizontal Stern, HM= Horizontal Mid ship, HB= Horizontal Bow).

Date	Site	Location	Depth (m)	Sediment (cm)
12/13/2010	AZH01	HS	2.4	2
12/13/2010	AZH02	HS	2.1	2
12/13/2010	AZH03	HS	2.4	2
12/13/2010	AZH04	HS	2.4	2
12/14/2010	AZH05	HS	2.4	4
12/14/2010	AZH06	HS	2.4	2
12/14/2010	AZH07	HS	2.4	2
12/14/2010	AZH08	HS	2.7	4
12/14/2010	AZH09	HS	2.7	9
12/14/2010	AZH10	HS	3.0	6
12/14/2010	AZH11	HS	2.4	15
12/14/2010	AZH12	HS	2.4	2
12/14/2010	AZH13	HS	2.4	15
12/14/2010	AZH14	HS	2.1	40
12/14/2010	AZH15	HS	3.0	8
12/13/2010	AZH16	HS	3.0	5
12/13/2010	AZH17	HS	2.7	4
12/13/2010	AZH18	HS	3.3	15
12/13/2010	AZH19	HS	2.4	10
12/13/2010	AZH20	HS	2.7	9
12/13/2010	AZH21	HS	1.8	2
12/13/2010	AZH22	HS	0.9	1
12/13/2010	AZH23	HM	2.1	2
12/13/2010	AZH24	HM	1.5	2
12/13/2010	AZH25	HM	1.2	2
12/13/2010	AZH26	HM	2.7	15
12/14/2010	AZH27	HM	2.7	15
12/14/2010	AZH28	HM	2.1	1
12/14/2010	AZH29	HM	2.1	1
12/14/2010	AZH30	HM	2.1	1
12/14/2010	AZH31	HM	1.8	10
12/14/2010	AZH32	HM	3.9	30
12/14/2010	AZH33	HM	5.2	60
12/14/2010	AZH34	HM	2.7	10
12/15/2010	AZH35	HM	5.8	40
12/15/2010	AZH36	HM	6.7	20
12/15/2010	AZH37	HM	3.0	2
12/15/2010	AZH38	HM	3.0	10
12/15/2010	AZH39	HB	6.7	90
12/15/2010	AZH40	HB	5.8	20
12/15/2010	AZH41	HB	6.1	42
12/15/2010	AZH42	HB	8.5	80
12/15/2010	AZH43	HB	3.6	1
12/15/2010	AZH44	HB	7.6	120
12/15/2010	AZH45	HB	8.8	120

Table 1. Depths and sediment thickness at USS Arizona horizontal (deck) sampling locations (Continued). HS= Horizontal Stern, HM= Horizontal Mid ship, HM= Horizontal Bow).

Date	Site	Location	Depth (m)	Sediment (cm)
12/15/2010	AZH46	HB	8.8	120
12/15/2010	AZH47	HB	9.1	120
12/15/2010	AZH48	HB	9.1	20
12/15/2010	AZH49	HB	9.1	120
12/15/2010	AZH50	HB	8.8	90
12/15/2010	AZH51	HB	7.0	1
12/15/2010	AZH52	HB	5.8	80
12/15/2010	AZH54	HB	3.9	10
12/15/2010	AZH55	HB	1.5	1
12/15/2010	AZH56	HB	1.5	1

Table 2. Depths and fouling thickness on USS Arizona starboard vertical sampling locations (VSS= Vertical Starboard Shallow, VSM= Vertical Starboard mid depth, VSB= Vertical Starboard bottom), n.d.= no data.

Date	Site	Location	Depth (m)	Fouling (cm)
4/13/2011	AZVS01	VSS	3.0	1
4/13/2011	AZVS02	VSM	6.4	2
4/13/2011	AZVS03	VSB	8.8	2
4/13/2011	AZVS04	VSS	3.3	1
4/13/2011	AZVS05	VSM	7.0	1
4/13/2011	AZVS06	VSB	9.1	2
4/13/2011	AZVS07	VSB	9.1	4
4/13/2011	AZVS08	VSB	8.5	1
4/13/2011	AZVS09	VSM	6.4	2
4/13/2011	AZVS10	VSM	6.1	5
4/13/2011	AZVS11	VSS	4.5	5
4/13/2011	AZVS12	VSM	6.7	3
4/13/2011	AZVS13	VSS	8.5	2
4/13/2011	AZVS14	VSS	1.5	2
4/13/2011	AZVS15	VSS	3.3	2
4/13/2011	AZVS16	VSM	6.4	5
4/13/2011	AZVS17	VSS	1.8	8
4/13/2011	AZVS18	VSB	4.2	4
4/13/2011	AZVS19	VSS	6.7	3
4/13/2011	AZVS20	VSS	3.3	3
4/13/2011	AZVS21	VSM	6.7	3
4/13/2011	AZVS22	VSB	8.2	5
4/13/2011	AZVS23	VSS	4.2	2
4/13/2011	AZVS24	VSM	5.8	3
4/13/2011	AZVS25	VSB	7.9	1
4/13/2011	AZVS26	VSS	3.0	4
4/13/2011	AZVS27	VSM	6.4	3
4/13/2011	AZVS28	VSS	8.5	2
4/13/2011	AZVS29	VSS	3.0	1
4/13/2011	AZVS30	VSM	6.7	1
4/13/2011	AZVS31	VSB	9.4	n.d.

Table 3. Depths and fouling thickness on USS Arizona port vertical sampling locations (VPS=Vertical Port Shallow, VPM= Vertical Port mid depth, VPB= Vertical Port bottom), n.d.= no data.

Date	Site	Location	Depth (m)	Fouling (cm)
12/15/2010	AZVP32	VPS	3.0	2
12/15/2010	AZVP33	VPM	7.0	1
12/15/2010	AZVP34	VPB	9.1	11
12/15/2010	AZVP36	VPS	3.9	3
12/15/2010	AZVP37	VPM	6.7	3
12/15/2010	AZVP38	VPB	8.5	2
12/15/2010	AZVP39	VPS	4.5	5
12/15/2010	AZVP40	VPM	6.4	5
12/15/2010	AZVP41	VPB	8.5	2
12/15/2010	AZVP42	VPS	4.2	5
12/15/2010	AZVP43	VPM	7.9	2
12/15/2010	AZVP44	VPB		
12/15/2010	AZVP45	VPS	3.0	2
12/15/2010	AZVP46	VPM	4.2	2
12/15/2010	AZVP47	VPB	7.9	1
12/15/2010	AZVP48	VPS	3.0	1
12/15/2010	AZVP49	VPM	5.2	2
12/15/2010	AZVP50	VPB	8.2	3
12/15/2010	AZVP51	VPS	3.0	1
12/15/2010	AZVP52	VPB	7.9	n.d.
12/15/2010	AZVP53	VPM	5.2	n.d.
12/15/2010	AZVP54	VPM	5.8	10
5/18/2011	AZVP55	VPB	9.4	1
5/18/2011	AZVP56	VPB	6.4	1
5/18/2011	AZVP57	VPS	2.7	1
5/18/2011	AZVP58	VPB	6.7	1
5/18/2011	AZVP59	VPB	8.5	1
4/13/2011	AZVP60	VPS	3.6	2
4/13/2011	AZVP61	VPB	7.9	1
4/13/2011	AZVP62	VPB	9.7	n.d.

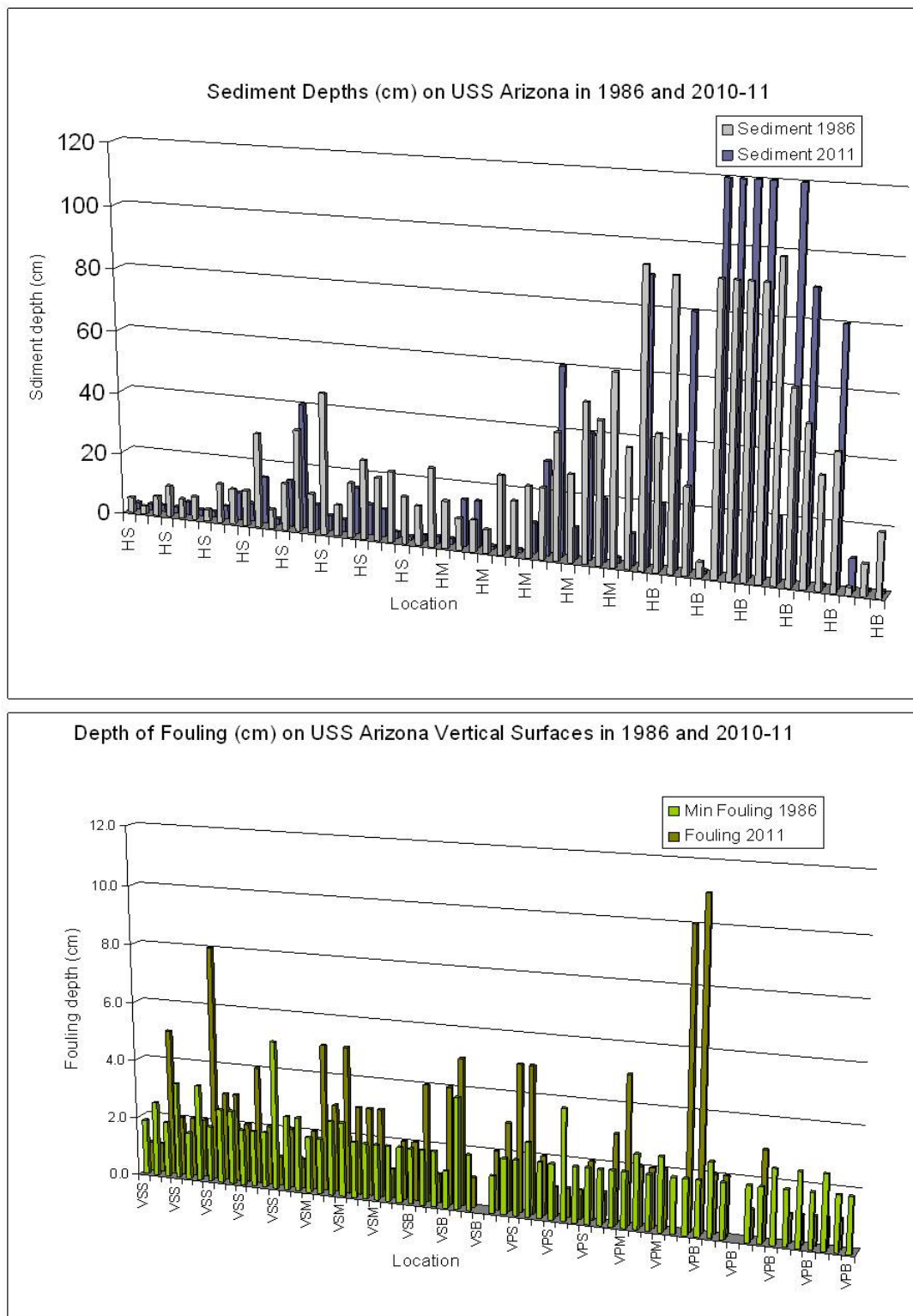


Figure 8. Sediment and fouling thickness on USS Arizona horizontal (deck) and vertical surfaces in 1986 and 2010-11. (See Tables 1-3 for location definitions).

Table 4. Depths and sediment thickness at USS Utah port (deck) sampling locations. (PS= Shallow, PM= mid depth, PB= bottom), n.d.= no data.

Date	Site	Location	Depth (m)	Sediment (cm)
4/14/2011	UTH02	PS	2.7	3
4/14/2011	UTH04	PS	1.8	1
4/14/2011	UTH07	PS	1.2	1
4/15/2011	UTH10	PS	0.6	0.5
4/15/2011	UTH13	PS	1.2	1
4/15/2011	UTH16	PS	2.1	1
4/15/2011	UTH19	PS	2.1	4
4/15/2011	UTH22	PS	2.4	5
4/15/2011	UTH25	PS	2.7	0
4/15/2011	UTH28	PS	2.4	1
4/15/2011	UTH31	PS	3.6	1
4/15/2011	UTH34	PS	3.6	2
4/15/2011	UTH37	PS	6.1	0.5
4/15/2011	UTH40	PS	6.4	3
4/14/2011	UTH01	PM	4.2	1
4/14/2011	UTH05	PM	4.5	2
4/14/2011	UTH08	PM	3.6	1
4/15/2011	UTH11	PM	4.8	2
4/15/2011	UTH14	PM	3.0	2
4/15/2011	UTH17	PM	4.5	0.5
4/15/2011	UTH20	PM	4.5	9
4/15/2011	UTH23	PM	4.8	13
4/15/2011	UTH26	PM	4.5	2
4/15/2011	UTH29	PM	4.2	1
4/15/2011	UTH32	PM	7.6	45
4/15/2011	UTH35	PM	6.4	3
4/14/2011	UTH03	PB	6.1	4
4/14/2011	UTH06	PB	8.2	1
4/14/2011	UTH09	PB	8.2	1
4/15/2011	UTH12	PB	9.4	30
4/15/2011	UTH15	PB	9.7	100
4/15/2011	UTH18	PB	8.5	2.5
4/15/2011	UTH21	PB	9.7	200
4/15/2011	UTH24	PB	9.7	5
4/15/2011	UTH27	PB	10.6	180
4/15/2011	UTH30	PB	10.6	200
4/15/2011	UTH33	PB	10.6	200
4/15/2011	UTH36	PB	11.2	85
4/15/2011	UTH38	PB	10.9	85
4/15/2011	UTH39	PB	11.8	5
4/15/2011	UTH41	PB	10.6	6
4/15/2011	UTH42	PB	10.0	n.d.

Table 5. Depths and fouling thickness on USS Utah starboard vertical sampling locations.

Date	Site	Location	Depth (m)	Fouling (cm)
4/14/2011	UTVS01	SS	4.2	1
4/14/2011	UTVS04	SS	3.0	1
4/14/2011	UTVS07	SS	1.5	1
4/14/2011	UTVS10	SS	1.2	0
4/14/2011	UTVS13	SS	1.8	1
4/14/2011	UTVS16	SS	2.1	0.5
4/14/2011	UTVS19	SS	2.4	1
4/14/2011	UTVS22	SS	3.3	2
4/14/2011	UTVS02	SM	6.7	1
4/14/2011	UTVS05	SM	6.4	2
4/14/2011	UTVS08	SM	4.5	1
4/14/2011	UTVS11	SM	4.5	1
4/14/2011	UTVS14	SM	3.9	
4/14/2011	UTVS17	SM	3.9	2
4/14/2011	UTVS20	SM	4.2	1
4/14/2011	UTVS23	SM	5.5	0.5
4/14/2011	UTVS03	SB	9.4	1
4/14/2011	UTVS06	SB	8.8	5
4/14/2011	UTVS09	SB	6.4	0
4/14/2011	UTVS12	SB	7.3	0.5
4/14/2011	UTVS15	SB	7.9	5
4/14/2011	UTVS18	SB	8.2	0.5
4/14/2011	UTVS21	SB	7.3	1
4/14/2011	UTVS24	SB	7.6	2
4/14/2011	UTVS25	SB	7.0	1
4/14/2011	UTVS26	SB	8.2	1
4/14/2011	UTVS27	SB	9.4	3
4/15/2011	UTVS28	SB	7.9	6
4/15/2011	UTVS29	SB	9.1	6
4/15/2011	UTVS30	SB	9.7	

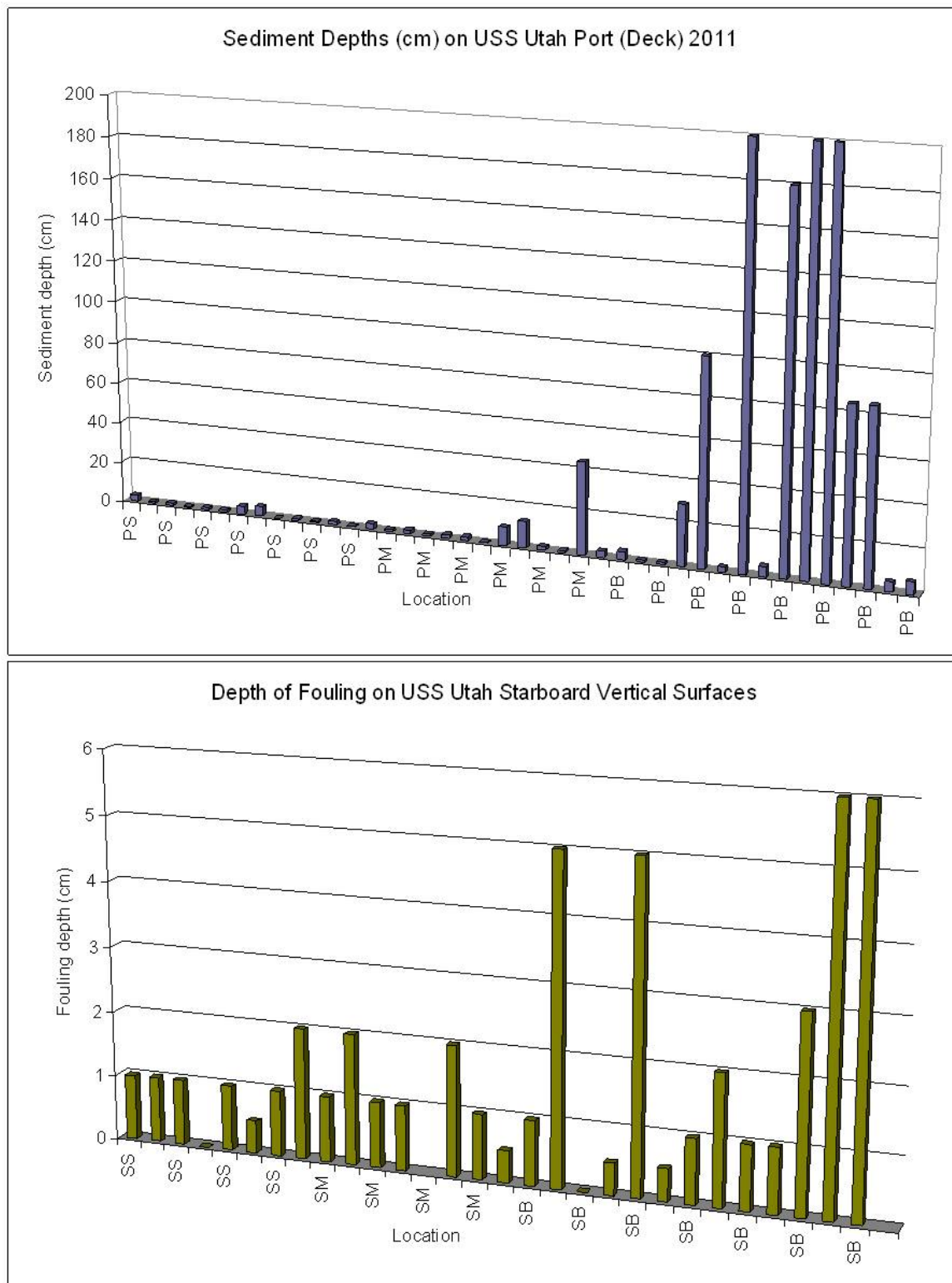


Figure 9. Depths of fouling and sediments on USS Utah in 1986 and 2011. See Tables 4-5 for Location definitions).

Benthic Communities

General Observations

A total of 45 benthic megafauna taxa were identified from the surveys on the USS Arizona and Utah (Table 6), comprised of two species of algae, seventeen sponges, eight cnidarians including four hard corals, eight mollusks, three crustacean arthropods, five polychaete annelids, two ectoprocts, two bryozoans, one holothurian echinoderm, and two groups of ascidian chordates. Sixteen (35%) of the total were introduced or cryptogenic (i.e. of uncertain geographic origin) species listed in Carlton and Eldredge (2011), and these categories dominated the sponges, the most abundant and frequently occurring benthic taxonomic group. One introduced species, the invasive octocoral *Carijoa riisei*, which was reported on the USS Arizona in 1986 (Lenihan et al. 1990), was not seen on the vessel but was abundant on an adjacent pier on the shore side of the ship.

USS Arizona

Species Composition

The benthic species observed and/or photographed at the 55 horizontal (deck) and 62 vertical survey sites are listed in Appendix B for each survey site. The total observations for each taxa in quadrats for the bow, mid ship and stern sections of the deck and the shallow, mid depth and deep zones of the starboard and port sides of the vessel are shown in Table 7. Of the forty-five taxa that were recorded in or near quadrats, the most frequently occurring were sponges, especially the orange keyhole sponge, *Mycale grandis* (Figure 10), which occurred at 37 deck sites and 50 vertical sites, followed by *Haliclona* (S.) *caerulea* (30 deck, 33 vertical) and *Biemna fistulosa* (13 deck, 42 vertical) (Figure 11). Non-sponge organisms were dominated by the polychaete worms *Sabellastarte spectabilis* (21 deck, 32 vertical) (Figure 12) and *Branchiomma* sp. (7 deck, 40 vertical) (Figure 13). Hard corals occurred surprisingly frequently, given that none were found during the 1986 survey (Lenihan et al. 1990). *Pocillopora damicornis* (Figure 14) occurred at 11 deck sites and 9 vertical sites, and *Leptastrea purpurea* (Figure 15) at 10 deck sites and 6 vertical sites. Although the distinctive bryozoan *Schizoporella* sp. cf. *errata* did not occur in the vicinity of any deck site, it occurred frequently on the vessel's vertical surfaces, at 22 sites.

Total numbers of benthic taxa showed clear zonation on both the deck and the sides of the USS Arizona. Total taxa decreased from 132 on the stern section of the deck to 99 for mid-ship sites and 39 on the bow. This is the reverse of the pattern found for sediment depth and clearly shows the negative influence of sedimentation on the macrobenthic community on the forward portion of the ship where silt covers much of the deck. On both the starboard and port sides, there is a general decrease in the number of taxa with depth, from 106 for the shallow sites to 36 for the deep sites on the starboard side and 106 shallow to 87 for the port side. This also probably reflects the negative influence of silt and turbidity with increasing depth on organism settlement and survival.

Areal Coverage

Percent coverage of surfaces by major taxonomic group and by substratum type is summarized for the horizontal and vertical surfaces of both vessels in Figures 16 and 17. Overall, sponges were the dominant benthic group on all surfaces of both vessels, with averages ranging up to

Table 6. Benthic taxa observed on surfaces of USS Arizona and Utah 2010-11.

PHYLUM	FAMILY	SPECIES	STATUS
RHODOPHYTA	RHODOMELACEAE	<i>Acanthophora spicifera</i> (Vahl) Børgesen	Introduced 1952
	GALAXAURACEAE	<i>Dichotomaria marginata</i> (=Galaxaura sp. (Ellis & Solander) Lamarck	Native
PORIFERA	SUBERITIDAE	<i>Suberites aurantiacus</i> (Duchassaing & Michelotti, 1864 (=Terpios zeteki	Introduced 1947
	RASPAILIIDAE	<i>Raspailia</i> sp. (Black Knobby)	Undetermined
	CRAMBIDAE	<i>Monanchora clathrata</i> Carter, 1883	Crypto. 2008
	TEDANIIDAE	<i>Tedania ignis</i> Duchassaing & Michelotti, 1864	Introduced 1950
	DESMACELLIDAE	<i>Biemna fistulosa</i> (Topsent, 1897)	Crypto. 1996
		<i>Iotrochota purpurea</i> (Bowerbank, 1875)	Crypto. 2008
	MYCALIDAE	<i>Mycale grandis</i> Gray, 1867 (=Mycale armata)	Introduced 1996
		<i>Mycale</i> sp.	Undetermined
	CALLYSPONGIIDAE	<i>Callyspongia</i> sp.	Undetermined
	NIPHATIDAE	<i>Gelliodes fibrosa</i> (Wilson, 1925)	Introduced 1996
	CHALINIDAE	<i>Haliclona</i> sp. (Black branching)	Undetermined
		<i>Haliclona</i> S. caerulea Hechtel, 1965 (=Sigmadocia caerulea)	Introduced 1996
		Porifera sp. (Grey)	Undetermined
		Porifera sp.(Black)	Undetermined
		Porifera Unident. sp.	Undetermined
CNIDARIA	DYSIDEIDAE	<i>Dysidea arenaria</i> Bergquist, 1965	Cryptogenic 1996
	HALOCORDYLIDAE	<i>Pennaria disticha</i> (Goldfuss), 1820)	Introduced 1929
	AIPTASIIDAE	<i>Aiptasia pulchella</i> Carlgren, 1943	Native
	ACROPORIDAE	<i>Monitipora capitata</i> (Dana, 1846)	Native
	POCILLOPORIDAE	<i>Pocillopora damicornis</i> (Linnaeus, 1758)	Native
	PORITIDAE	<i>Porites compressa</i> Dana, 1846	Native
	PORITIDAE	<i>Porites lobata</i> Dana, 1846	Native
	FAVIIDAE	<i>Leptastrea purpurea</i> Dana, 1846	Native
MOLUSCA	OSTREIDAE	Ostreidae sp.	Native
		<i>Dendostrea sandvicensis</i> (Sowerby, 1871)	Native
	ANOMIIDAE	<i>Anomia nobilis</i> Reeve, 1859	Introduced 1914
	ISOGNOMONIDAE	<i>Isognomon</i> sp.	Undetermined
	PTERIIDAE	<i>Pinctada margaritifera</i> (Linnaeus, 1758)	Native
	HIPPONICIDAE	<i>Hipponix imbricatus</i> Gould, 1846	Native
	VERMETIDAE	<i>Vermetus alii</i> (Chenu, 1843) (=Eualetes tulipa)	Introduced 1973
	CHROMODORIDIDAE	<i>Hypselodoris infucata</i> (Ruppell and Leuckart, 1828)	Native
		<i>Balanus</i> spp.	Undetermined
		<i>Chthamalus proteus</i> Dando & Southward, 1980	Introduced 1996
ANNELIDA	ALPHEIDAE	<i>Alpheus</i> sp. burrows	
	AMPHINOMIDAE	<i>Eurythoe complanata</i> (Pallas, 1766)	Native
	SABELLIDAE	<i>Branchiomma</i> sp.	Undetermined
		<i>Sabellastarte spectabilis</i> (Savigny, 1818)	Native
	SERPULIDAE	<i>Salmacina dysteri</i> (Huxley, 1855)	Introduced 1972
ECTOPROCTA		<i>Hydroides</i> sp.	Undetermined
	CLEIDOCHASMATIDAE	<i>Diaperoforma</i> sp.	Undetermined
	SCHIZOPORELLIDAE	<i>Schizoporella</i> cf. <i>errata</i> (Waters, 1878)	Introduced 1973
ECHINODERMATA	SYNAPTIDAE	<i>Opheodesoma spectabilis</i> Fisher, 1907	Native
CHORDATA	DIDEMNIDAE	Unident. Colonial tunicates, cf. <i>Didemnum</i> sp.	Undetermined

Table 7. Percent frequency of occurrence of benthic taxa in quadrats on USS Arizona horizontal (deck) and vertical surfaces 2010-11.

	Horizontal (Deck)				Starboard Vertical				Port Vertical				Grand
	Bow	Mid	Stern	Total	Shallow	Mid	Deep	Total	Shallow	Mid	Deep	Total	Total
MACROALGAE													
<i>Acanthophora spicifera</i>	0.0	0.0	13.6	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7
<i>Dichotomaria marginata</i>	0.0	31.3	4.5	10.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3
Unidentified Algae	0.0	18.8	0.0	5.4	72.7	70.0	71.4	71.4	100.0	50.0	75.0	75.9	39.8
SPONGES													
<i>Biemna fistulosa</i>	11.1	12.5	40.9	23.2	90.9	60.0	28.6	64.3	55.6	87.5	100.0	82.8	48.7
<i>Callyspongia</i> sp.	0.0	6.3	13.6	7.1	27.3	0.0	0.0	10.7	11.1	0.0	0.0	3.4	7.1
<i>Dysidea arenaria</i>	16.7	50.0	45.5	37.5	36.4	40.0	0.0	28.6	55.6	0.0	8.3	20.7	31.0
<i>Gelliodes fibrosa</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.2	0.0	0.0	6.9	1.8
<i>Haliclona</i> (S.) <i>caerulea</i>	33.3	37.5	81.8	53.6	90.9	70.0	28.6	67.9	100.0	87.5	66.7	82.8	64.6
<i>Haliclona</i> sp. (Black branching)	16.7	0.0	27.3	16.1	0.0	0.0	0.0	0.0	44.4	25.0	0.0	20.7	13.3
<i>Iotrochota purpurea</i>	0.0	62.5	36.4	32.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.9
<i>Monanchora clathratha</i>	0.0	0.0	9.1	3.6	18.2	20.0	0.0	14.3	111.1	12.5	0.0	37.9	15.0
<i>Mycale grandis</i>	38.9	62.5	90.9	66.1	100.0	80.0	42.9	78.6	100.0	100.0	91.7	96.6	77.0
<i>Mycale</i> sp.	0.0	12.5	0.0	3.6	0.0	0.0	0.0	0.0	0.0	12.5	0.0	3.4	2.7
<i>Porifera</i> Unident. sp.	5.6	18.8	13.6	12.5	90.9	70.0	71.4	78.6	55.6	75.0	66.7	65.5	42.5
<i>Porifera</i> sp. (Grey)	0.0	0.0	4.5	1.8	36.4	50.0	14.3	35.7	33.3	50.0	33.3	37.9	19.5
<i>Porifera</i> sp. (Black)	27.8	6.3	31.8	23.2	54.5	60.0	28.6	50.0	66.7	50.0	66.7	62.1	39.8
<i>Raspailia</i> sp. (Black knobby)	0.0	0.0	4.5	1.8	18.2	0.0	14.3	10.7	0.0	0.0	8.3	3.4	4.4
<i>Subrites auranticus</i>	5.6	12.5	50.0	25.0	0.0	10.0	0.0	3.6	11.1	0.0	8.3	6.9	15.0
<i>Tedania ignis</i>	27.8	12.5	40.9	28.6	9.1	30.0	0.0	14.3	22.2	37.5	25.0	27.6	25.7
CNIDARIA													
<i>Aiptasia pulchella</i>	0.0	6.3	9.1	5.4	18.2	0.0	0.0	7.1	0.0	0.0	0.0	0.0	4.4
<i>Pennaria disticha</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Zoanthus</i> sp.	0.0	0.0	0.0	0.0	9.1	0.0	14.3	7.1	0.0	0.0	0.0	0.0	1.8
CORALS													
<i>Leptastrea purpurea</i>	0.0	56.3	4.5	17.9	18.2	10.0	0.0	10.7	0.0	25.0	8.3	10.3	14.2
<i>Pocillopora damicornis</i>	0.0	50.0	13.6	19.6	27.3	10.0	0.0	14.3	33.3	25.0	0.0	17.2	17.7
<i>Porites compressa</i>	0.0	0.0	0.0	0.0	0.0	0.0	14.3	3.6	0.0	12.5	0.0	3.4	1.8
MOLLUSCS													
Ostreidae sp.	0.0	37.5	0.0	10.7	0.0	0.0	85.7	21.4	0.0	0.0	25.0	10.3	13.3
<i>Dendostrea sandvicensis</i>	0.0	6.3	0.0	1.8	0.0	0.0	14.3	3.6	11.1	12.5	0.0	0.1	0.0

Table 7. Percent frequency of occurrence of benthic taxa in quadrats on USS Arizona horizontal (deck) and vertical surfaces 2010-11 (Continued).

	Horizontal (Deck)				Starboard Vertical				Port Vertical				Grand
	Bow	Mid	Stern	Total	Shallow	Mid	Deep	Total	Shallow	Mid	Deep	Total	Total
MOLLUSCS													
<i>Hipponix imbricatus</i>	0.0	31.3	4.5	10.7	18.2	0.0	0.0	7.1	0.0	0.0	0.0	0.0	7.1
<i>Vermetus alii</i>	0.0	6.3	0.0	1.8	0.0	0.0	14.3	3.6	0.0	0.0	0.0	0.0	1.8
POLYCHAETES													
<i>Branchiomma</i> sp.	16.7	6.3	9.1	12.5	45.5	100.0	57.1	67.9	66.7	100.0	58.3	72.4	41.6
<i>Eurythoe complanata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Sabellastarte spectabilis</i>	16.7	56.3	40.9	37.5	72.7	80.0	0.0	57.1	100.0	75.0	8.3	55.2	46.9
<i>Salmacina dysteri</i>	0.0	0.0	0.0	0.0	0.0	20.0	0.0	7.1	0.0	0.0	8.3	3.4	2.7
ASCIDIANS													
Ascidacea sp.	0.0	12.5	4.5	5.4	54.5	70.0	14.3	50.0	77.8	75.0	33.3	58.6	30.1
BRYOZOANS													
<i>Diaperoforma</i> sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3	3.4	0.9
<i>Schizoporella</i> sp.	0.0	0.0	0.0	0.0	54.5	30.0	0.0	32.1	88.9	25.0	25.0	44.8	19.5
ECHINODERMS													
<i>Opheodesoma spectabilis</i>	0.0	6.3	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
Total	5.9	16.7	16.2	13.4	26.0	28.6	13.9	23.9	30.0	25.3	19.6	25.0	18.8



Figure 10. *Mycale grandis* sponge on the side of the USS Arizona.

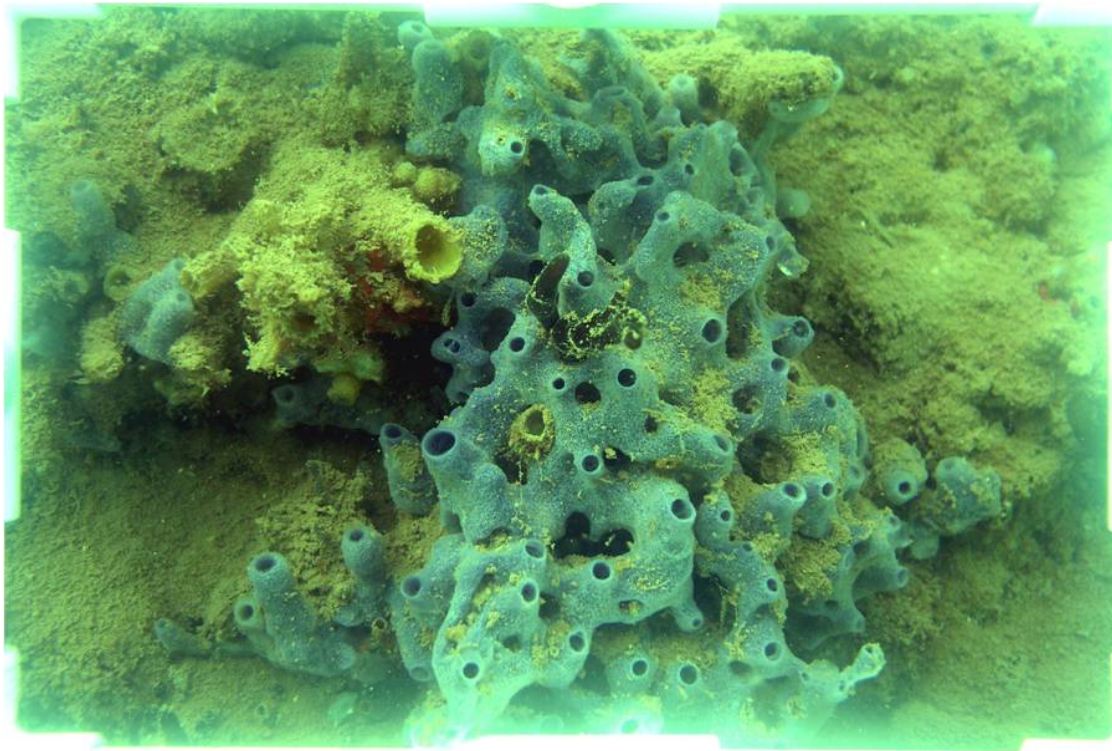


Figure 11. *Biemna fistulosa* (left) and *Haliclona (Sigmadocia) caerulea* sponges on the side of the USS Utah.

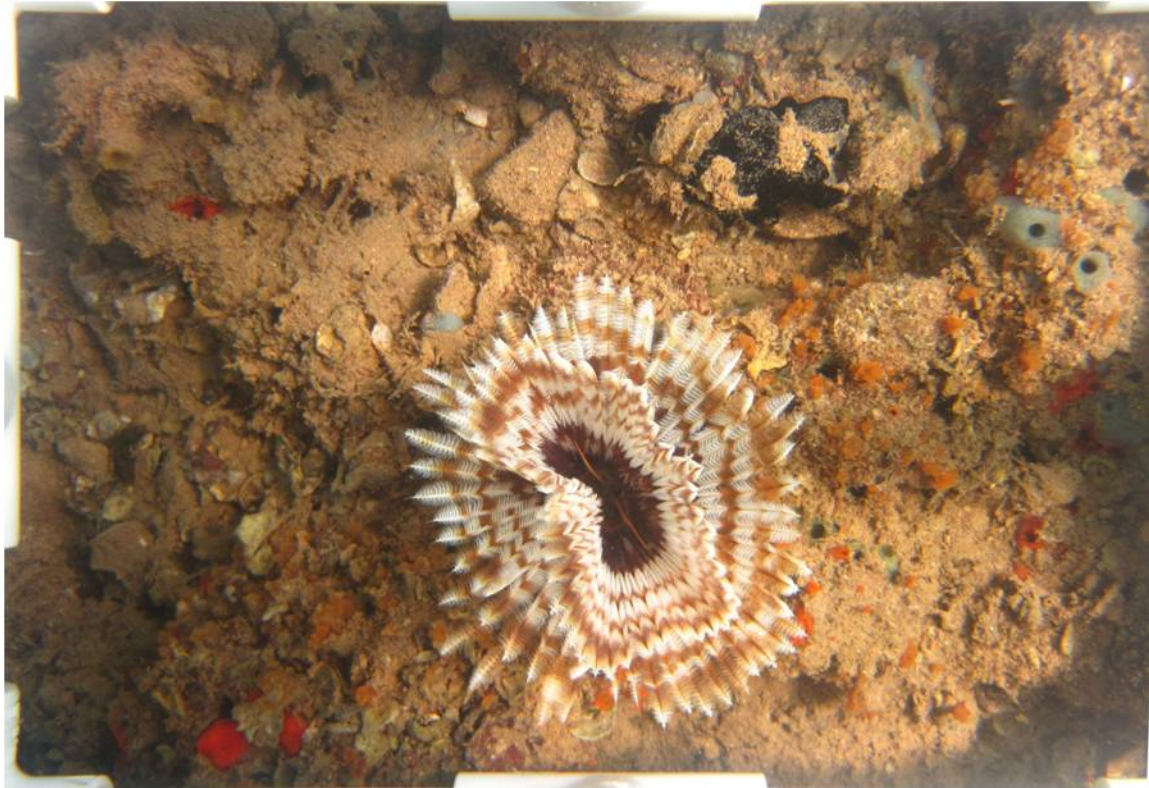


Figure 12. *Sabellastarte spectabilis* fanworm on the deck of the USS Arizona.

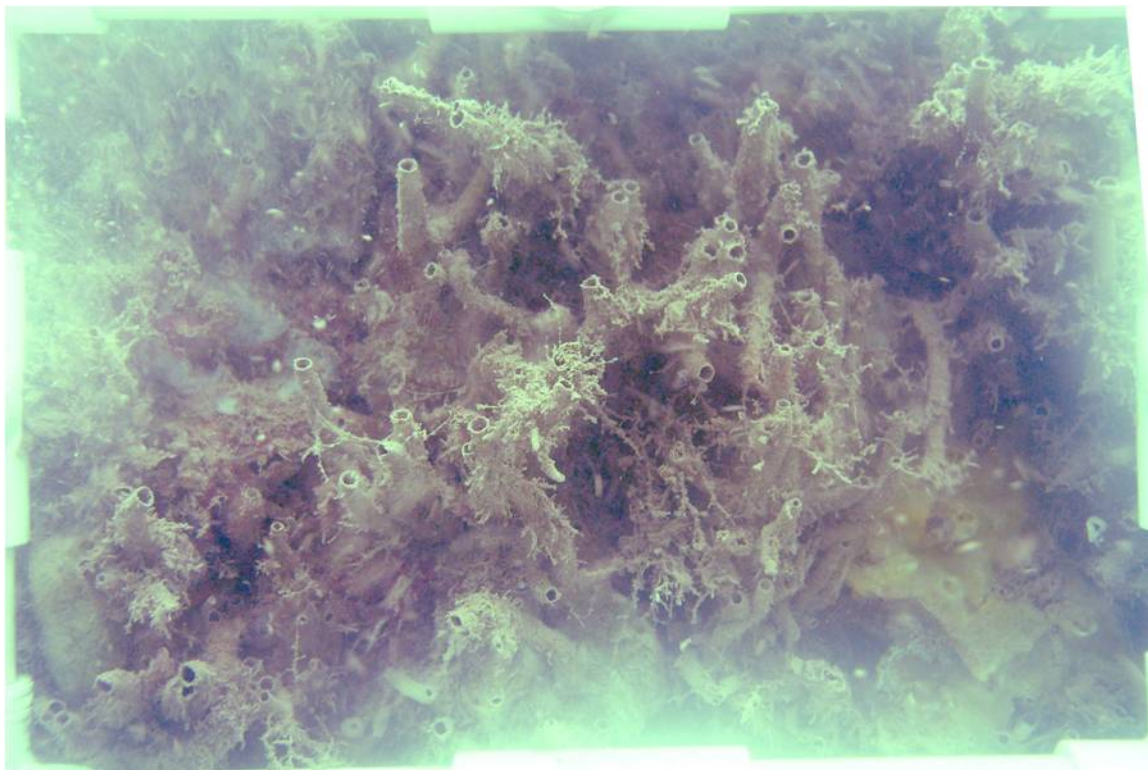


Figure 13. *Branchiomma* sp. worm tubes on the side of the USS Arizona.



Figure 14. *Pocillopora damicornis* corals on the deck of the USS Arizona.



Figure 15. *Leptastrea purpurea* corals (right) and *Hipponix* gastropods on the deck of the USS Utah.

20% on the aft deck of the Arizona, and up to 30-40% on shallow vertical surfaces. Polychaetes were the second most abundant group, followed by mixed algae. However, the mean coverage of all benthic organisms was well exceeded by dead substrata, especially silt mixed with filamentous algae on all surfaces, ranging up to >50% except on the foredeck and bow where silt was the dominant substratum type, with a mean cover of around 50%. Mixed shell and sand was a dominant substratum on the aft and mid ship deck, averaging around 40% cover in both areas.

The mean cover for each major benthic group and substratum category at each site for the USS Arizona are listed in Appendix A by zonation on the horizontal and vertical ship surfaces and shown in Figures 18-20, showing in detail the changes in dominant cover with location on the ship. Silt was the dominant cover on the bow and foredeck, with 100% deep sediment at eight of the 17 sites, all between gun turret number 1 and the collapsed area on the bow. Cover by benthic organisms in this section was very low, with a maximum for sponges, the dominant benthic type, of 16% and polychaetes 21% at one site.

Eight of the 16 mid-ship deck sites were dominated by mixed shell and sand averaging up to >90% cover, and silt/algae dominated most of the other sites, ranging up to 78%. Algae comprised the greatest benthic organism cover, primarily because of an extensive growth of *Dichotomaria marginata* (Figure 21) that averaged 56% cover at one site. The only other prominent benthic type was sponge which averaged up to 31% cover at one site. Mixed shell/sand and silt/algae were also the dominant cover on the stern of the ship averaging up to 86% and 74% respectively, but live benthos was more represented here than on the other sections of the ship's deck. Sponge was present at all sites, ranging 4-60% and averaging 17% for all 22 sites. Polychaete mean cover ranged 1-4% at eight sites and hard corals 1-8% at four sites, the highest abundance found for any section on the two vessels.

Vertical surfaces on both sides of the Arizona had much higher cover of live benthos than the deck due to much less accumulated sediment at most sites. Sponges again were the dominant invertebrate group present, with percent cover at shallow sites ranging up to 95% on the starboard and to 68% on the port side. Other abundant invertebrate benthos were polychaetes which tend to become more abundant with increasing depth, reaching 61% at one deep site on the starboard side and 41% at one mid-depth port site. Mean cover of bryozoans, mostly *Schizoporella* sp. cf. *errata*, (Figure 22) ranged up to 16-17% at starboard and port shallow sites. Hard corals did occur at many sites in all depth zones on both the starboard and port surfaces, with cover usually <4%, except at one port mid-depth site where a single colony of *Porites compressa* in one photo quadrat was responsible for a mean cover of >25% at that location. Unidentified, mostly fine filamentous algae, became more abundant with depth on both sides of the vessel, reaching 80% cover at two deep starboard sites. Otherwise most of the surface cover was mixed silt/algae, ranging > 50% at the majority of sites in all zones on both sides of the ship.

Dominant Species

The percent cover of benthic taxa where values were greater than 2% for at least one site is shown in Figures 23-25 for the USS Arizona. Data for all taxa are listed in Appendix B. Horizontal (deck) sites for the Arizona grouped according to their location on the ship's deck, i.e. bow and foredeck, are shown in Figure 23. For areas of the bow section that were not covered with silt or shell sand, the invasive orange keyhole sponge, *Mycale grandis* had the most sites

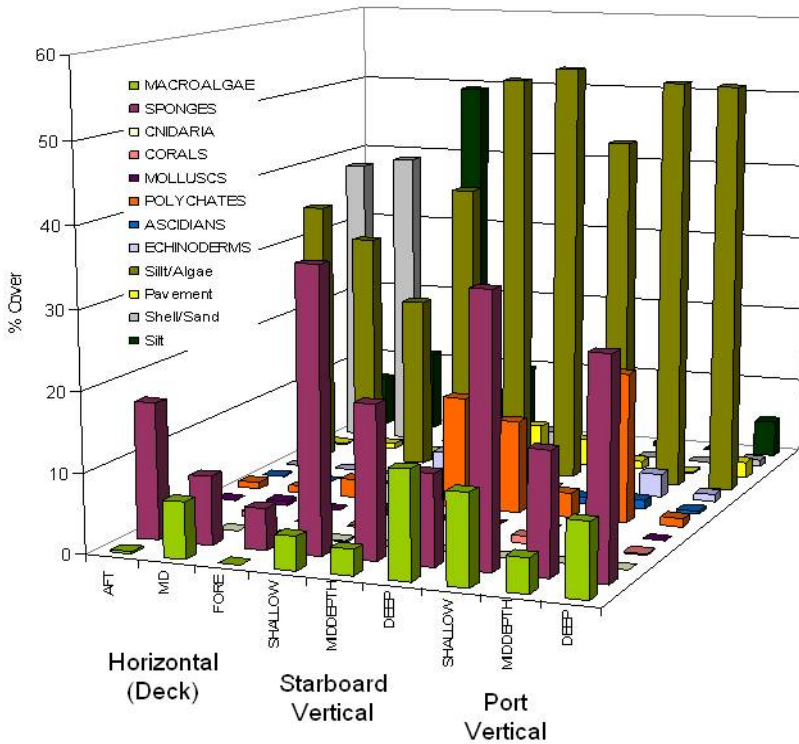


Figure 16. Mean benthic percent cover on USS Arizona.

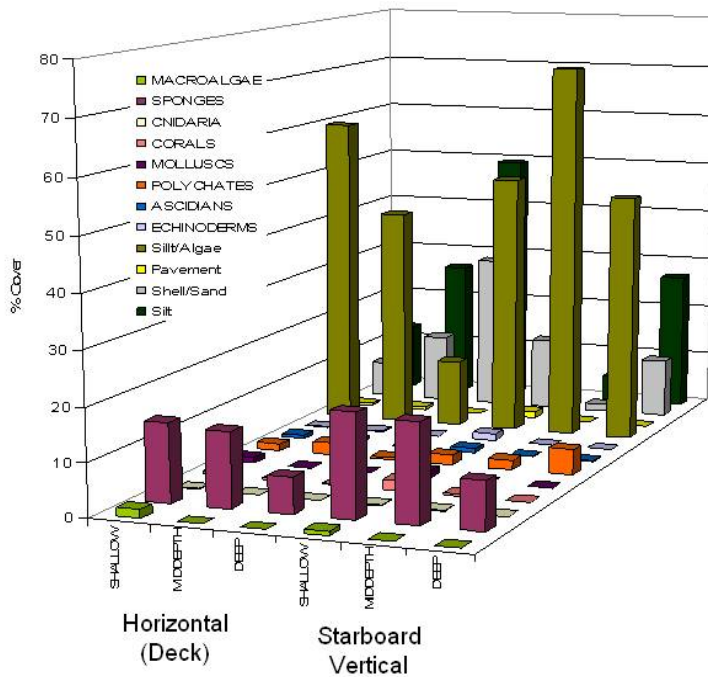
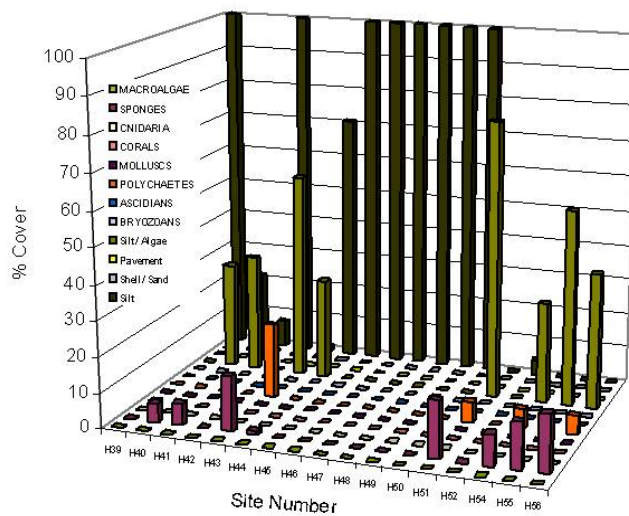
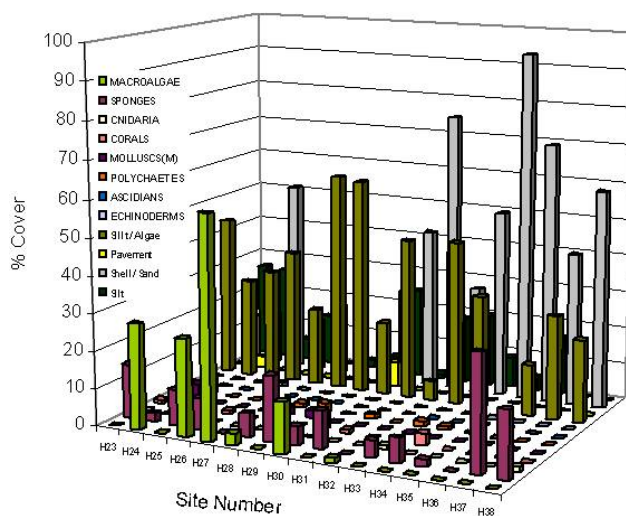


Figure 17. Mean benthic percent cover on USS Utah.

Bow



Mid-Ship



Stern

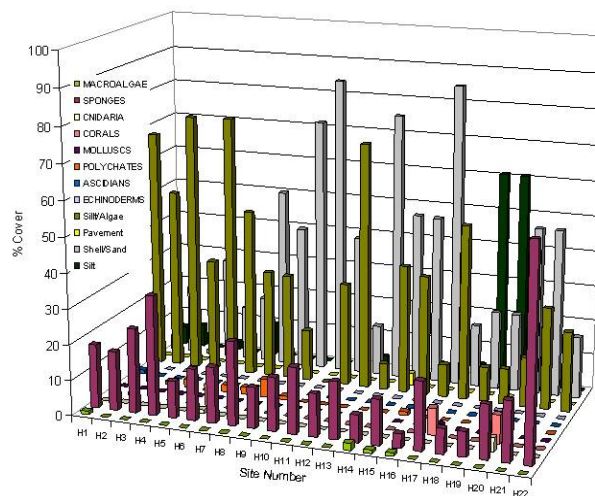
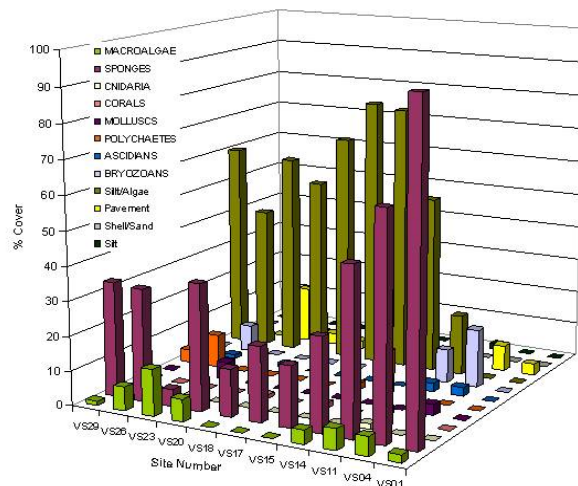
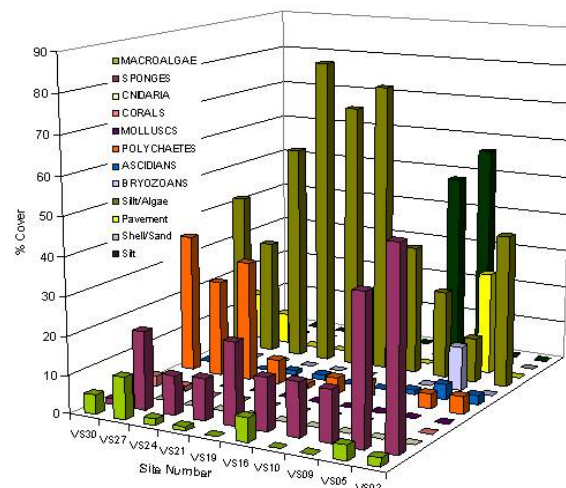


Figure 18. Mean cover by category at Arizona horizontal (deck) sites.

Shallow



Mid-depth



Deep

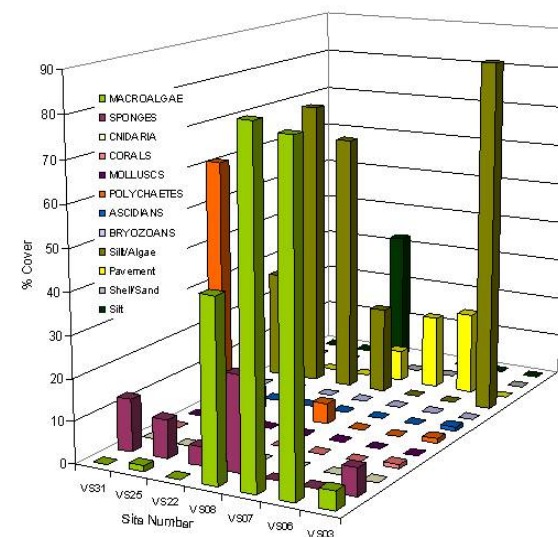
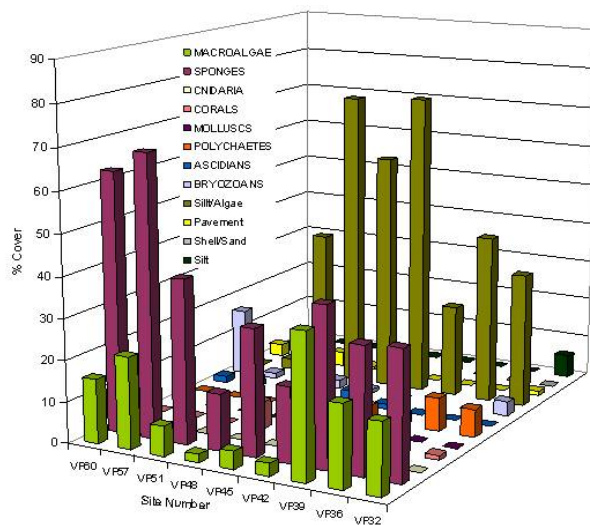
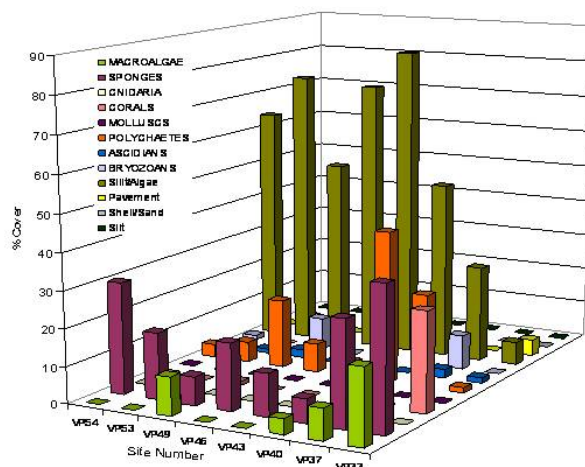


Figure 19. Mean benthic cover by category at Arizona starboard vertical sites.

Shallow



Mid-depth



Deep

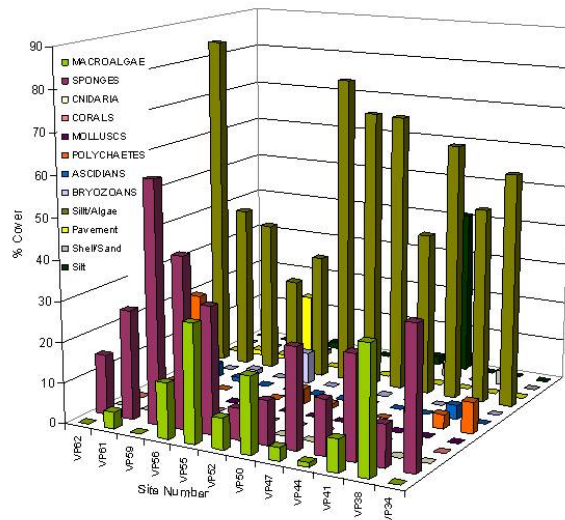


Figure 20. Mean cover by benthic category at Arizona port vertical sites.

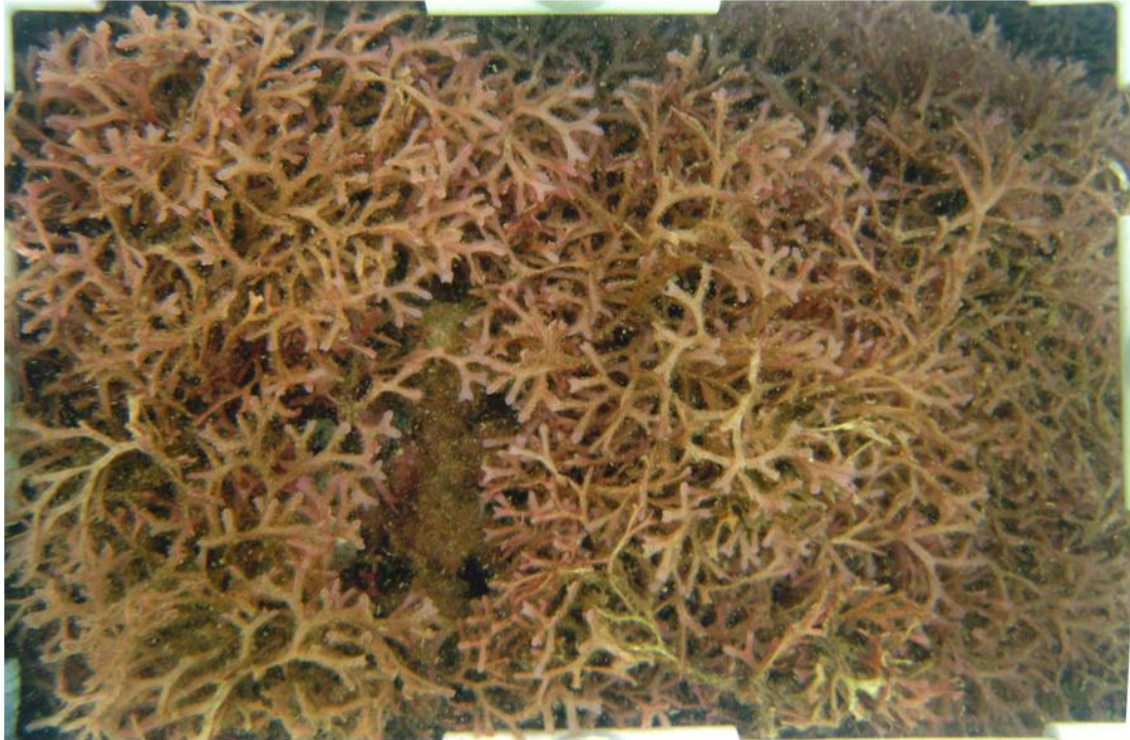


Figure 21. *Dichotomaria marginata* algae on the deck of the USS Arizona.



Figure 22. *Schizoporella* sp. cf. *errata* bryozoan along the side of the USS Arizona.

with relatively high cover, >6% at five sites and averaging 2.2% for tall bow sites. Another sponge *Haliclona (S.) caerulea* had cover >2% at four sites. Other taxa with relatively high cover values were the fanworm *Sabellastarte spectabilis*, with cover >4.5% at three sites, and another tubeworm *Branchiomma* sp. at two sites, with one of them >14% cover.

The mid-ship sites on the Arizona had relatively low cover of benthic invertebrates, the maximum being *Haliclona (S.) caerulea* at two sites with 7-14% and *Mycale grandis* with five sites of 2-6%. The dominant benthic organism in this section of the ship's deck was the red alga *Dichotomaria marginata*, which had cover of 13-56% at four sites. Benthic cover was more diverse on the stern section of the deck, where the dominant species was *Haliclona (S.) caerulea* which had 40% cover at a single site and averaged nearly 5% overall, followed by *Mycale grandis*, having 17 of the 22 sites with cover of 2-20%. Other sponges with relatively high cover were *Biemna fistulosa*, *Dysidea arenaria*, and *Suberites aurantiacus*. *Sabellastarte spectabilis* was relatively abundant (2-5%) at the most sternward sites, and the coral *Pocillopora damicornis* had cover of 6-8% at three sites.

Percent cover on the starboard and port vertical surfaces of the USS Arizona's hull are shown in Figures 24 and 25. Both sides show high and diverse cover for the shallower sites and decreasing abundance going to the deeper sites. As with deck sites, sponges dominated cover in the shallows, led by *Mycale grandis*, which was present at all sites and averaged 11% on the starboard and 13% on the port sides of the ship, followed by *Haliclona (S.) caerulea* with averages of 7% on either side. The coral *Pocillopora damicornis*, although not abundant, was intermittently present with a cover of 7% at one site, as was the branching bryozoan *Schizoporella* sp. cf. *errata*, which had cover as high as 65-75% at two mid-depth sites.

Sponge coverage was less at the mid-depth and deep sites on the starboard side of the ship, where relatively few sponges were found and maximum cover of any sponge at the deep sites was <7% (*Mycale grandis*). This may be due to the starboard side facing the Ford Island dock and therefore being less likely to receive benthic organisms recruiting to the hull. The dominant organism occurring on the starboard mid and deep sites was the bivalve *Branchiomma* sp. which had 36% cover at one mid-depth site and 61% cover at one deep site. Sponge cover was more diverse and abundant at starboard mid-depth sites where *Mycale grandis* occurred at all but two sites with cover up to 21%, *Haliclona (S.) caerulea* up to 11% and an unidentified black sponge as much as 8%. *Schizoporella* sp. cf. *errata* occurred at one site with cover of 12%

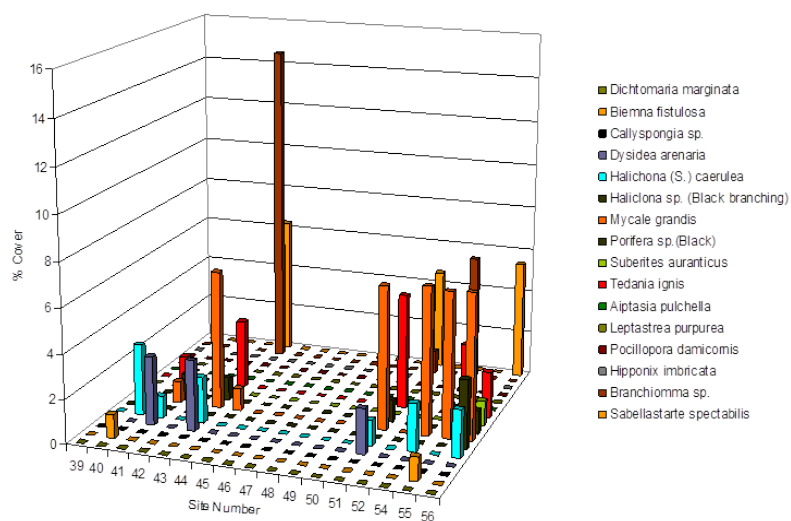
All port mid-depth sites had *Mycale grandis* with cover up to 14% and all but two sites with *Haliclona (S.) caerulea* up to 10%. The tubeworm *Branchiomma* sp. was present at all sites with cover up to 41%, and the bryozoan *Schizoporella* sp. cf. *errata* occurred at four sites with cover ranging 9-75%. A single *Porites compressa* coral colony resulted in 25% cover at a single site. At the port deep sites, diversity and cover were higher than for mid depth sites on this side of the ship as well as deep sites on the starboard side.

USS Utah

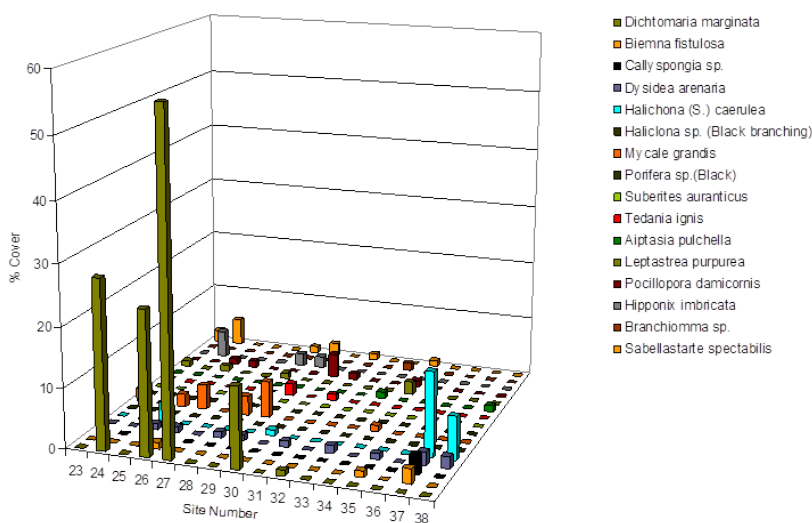
Species Composition

Presence and cover by taxa are listed for the USS Utah by site in Appendix C and frequency of occurrence by taxa within quadrats in Table 8. Although there were fewer total taxa and frequencies of occurrence in or near on the USS Utah (437 reports for 31 taxa at 85 sites) than on

Shallow



Mid-depth



Deep

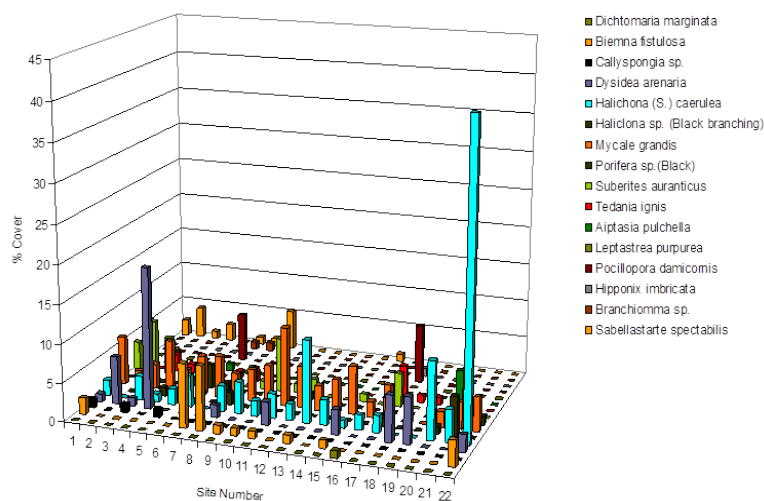
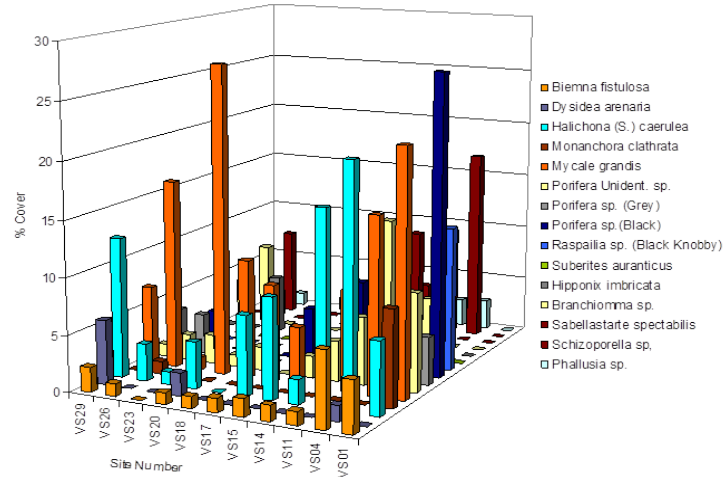
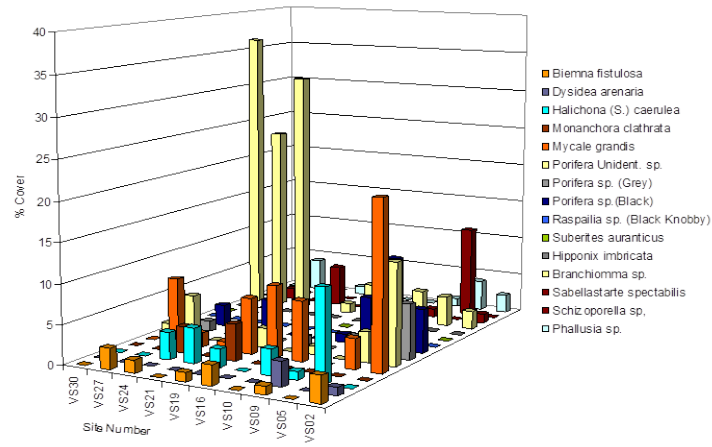


Figure 23. Percent cover by dominant species on horizontal (deck) sites of USS Arizona.

Shallow



Mid-depth



Deep

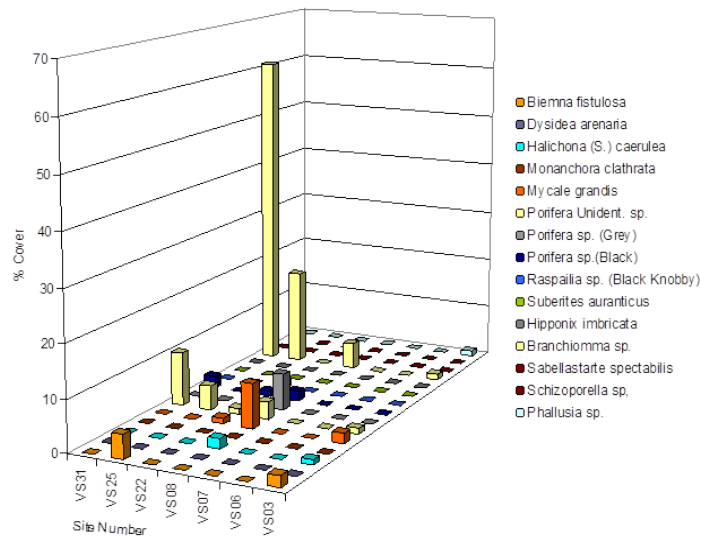
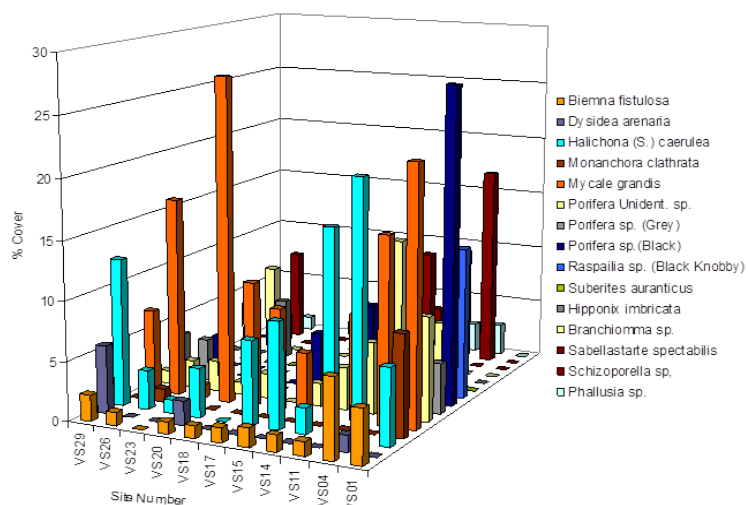
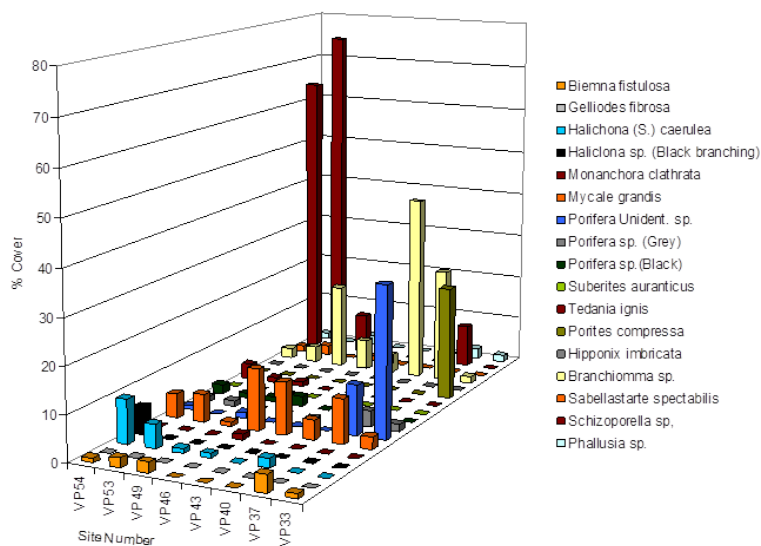


Figure 24. Percent cover by dominant species on starboard vertical sites of USS Arizona.

Shallow



Mid-depth



Deep

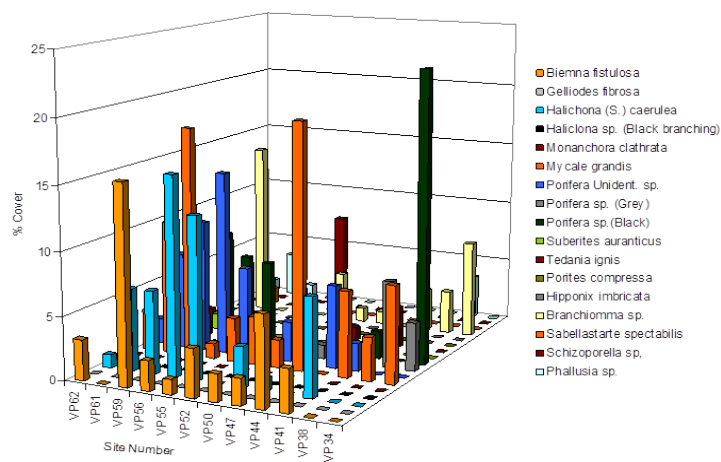


Figure 25. Percent cover by dominant species on port vertical sites of USS Arizona.

Table 8. Percent frequency of occurrence of benthic taxa identifiable in quadrats on USS Utah horizontal (deck) and vertical surface locations in 2010-11.

	Port Horizontal (Deck)				Starboard Vertical				Grand
	Shallow	Mid	Deep	Total	Shallow	Mid	Deep	Total	Total
MACROALGAE									
<i>Acanthophora spicifera</i>	14.3	0.0	0.0	4.7	12.5	9.1	0.0	7.1	5.6
<i>Dichotomaria marginata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unident. Algae	14.3	0.0	0.0	4.7	37.5	0.0	0.0	10.7	7.0
SPONGES									
<i>Biemna fistulosa</i>	42.9	31.3	30.8	34.9	62.5	81.8	100.0	82.1	53.5
<i>Callyspongia</i> sp.	7.1	0.0	0.0	2.3	0.0	0.0	0.0	0.0	1.4
<i>Dysidea arenaria</i>	35.7	31.3	15.4	27.9	50.0	9.1	0.0	17.9	23.9
<i>Gelliodes fibrosa</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Haliclona</i> (S.) <i>caerulea</i>	92.9	75.0	23.1	65.1	100.0	81.8	66.7	82.1	71.8
<i>Haliclona</i> sp. (Black branching)	28.6	18.8	0.0	16.3	25.0	0.0	33.3	17.9	16.9
<i>Iotrochota purpurea</i>	0.0	12.5	0.0	4.7	0.0	18.2	0.0	7.1	5.6
<i>Monanchora clathratha</i>	14.3	6.3	0.0	7.0	25.0	18.2	0.0	14.3	9.9
<i>Mycale grandis</i>	85.7	68.8	30.8	62.8	100.0	90.9	88.9	92.9	74.6
<i>Mycale</i> sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Porifera</i> Unidentified sp.	50.0	37.5	15.4	34.9	50.0	63.6	66.7	60.7	45.1
<i>Porifera</i> sp. (Grey)	14.3	6.3	7.7	9.3	0.0	0.0	22.2	7.1	8.5
<i>Porifera</i> sp. (Black)	64.3	43.8	7.7	39.5	37.5	63.6	22.2	42.9	40.8
<i>Raspailia</i> sp. (Black Knobby)	0.0	0.0	0.0	0.0	0.0	9.1	0.0	3.6	1.4
<i>Subrites auranticus</i>	57.1	25.0	0.0	27.9	25.0	45.5	0.0	25.0	26.8
<i>Tedania ignis</i>	50.0	25.0	0.0	25.6	0.0	18.2	0.0	7.1	18.3
CNIDARIA									
<i>Aiptasia pulchella</i>	14.3	0.0	0.0	4.7	12.5	9.1	0.0	7.1	5.6
<i>Pennaria disticha</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.6	1.4
<i>Zoanthus</i> sp.	0.0	0.0	0.0	0.0	12.5	0.0	0.0	0.0	0.0
CORALS									
<i>Leptastrea purpurea</i>	28.6	12.5	0.0	14.0	50.0	27.3	0.0	25.0	18.3
<i>Pocillopora damicornis</i>	42.9	12.5	7.7	20.9	25.0	0.0	0.0	7.1	15.5
<i>Porites compressa</i>	7.1	0.0	0.0	2.3	0.0	0.0	0.0	0.0	1.4
MOLLUSCS									
Ostreidae sp.	7.1	0.0	0.0	2.3	12.5	9.1	11.1	10.7	5.6
<i>Dendostrea hawiensis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Hipponix imbricatus</i>	21.4	0.0	0.0	7.0	25.0	0.0	0.0	7.1	7.0
<i>Vermetus alii</i>	7.1	0.0	0.0	2.3	12.5	0.0	0.0	3.6	2.8
POLYCHAETES									
<i>Branchiomma</i> sp.	28.6	37.5	15.4	27.9	12.5	27.3	66.7	35.7	31.0
<i>Eurythoe complanata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Sabellastarte spectabilis</i>	92.9	62.5	7.7	55.8	62.5	63.6	44.4	57.1	56.3
<i>Salmacina dysteri</i>	0.0	0.0	0.0	0.0	12.5	0.0	0.0	3.6	1.4
ASCIDIANS									
Ascidacea sp.	35.7	62.5	23.1	41.9	75.0	36.4	33.3	46.4	43.7
BRYOZOANS									
<i>Diaperoforma</i> sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 8. Frequency of occurrence of benthic taxa identifiable in quadrats on USS Utah horizontal (deck) and vertical surfaces 2010-11 (Continued).

	Port Horizontal (Deck)				Starboard Vertical				Grand
	Shallow	Mid	Deep	Total	Shallow	Mid	Deep	Total	Total
BRYOZOANS			0						
<i>Schizoporella</i> sp.	7.1	18.8	0.0	9.3	62.5	0.0	11.1	21.4	14.1
ECHINODERMS									
<i>Opheodesoma spectabilis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	23.4	17.3	5.0	3.6	24.3	18.4	14.4	19.1	16.6

the USS Arizona (788 for 45 taxa at 117 sites) similar patterns of species dominance and zonation occurred on the Utah as on the Arizona (Figure 26). Sponges were the most frequently occurring group, with *Mycale grandis* at 27 of the 42 deck sites and 26 of the 30 vertical sites, *Haliclona* (S.) *caerulea* at 28 deck and 23 vertical sites and *Biemna fistulosa* at 15 deck and 23 vertical sites. *Sabellastarte spectabilis* (24 deck, 16 vertical) and *Branchiommia* sp. (12 deck, 10 vertical) dominated the non-sponge taxa, and hard corals, though less frequent than on the Arizona, occurred at numerous sites (*Pocillopora damicornis* at 9 deck sites and 2 vertical sites; *Leptastrea purpurea* at 6 deck sites and 7 vertical sites). *Schizoporella* sp. cf. *errata* occurred at 5 deck sites and 6 vertical surfaces.

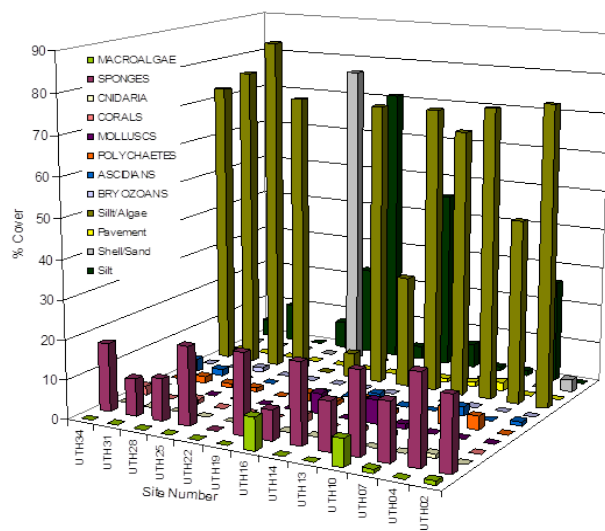
Zonation of total taxa showed a decreasing pattern with depth on the port (deck) surfaces, decreasing from 124 for shallow sites, to 94 mid-depth and 24 for deep sites. This was clearly due to a dramatic increase in silt cover and thickness with depth on the sloping deck surface. This zonation pattern did not occur as distinctly on the starboard vertical surfaces where total taxa were 72-75 for the shallow sites and 51 for the deep sites. This is probably a reflection of less accumulation of sediment on the outwardly tilted starboard side of the Utah.

Areal Coverage

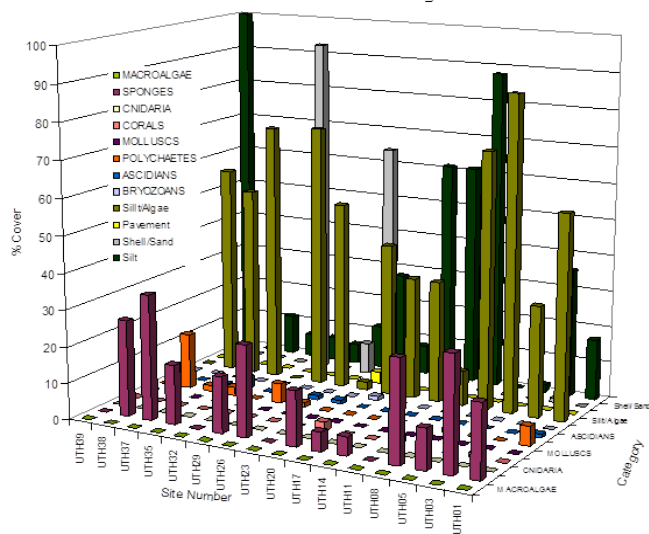
Silt and silt/algae were the dominant substrata in all zones on the deck of the USS Utah, with the latter comprising most of the cover on the deep sites, where seven of the 13 sites had silt cover of 50-100% (Figure 26). Most of the other deep sites had cover up to 100% of shell/sand or silt/algae, consequently little live benthos occurred in the deep zone. Silt/algae cover was also dominant in the shallow and mid-depth zones, but most sites still had sponge cover of 5-20% and polychaete cover of 1-5%, with one mid-depth site as high as 15%. Hard corals were sufficiently abundant to equal 1-2% cover at four shallow sites and three mid-depth sites.

This general pattern of increasing silt and shell/sand cover with depth was largely duplicated on the starboard side of the Utah (Figure 27), while silt/algae was the dominant cover type at all depths. However, live benthos was more prominent than on the ship's deck, with sponge cover in all three zones ranging to maximum values of 27-38% and all sites having cover >5%. Polychaetes were also more abundant, especially in the deep zone where cover ranged 4-12% at six of the ten sites. Hard coral cover ranged 1-7%, bryozoans 1-4%, and ascidians 1-2% each at four of the shallow sites.

Shallow



Mid-depth



Deep

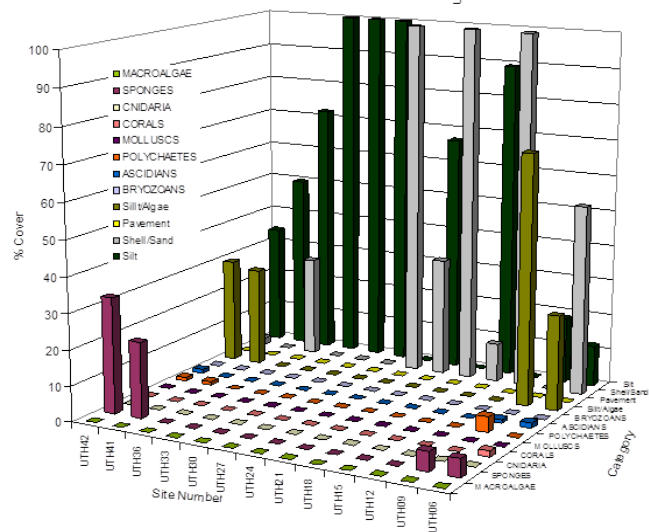
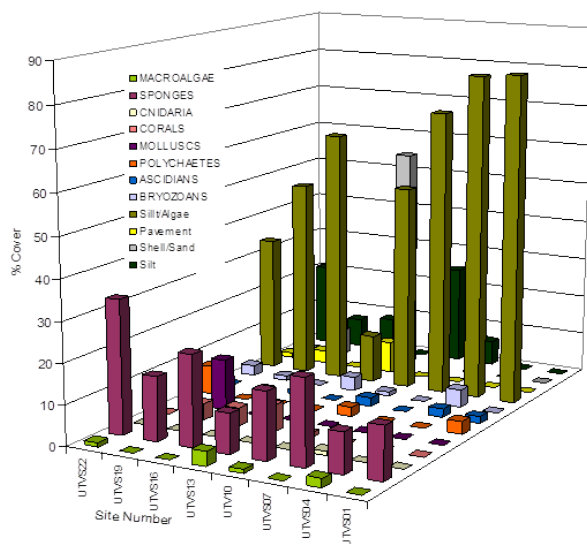
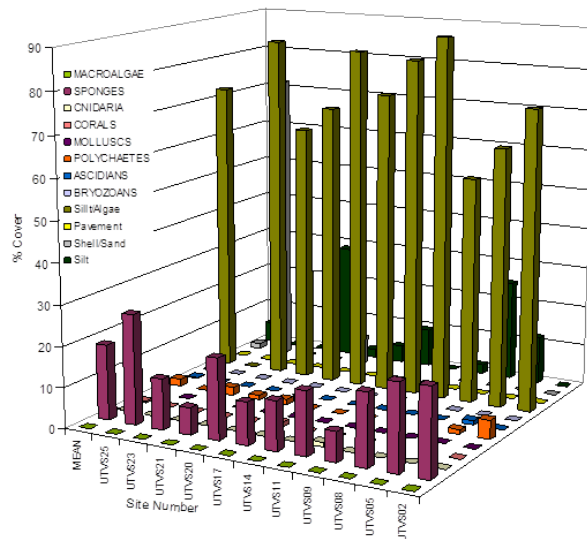


Figure 26. Mean cover by benthic category at Utah horizontal (deck) sites.

Shallow



Mid-depth



Deep

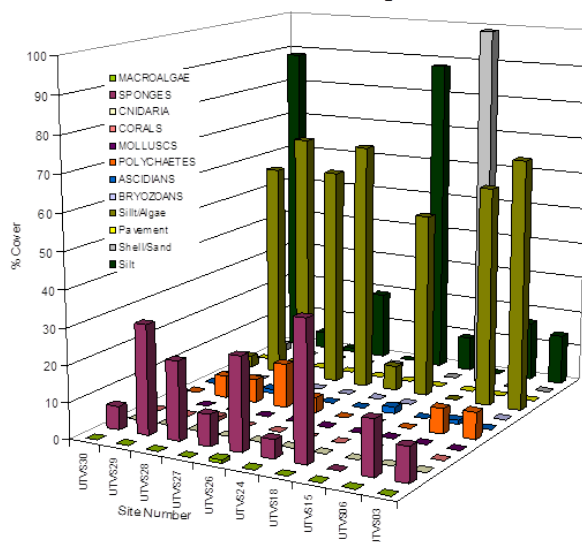


Figure 27. Mean cover by benthic category at Utah starboard vertical sites.

Dominant Species

A similar zonation pattern with depth is shown for the USS Utah port (deck) sites as occurred with the starboard side of the USS Arizona. In this case, the primary reason for decreasing benthic diversity and abundance with depth is the lack of habitat at the deeper site due to deep silt cover on the deck. Benthic organisms at deep sites occurred only at the stern and, less so, the bow extremities of the ship's deck where surfaces were not covered with sediment.

As with the Arizona, *Mycale grandis* and *Haliclona* (S.) *caerulea* were the dominant taxa here and elsewhere on the Utah (Figures 28 and 29). Both occurred at most shallow and mid-depth sites on both the deck and starboard sites, with cover of the former ranging up to 29% and the latter up to 28%. Other frequently occurring sponges were *Biemna fistulosa*, *Dysidea arenaria*, *Suberites aurantiacus*, and an unidentified black sponge with cover values up to 10%. The small hoof-shell *Hipponix imbricatus* was intermittently abundant at shallow sites with cover of 1-6% at three sites on three shallow deck sites and 13% at one shallow starboard site. Corals were also intermittently common, with *Leptastrea purpurea* cover of 1-4% at four shallow starboard sites and 1% at two shallow deck sites. *Sabellastarte spectabilis* occurred at six deck shallow sites and five mid depth sites with cover of 1-5%, and three each starboard shallow and mid-depth sites with cover of 2-6%. *Schizoporella* sp. cf. *errata* occurred at five starboard shallow sites with cover of 1-4%.

Coral Surveys

USS Arizona

Four hard coral species occurred on the vessel: the most abundant, *Pocillopora damicornis*, occurred at 58% of the 55 deck sites and 21% of the starboard or port vertical sites, *Leptastrea purpurea* at 10% of the deck sites and 21% of the vertical sites, *Porites compressa* at two deck sites (Figure 30) and one vertical site, and *Montipora capitata* at a single vertical site. The data for coral frequency, abundance and size on the USS Arizona are shown in Figure 31. A total of 637 corals were counted and measured on the ship, and most (308) were found on the mid-ship area of the ship's deck, followed by the stern deck (123). On the vertical surfaces, the most corals occurred on the mid-ship areas on both the starboard (35) and the port (52) sides with only 5-9 corals found on both bow and stern sections on both sides (Figure 38). Grouping the corals on the ship's sides by their vertical zonation, both starboard and port showed distinct decreases in coral abundance with depth from 24 corals in the shallow to 6 in the deep zone on the starboard side and 61 in the shallows to 7 at mid-depth and zero at the deep sites on the port side. Sixty-eight corals were found in total on the port versus 48 on the starboard side, suggesting that the location of the port facing the open water of the harbor has resulted in higher recruitment of corals on this side of the ship.

Size classes for the four coral species are shown on Figure 32 grouped by location of deck vs. the starboard and port sides of the ships. *Pocillopora damicornis*, as well as being the most numerous coral at all locations, also showed the largest colonies except for *Porites compressa*, ranging up to 40 cm in diameter on the deck and 15-20 cm diameter on the port or starboard sides. Most of the *Pocillopora damicornis* colonies were in the 5-10 cm size range (Figure 32), while *Leptastrea purpurea* ranged up to only 5 cm diameter and had most colonies in the 1-2 cm range, indicating that this coral, while possibly having a high recruitment, does not survive well on the ship very long after settlement. Only three colonies of *Porites compressa* were found on the entire ship, but these were all large corals 20-50 cm in diameter, raising the question of why

there were no smaller colonies of this species. This may represent rare recruitment that does not occur as frequently as with the other species of corals found.



Figure 30. *Porites compressa* coral on deck of USS Arizona.

USS Utah

Species abundance on the USS Utah differed from the Arizona in that *Leptastrea purpurea* was the most frequently occurring coral, found at 11 (36%) of the starboard sites and three (7%) of the deck sites, compared to three (10%) of the starboard sites and seven (17%) of the deck sites for *Pocillopora damicornis* (Figure 33). One colony each of *Porites compressa* and *Porites lobata* were found, both on the deck. Again, in contrast to the USS Arizona, more corals were found on the vertical starboard surface of the Utah, with a total of 40 (0.03/ m²), compared to 29 (0.01/ m²) on deck surfaces, most probably due to the deep silt on much of the ship's deck. Most of the corals were on the mid-ship area of both the deck (21) and the starboard side (24) with intermediate values on the bow areas of the deck (5) and starboard side (18), with virtually no corals found on the ship's stern sections (Figure 33). In terms of vertical zonation, most corals occurred at shallow sites on the deck (22) and mid depth (26) sites on the starboard surface, with virtually none at the deep sites (Figure 33).

Pocillopora damicornis corals on the deck of the USS Utah were smaller than on the Arizona, with diameters ranging up to 20 cm and a peak at 5-10 cm (Figure 34). Only three corals of this species were found on the starboard vertical surfaces, where *Leptastrea purpurea* was more abundant and ranged up to 10 cm with a peak at 2-3 cm. Only three *L. purpurea* were found on

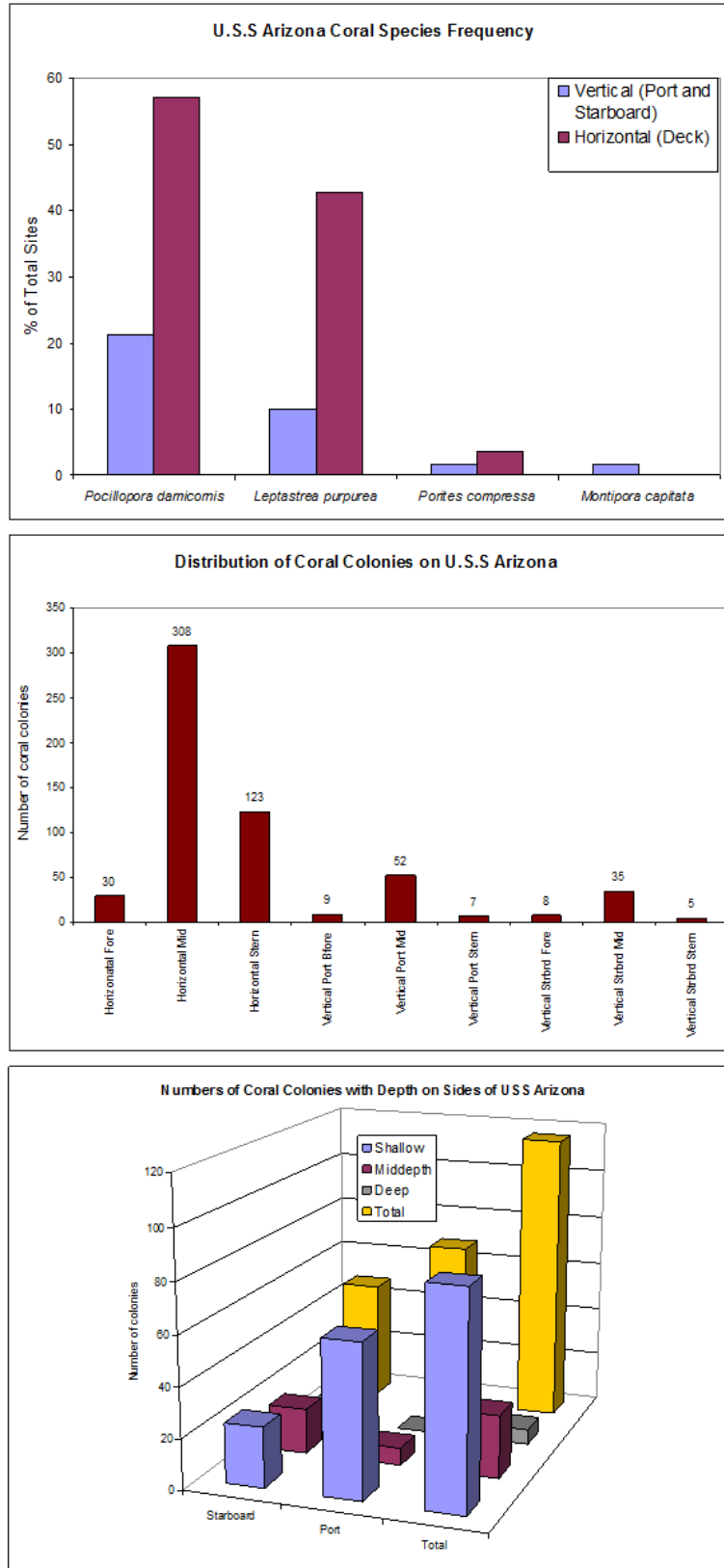


Figure 31. Species frequencies and distribution of corals on USS Arizona.

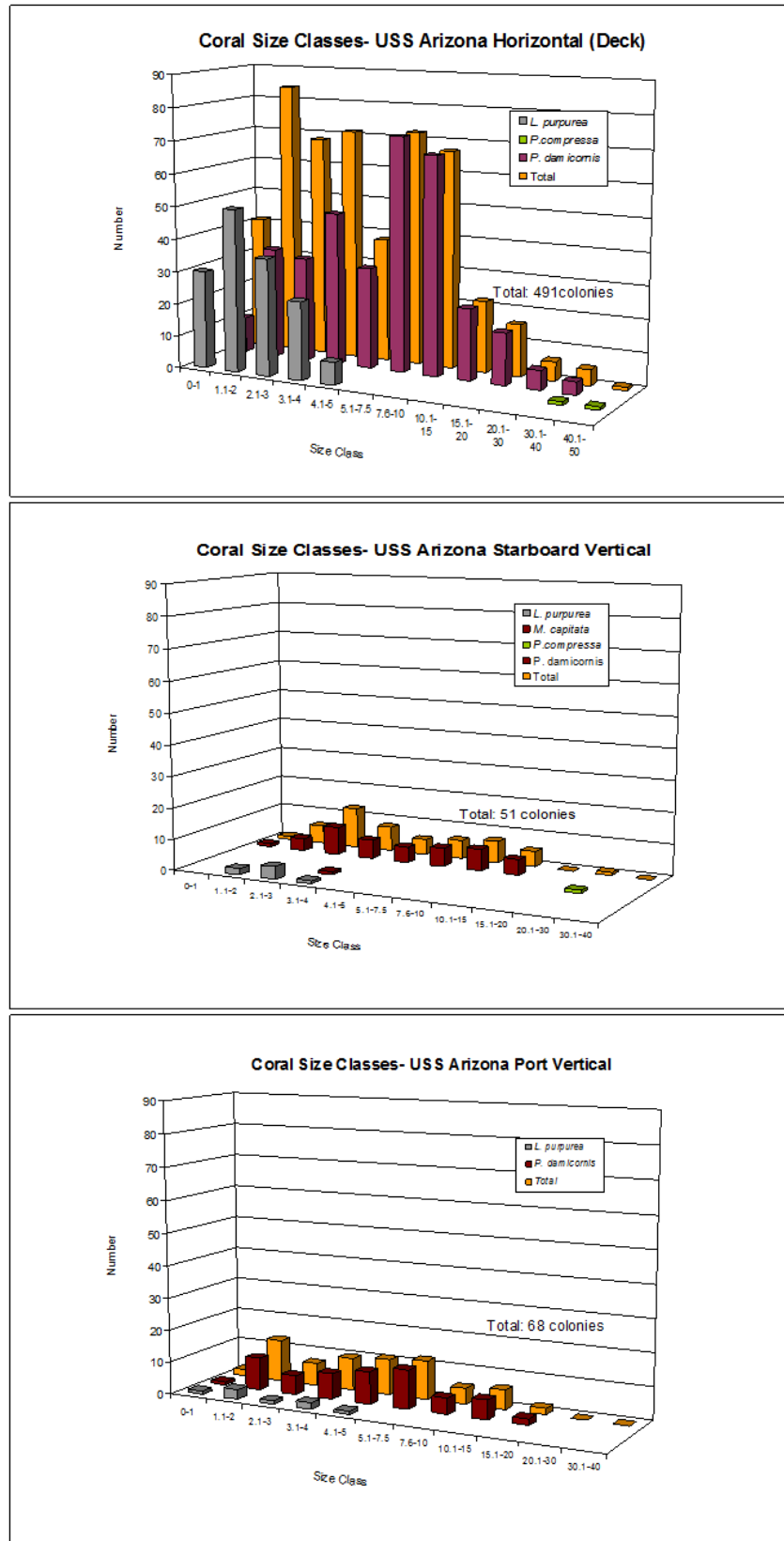


Figure 32. Size class frequencies of corals on USS Arizona.

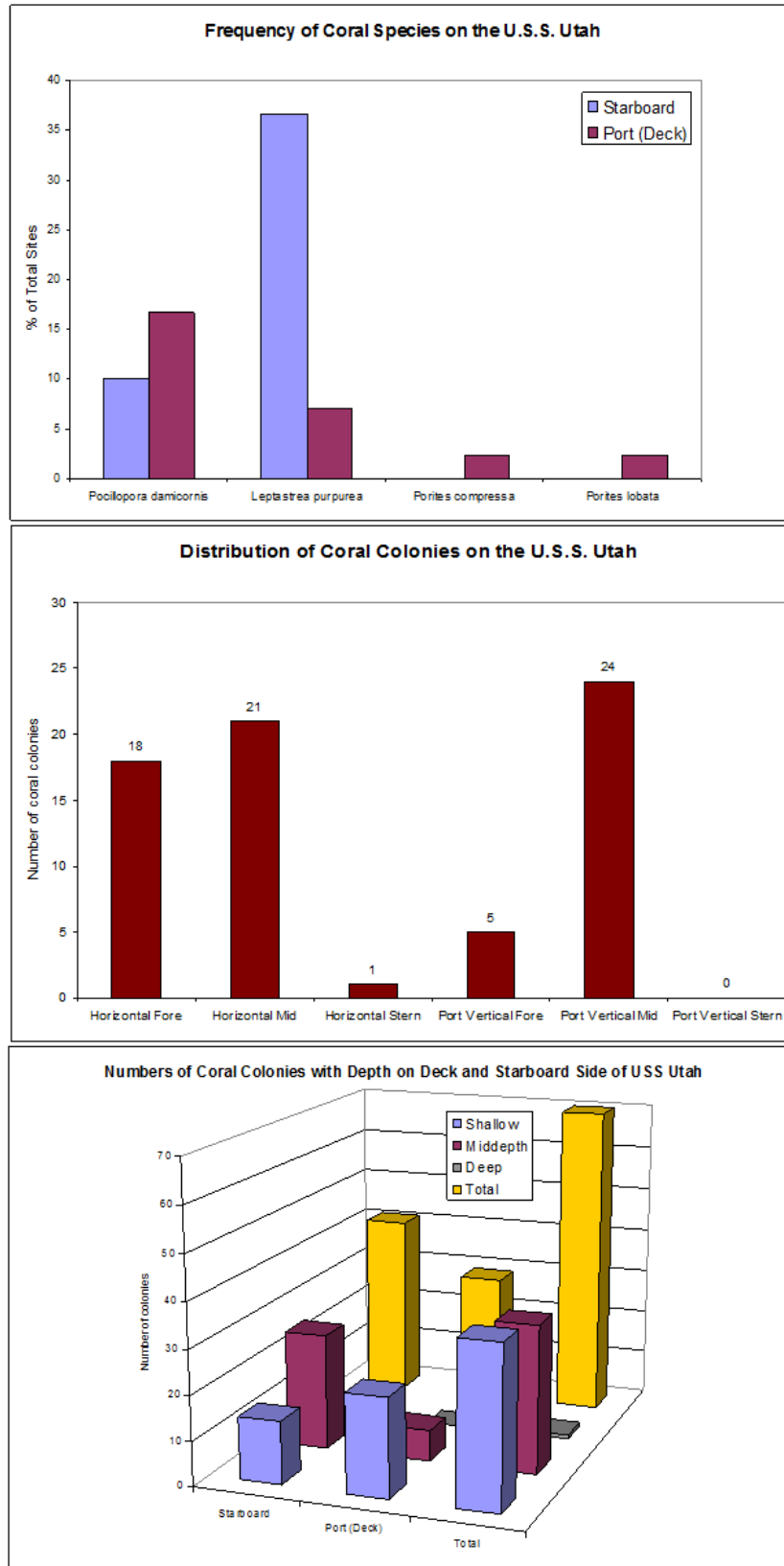


Figure 34. Size class frequencies of corals on USS Utah.

the Utah's deck, with sizes ranging 2-10 cm. In contrast to the Arizona, where three large *Porites compressa* were found with diameters 20-50 cm, the two *Porites* colonies on the Utah were recruits < 1 cm in diameter.

Fish Surveys

General Observations

There is high variability in fish populations spatially and temporally among the survey stations (Appendix D). The number of species present ranged from 0 to 7 and the number of individual fish ranged from 0 to 64 per site on the USS Arizona. Of the 115 fish stations completed there were 50 sites that had no fish present. The number of species present on the USS Utah at each survey station ranged from 0 to 9 and the number of fishes from 0 to 59. Of the 72 sites conducted 22 of them had no fish present (Appendix D). The fishes recorded on the USS Arizona and Utah surveys are listed on Table 9. Twenty-eight species occurred on both ships, with 21 of them found on the Arizona and 18 on the Utah. All but the introduced blacktailed snapper, *Lutjanus fulvus* (to'au) are native to Hawai'i.

USS Arizona

Top Species

The most abundant species on the USS Arizona were two species of Acanthuridae, *Acanthurus blochii* (Hawaiian name *pualu*, common name ringtail surgeonfish) and *Acanthurus xanthopterus* (Hawaiian name *pualu*, common name yellowfin surgeonfish) making up 29.5% and 26.1% of the individuals respectively (Figure 35, Table 10). Both of these species primarily feed on benthic algae. The species *Abudefduf abdominalis* (Hawaiian name *mamo*, common name sergeant major) also occurs in high frequency (21.6% of individuals) at this location. Other notable fish found in the top ten most abundant are *Mulloidichthys flavolineatus* (Hawaiian name *weke*, common name yellowstripe goatfish) and *Parupeneus porphyreus* (Hawaiian name *kūmū*, common name whitesaddle goatfish); both are desirable food fish. None of these species correspond with the statewide most numerically abundant species. Statewide most numerically abundant species are *Chromis vanderbilti*, *Acanthurus nigrofuscus*, *Thalassoma duperrey*, *Ctenochaetus strigosus* and *Zebrasoma flavescens* (Rodgers 2005). The reason for the disparity between this location and the statewide results is due to lower overall fish diversity relating to the lack of coral reef habitat in Pearl Harbor.

Greatest Biomass

Eight of the most abundant species were also found to be in the top species by biomass. The species with the highest biomass was again the two Acanthuridae, *A. xanthopterus* (38.2% of biomass) and *A. blochii* (24.4% of biomass) respectively (Figure 36, Table 11). Although lower on the abundance list and found at only 18 (64 %) of the sites, *Zebrasoma veliferum* (Hawaiian name *lau īpala*, common name sailfin tang) ranked third, making up 8.4% of the biomass. Like abundance, none of the species corresponded with the statewide top species for fish biomass. The species with the highest biomass statewide are *Lutjanus kasmira*, *Melichtys niger*, *Acanthurus leucopareius*, *Acanthurus nigrofuscus*, and *Ctenochaetus strigosus* (Rodgers 2005).

Table 9. Fish species recorded on the USS Arizona and Utah in 2010-11.

Family	Species	Author(s) Year	Origin	Hawaiian name	Common name	Arizona	Utah
Carangidae	<i>Carangoides ferdau</i>	(Forsskål, 1775)	Native		Barred Jack	x	
	<i>Caranx ignobilis</i>	(Forsskål, 1775)	Native	Ulua aukea	Giant Trevally	x	
	<i>Caranx melampygus</i>	Cuvier 1833	Native	ōmilu	Bluefin Trevally	x	x
Lutjanidae	<i>Lutjanus fulvus</i>	(Forster in Bloch and Schneider,	Introduced	to'au	Blacktail Snapper	x	x
Mullidae	<i>Mulloidichthys flavolineatus</i>	(Lacepède, 1801)	Native	weke ā	Yellowstripe Goatfish	x	x
	<i>Parupeneus porphyreus</i>	(Jenkins, 1902)	Native	kūmū	Whitesaddle Goatfish	x	x
	<i>Upeneus taeniopterus</i>	Cuvier, 1829	Native		Finstripe Goatfish	x	x
Chaetodontidae	<i>Chaetodon auriga</i>	Forsskål 1775	Native		Threadfin Butterflyfish	x	x
	<i>Chaetodon ornatissimus</i>	Solander in Cuvier 1831	Native	kīkākāpu	Ornate Butterflyfish	x	
Pomacentridae	<i>Abudefduf abdominalis</i>	(Quoy and Gaimard, 1824)	Native	mamo	Hawaiian Sergeant	x	x
	<i>Dascyllus albisella</i>	Gill 1862	Native	ālo'ilo'i	Hawaiian Dascyllus	x	x
Cirrhitidae	<i>Cirrhitops fasciatus</i>	(Bennett, 1828)	Native	pilikoa	Redbarred Hawkfish		x
Scaridae	<i>Calotomus carolinus</i>	(Valenciennes, 1839)	Native	pōnuhuu	Stareye Parrotfish	x	
	<i>Chlorurus perspicillatus</i>	(Steindachner, 1879)	Native	uhu 'ulī'ulī	Spectacled Parrotfish	x	
	<i>Chlorurus sordidus</i>	(Forsskål 1775)	Native	uhu	Spectacled Parrotfish	x	
	<i>Scarus psittacus</i>	Forsskål 1775	Native	uhu	Palenose Parrotfish	x	x
Gobiidae	Gobiidae spp.					x	x
Zanclidae	<i>Zanclus cornutus</i>	(Linnaeus, 1758)	Native	kīhikihi	Moorish Idol	x	
Acanthuridae	<i>Acanthurus blochii</i>	Valenciennes 1835	Native	pualu	Ringtail Surgeonfish	x	
	<i>Acanthurus xanthopterus</i>	Valenciennes 1835	Native	pualu	Yellowfin Surgeonfish	x	x
	<i>Naso hexacanthus</i>	(Bleeker, 1855)	Native	kala lōlō, 'ōpelu kala	Sleek Unicornfish	x	
	<i>Naso lituratus</i>	(Forster and Schneider, 1801)	Native	umaumalei	Orangespine Unicornfish	x	
	<i>Naso unicornis</i>	(Forsskål, 1775)	Native	kala	Bluespine Unicornfish		x
	<i>Zebrasoma flavescens</i>	(Bennett, 1828)	Native	lau-ī-pala	Yellow Tang		x
	<i>Zebrasoma veliferum</i>	(Bloch, 1797)	Native	māne'one'o	Sailfin Tang	x	x
Tetraodontidae	<i>Arothron hispidus</i>	(Linnaeus, 1758)	Native	'o'opu-hue	Stripebelly Puffer		x
	<i>Arothron meleagris</i>	(Lacepède, 1798)	Native	'o'opu-hue	Spotted Puffer		x
Diodontidae	<i>Diodon hystrix</i>	Linnaeus 1758	Native		Spotfin Porcupinefish		x
					Total	21	18

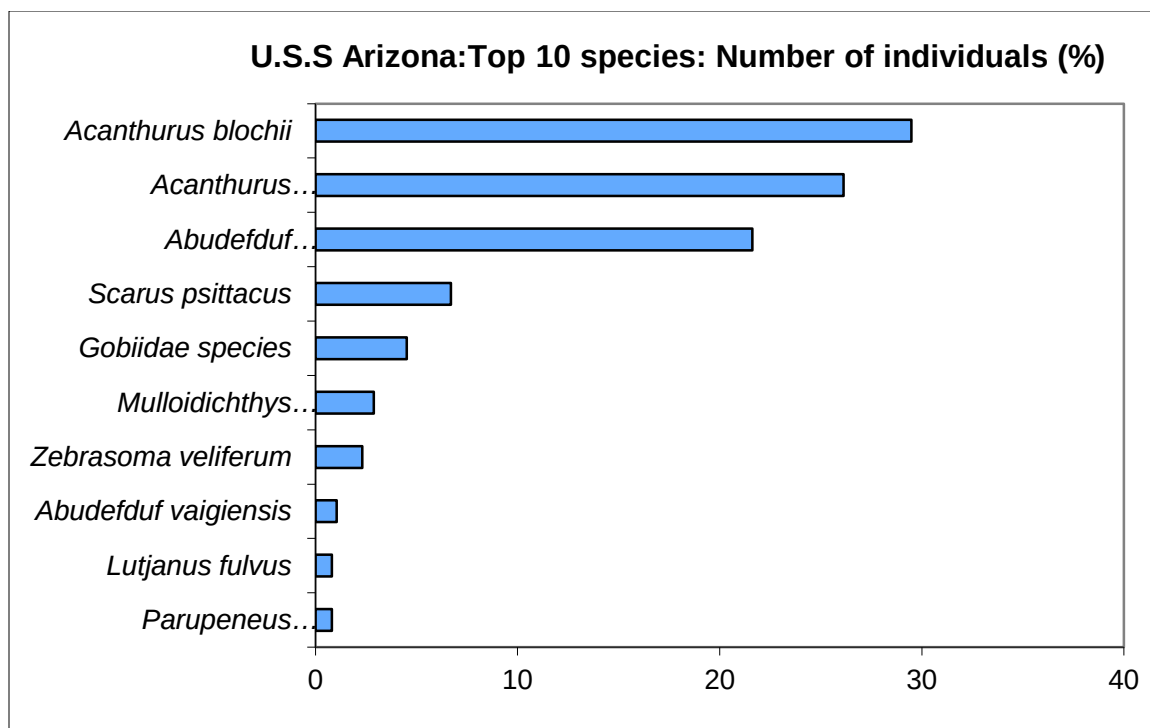


Figure 35. Top 10 species with the highest abundance (mean number of individuals (%)).

Table 10. Top ten fish species on the USS Arizona with the highest abundance (mean number of individuals/ha x 1000) shown in descending order with associated mean biomass (t/ha) and frequency of occurrence.

Taxonomic Name	Common Name	Hawaiian Name	Mean no. of Individuals (hax1000)	Mean Biomass (t/ha)	Frequency of occurrence (%)
<i>Acanthurus blochii</i>	Ringtail Surgeonfish	pualu	0.31	0.039	60.00
<i>Acanthurus xanthopterus</i>	Yellowfin Surgeonfish	pualu	0.28	0.061	43.08
<i>Abudefduf abdominalis</i>	Sergeant Major	mamo	0.23	0.011	47.69
<i>Scarus psittacus</i>	Palenose Parrotfish	uhu	0.07	0.003	18.46
Gobiidae sp.	Goby	'o'opu	0.05	0.000	16.92
<i>Mulloidichthys flavolineatus</i>	Yellowstripe Goatfish	weke	0.03	0.005	6.15
<i>Zebrasoma veliferum</i>	Sailfin Tang	māne'one'o	0.02	0.013	18.46
<i>Abudefduf vaigiensis</i>	Indo-Pacific Sargent	mamo	0.01	0.001	10.77
<i>Parupeneus porphyreus</i>	Whitesaddle Goatfish	kūmū	0.01	0.004	9.23
<i>Lutjanus fulvus</i>	Blacktail Snapper	to'au	0.01	0.003	9.23

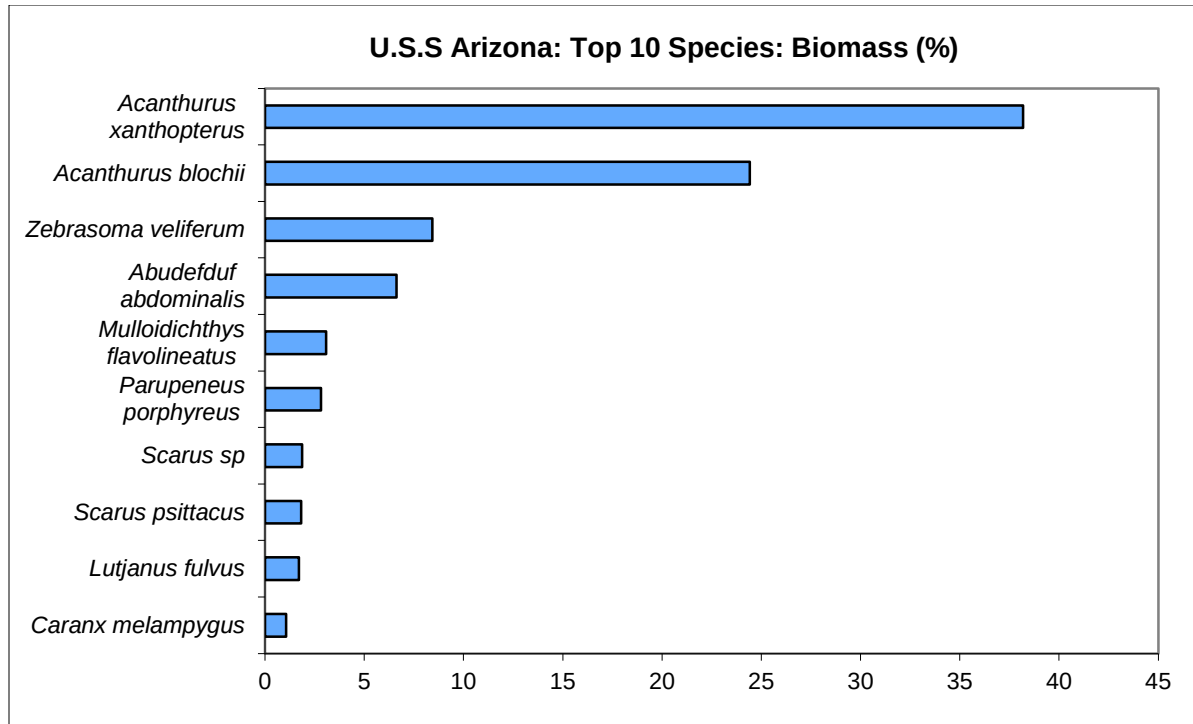


Figure 36. Top 10 species with the greatest mean biomass (%).

Table 11. Top ten fish species on the USS Arizona with the greatest mean biomass (t/ha) shown in descending order with associated abundance (mean number of individuals/ha x 1000) and frequency of occurrence (%).

Taxonomic Name	Common Name	Hawaiian Name	Mean Biomass (t/ha)	Mean no. of Individuals (ha x 1000)	Frequency of occurrence (%)
<i>Acanthurus xanthopterus</i>	Yellowfin Surgeonfish	pualu	0.061	0.278	43.08
<i>Acanthurus blochii</i>	Ringtail Surgeonfish	pualu	0.039	0.314	60.00
<i>Zebrasoma veliferum</i>	Sailfin Tang	māne'one'o	0.013	0.025	18.46
<i>Abudefduf abdominalis</i>	Sergeant Major	mamo	0.011	0.230	47.69
<i>Mulloidichthys flavolineatus</i>	Yellowstripe Goatfish	weke	0.005	0.031	6.15
<i>Parupeneus porphyreus</i>	Whitesaddle Goatfish	kūmū	0.004	0.009	9.23
<i>Scarus sp</i>	Scarus sp.	uhu	0.003	0.006	1.54
<i>Scarus psittacus</i>	Palenose Parrotfish	uhu	0.003	0.071	18.46
<i>Lutjanus fulvus</i>	Blacktail Snapper	to'au	0.003	0.009	9.23
<i>Caranx melampygus</i>	Blue Trevally	'ōmilu	0.002	0.005	4.62

Families of Fishes

The family with the most individuals on the USS Arizona is Acanthuridae, comprising 58.4% of the individuals (Figure 37). The Acanthuridae at this location is comprised of 5 different species; however, *A. blochii* and *A. xanthopterus* accounted for 50% and 44 % of the individuals respectively making up the vast majority. The number of individuals in the Pomacentridae family is also quite high, making up 22.7% of individuals with *A. abdominalis* making up 95% of

individuals in this family. These top families are similar to the state rankings except Acanthuridae and Pomacentridae are reversed. The statewide ranking for Pomacentridae is primarily driven by *Chromis* whereas at the USS Arizona it is exclusively *Abudefduf* sp. (Rodgers 2005).

All ten families ranked as having the highest number of individuals are also ranked in the top ten families by biomass. Consistent with state rankings, the Acanthuridae family makes up 77.4% of the biomass with *A. xanthopterus* accounting for 53% of the family (Figure 38, Table 12). Other families with notable biomass are Pomacentridae, Mullidae and Scaridae.

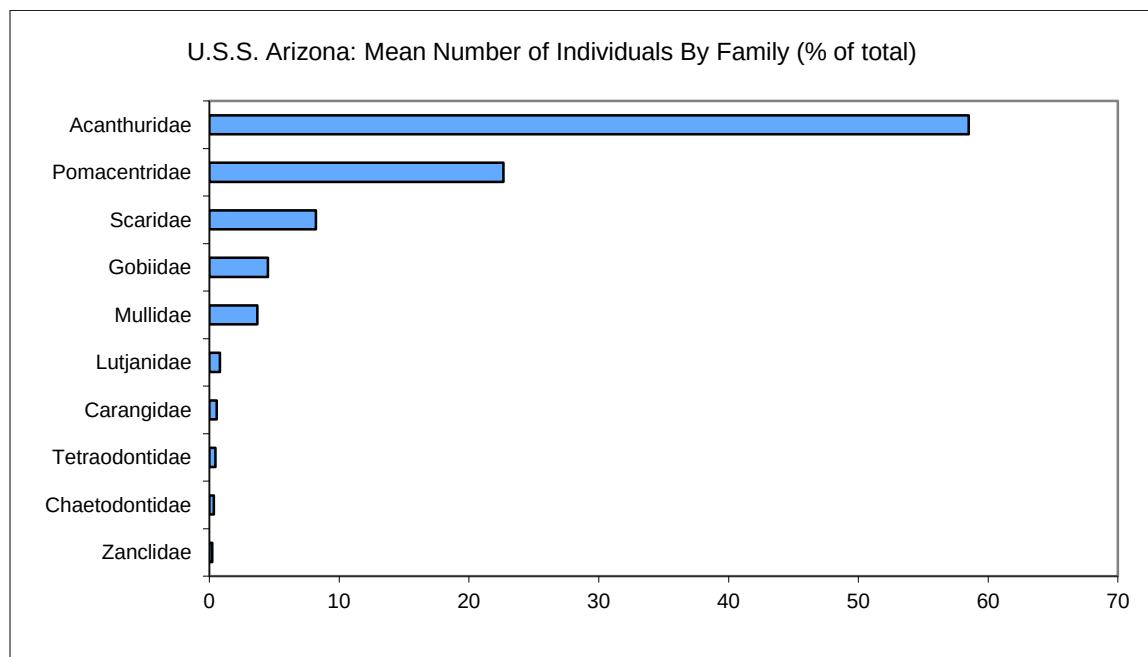


Figure 37. Top 10 fish families with the numerical highest abundance (mean number of individuals (% of total)).

Trophic Levels

Herbivores are the dominant trophic group in terms of both numerical abundance (66.5%) and biomass (82.0%), while piscivores are scarce (Figures 39 and 40, Table 13). This is consistent with fish populations in the main Hawaiian Islands (MHI) due to removal of apex predators by fishing. On the USS Arizona piscivores constitute only 1.2% of the total biomass and 0.6% of the number of individuals. The piscivores are made up of just two species. *Caranx melampygus* (Hawaiian name 'ōmilu, common name blue trevally) makes up the majority with 92.1% of the biomass and 80.0% of the individual fishes. The total piscivores value is considerably lower than the MHI statewide average of 11% of the biomass and 1.4% of the total individuals. In the Northwestern Hawaiian Islands (NWHI), an area with minimal fishing pressure, there is a significant shift in the fish populations in terms of trophic distribution. The NWHI has fish populations with piscivores making up the vast majority of the biomass at 75% (Friedlander and DeMartini 2002). Zooplanktivores and invertebrate feeders on the Arizona respectively make up 8.1% and 8.7% of the total biomass, and 22.9% and 10.1% of the numerical abundance.

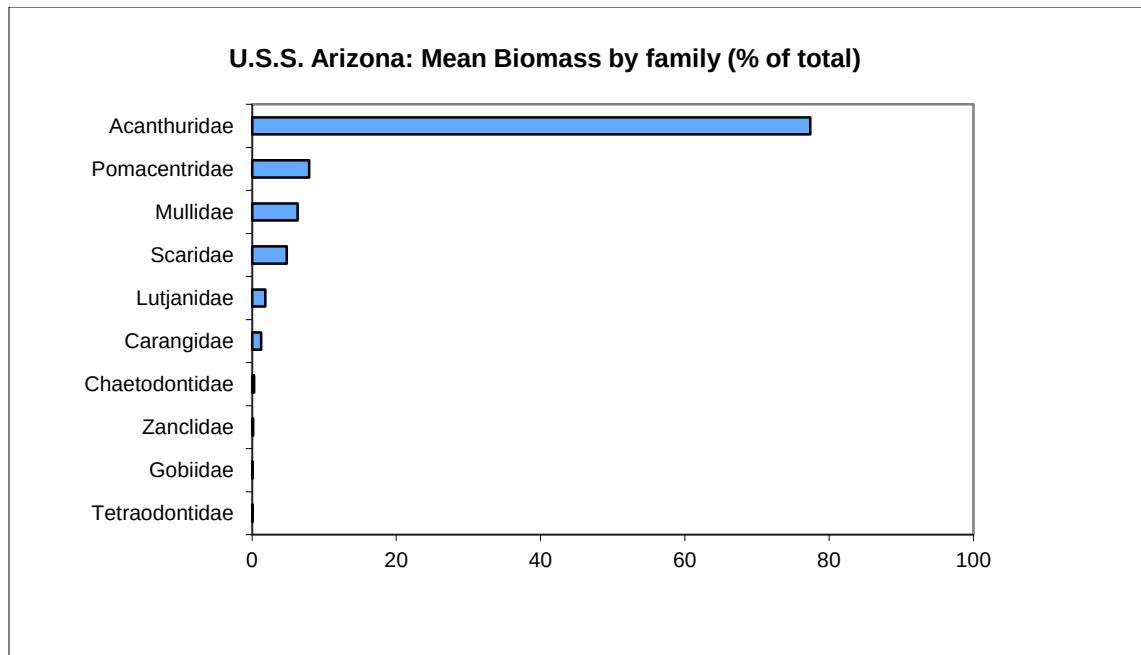


Figure 38. Top 10 fish families with the greatest mean biomass (% of total).

Table 12. Top ten fish families with the greatest mean biomass (t/ha) and density (mean number of individuals (hax1000)) and standard deviations are shown in descending order.

Top 10 families: mean biomass (t/ha)			Top 10 families: mean number (hax1000)		
family	mean	SD	family	mean	SD
Acanthuridae	0.1148	0.225	Acanthuridae	0.623	0.64
Pomacentridae	0.0117	0.022	Pomacentridae	0.241	0.43
Mullidae	0.0094	0.040	Scaridae	0.087	0.26
Scaridae	0.0072	0.029	Gobiidae	0.048	0.23
Lutjanidae	0.0027	0.009	Mullidae	0.039	0.17
Carangidae	0.0018	0.009	Lutjanidae	0.009	0.03
Chaetodontidae	0.0004	0.003	Carangidae	0.006	0.03
Zanclidae	0.0002	0.001	Tetraodontidae	0.005	0.02
Gobiidae	0.0001	0.000	Chaetodontidae	0.004	0.02
Tetraodontidae	0.0000	0.000	Zanclidae	0.002	0.01

The large increase in zooplanktivores on the USS Arizona is mainly due to *A. abdominalis*, which makes up 87% of the zooplanktivore biomass and 94% of the number of individuals. This species makes up only 6.6% of the total biomass; however it comprises 21.6% of the individual fish on the ship. Invertebrate feeders consist of a large number of Gobiidae individuals (44% of invertebrate feeders) that have very small biomass (0.6%). The biomass of invertebrate feeders is driven by *Mulloidichthys flavolineatus* (38.2%) and *Parupeneus porphyreus* (34.8%).

Herbivorous fishes represent the vast majority with 82.0% of the total biomass and 66.5% of the number of individuals. This is primarily driven by two species of Acanthurids, *A. xanthopterus* makes up 45.8% of the biomass and 39.3% of the individuals, and *A. blochii* which makes up 29.3% of the biomass and 44.3% of the individuals.

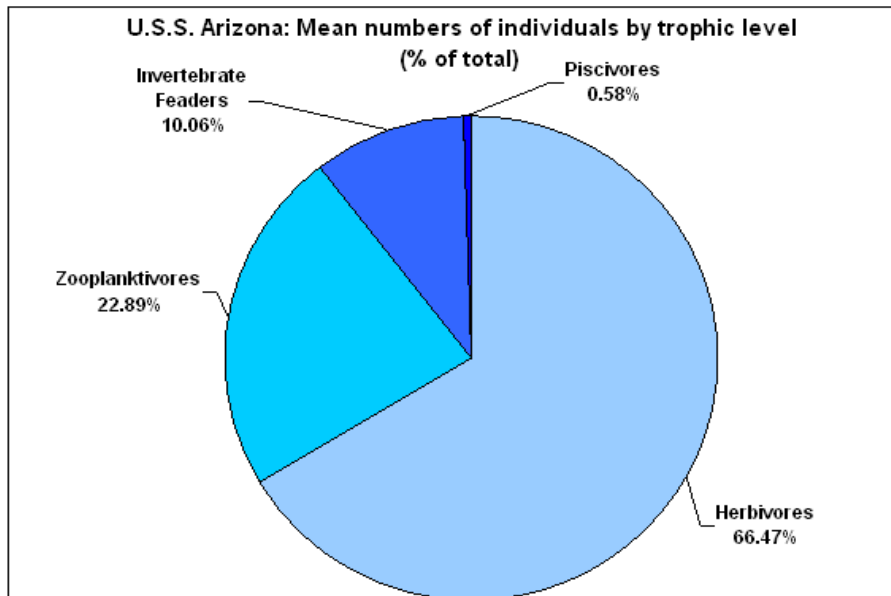


Figure 39. Numeric abundance (% of total) by trophic level.

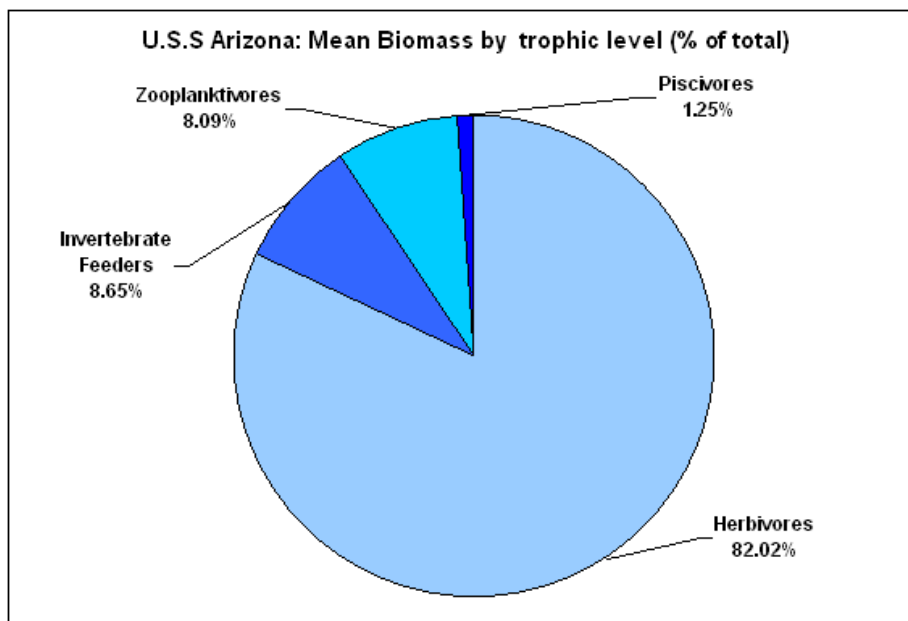


Figure 40. Mean biomass (% of total) by trophic levels.

Table 13. Mean biomass (t/ha) and density (mean number of individuals hax1000) by trophic levels and their standard deviations are shown in descending order.

Mean numbers of individuals by trophic level (hax1000)			Mean biomass by trophic level (t/ha)		
	mean	SD		mean	SD
Herbivores	0.71	0.73	Herbivores	0.12	0.23
Zooplanktivores	0.25	0.44	Zooplanktivores	0.01	0.04
Invertebrate Feeders	0.11	0.27	Invertebrate Feeders	0.01	0.02
Piscivores	0.01	0.03	Piscivores	0.00	0.01

Endemic Status

The endemic fish population on the USS Arizona makes up 10.1 % of the biomass and 22.4% of the individual fishes, which is highly consistent with statewide values of 11.6% of the biomass and 22.9% of individual fish (Fig 41, Table 14). There are only three species of endemic fish at this location, *P. porphyreus*, *Chlorurus perspicillatus* (Hawaiian name *uhu uliuli*, common name spectacled parrotfish), and *A. abdominalis*. *A. abdominalis* makes up the majority of the endemic fishes with 70% of the biomass and 96% of the number of individuals.

The non-native fish population was made up entirely of seven large (>30cm) individuals of the introduced *Lutjanus fulvus* (Tahitian name *to'au*, common name blacktail snapper). *L. fulvus* was introduced from Marquesas in the 1956 by Hawaii Fish and Game to boost edible fish stocks. This shallow water fish was selected because Hawai'i has several deep-water snappers that are highly sought after. After its introduction, *L. fulvus* became widely distributed throughout the archipelago; however it has not become a popular game fish.

The bulk of the fish, in terms of both biomass (88.0%) and abundance (77.8%), are indigenous to Hawai'i, having wide distributions in the Pacific. This is relatively consistent with statewide fish populations with 76.7% of biomass and 72.9% of individuals represented by indigenous fishes (Rodgers 2005). *A. blochii* and *A. xanthopterus* contribute most of the biomass and individuals of the indigenous fish population.

Size Classes

The highest biomass (88%) and abundance (45%) is found in the largest size group (>15cm) (Figure 42). The numerical abundance of the 5-15 cm size class is only slightly lower than that of the largest size (44%) but has a much lower biomass (11%) due to the smaller size. The largest size class is made up primarily of *A. xanthopterus* with 45.3% of biomass and 41.8% of the individuals and secondly by *A. blochii* with 27.9% biomass and 39.9% of individuals. The medium size group (5-15 cm) is comprised mostly by *A. abdominalis* in terms of biomass and abundance (62.3% and 48.9% respectively). Biomass is considerably higher in the large size class because 34.8% of this category are very large fish (>25cm). These very large fish comprise 57.6% of the total biomass on the USS Arizona. There are also very few small fish (<5cm) at this location (12 *Gobiidae* sp.). Gobies (97% of them) primarily inhabited the heavily sedimented regions of the ship's horizontal surface and were scarce on the vertical surfaces. This pattern is explained by gobies having a preference for being directly on the substrate in shallower water. The graph is not able to show the value of biomass for the small size class due to the fact that it makes up only 0.01% of the total biomass at this location. This location has a low abundance of

medium-sized fish and a higher abundance of large fish compared to the statewide averages (Rodgers 2005).

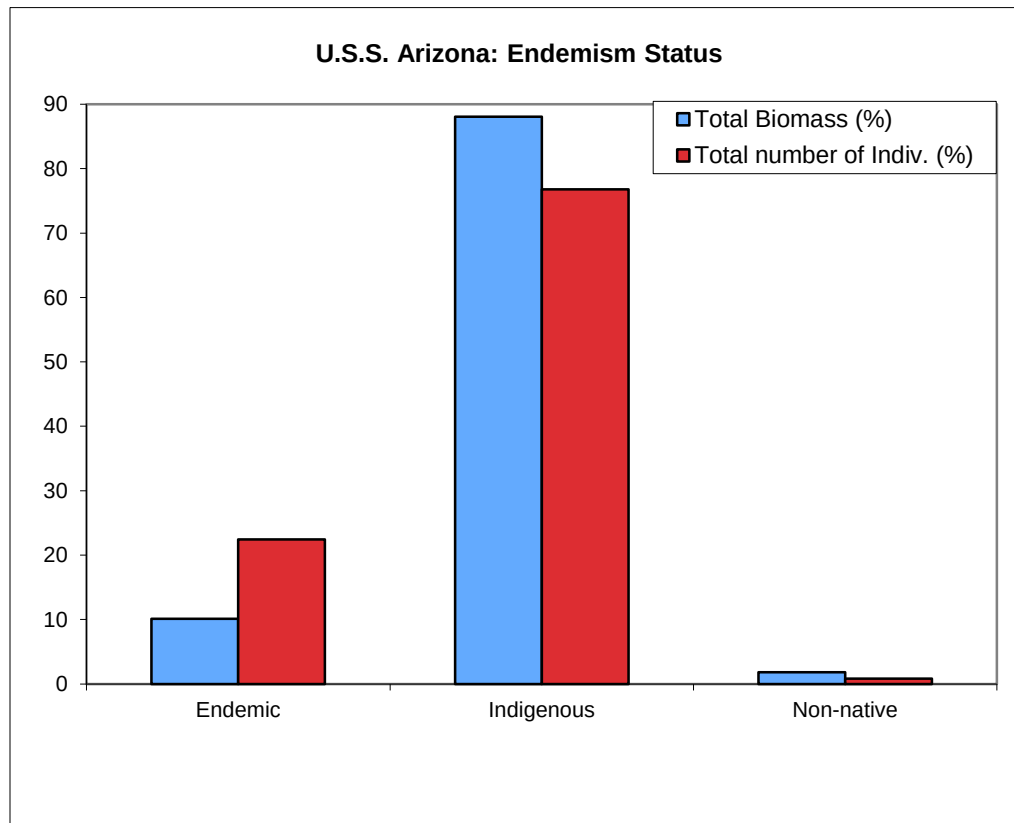


Figure 41. Biomass (%) and number of individuals (%) by endemic status.

Table 14. Mean biomass (t/ha) and mean number of individuals (ha x 1000) by endemic status.

Origin	Mean Biomass (t/ha)	SD	Mean No. of individuals (ha x 1000)	SD
Endemic	0.04	0.07	340.43	417.52
Indigenous	0.05	0.13	302.53	424.01
Non-native	0.03	0.01	93.33	32.66

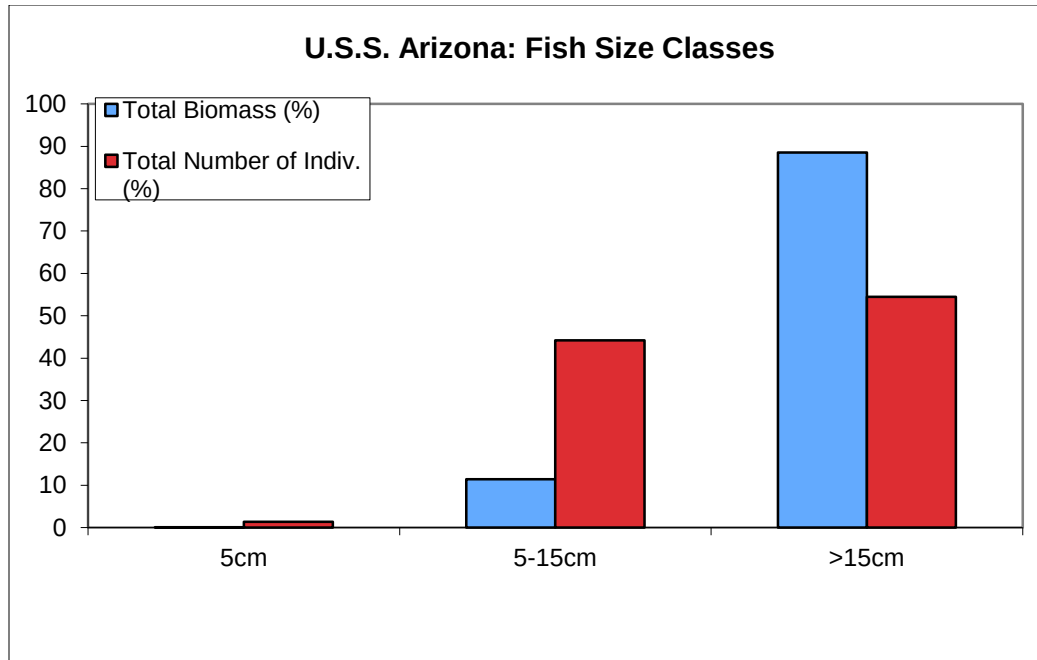


Figure 42. Size classes of fishes by biomass (% of total) and abundance (% of total).

Depth Ranges

The fish survey sites ranged from the shallowest at 0.9 m to the deepest point at 9.8 m. Depth had a negative effect on all of the different metrics measured in this study. Number of species, biomass, and number of individuals all decrease with depth (Figure 43). There were differing numbers of sites in each of the depth categories as follows: 0-3 m had 27.8% of the sites, 3-6 m 32.1 % of the sites, and >6 m 40.0% of the sites. A large portion of the fish population was found to be in the shallowest portions of the ship with 52.9% of the biomass and 59.8% of the individuals. Even though there are a greater number of deep survey sites the deep area only contains 9.9% of the biomass and 13.2% of the fishes on the entire ship. This is mainly due to differences in spatial complexity around the ship.

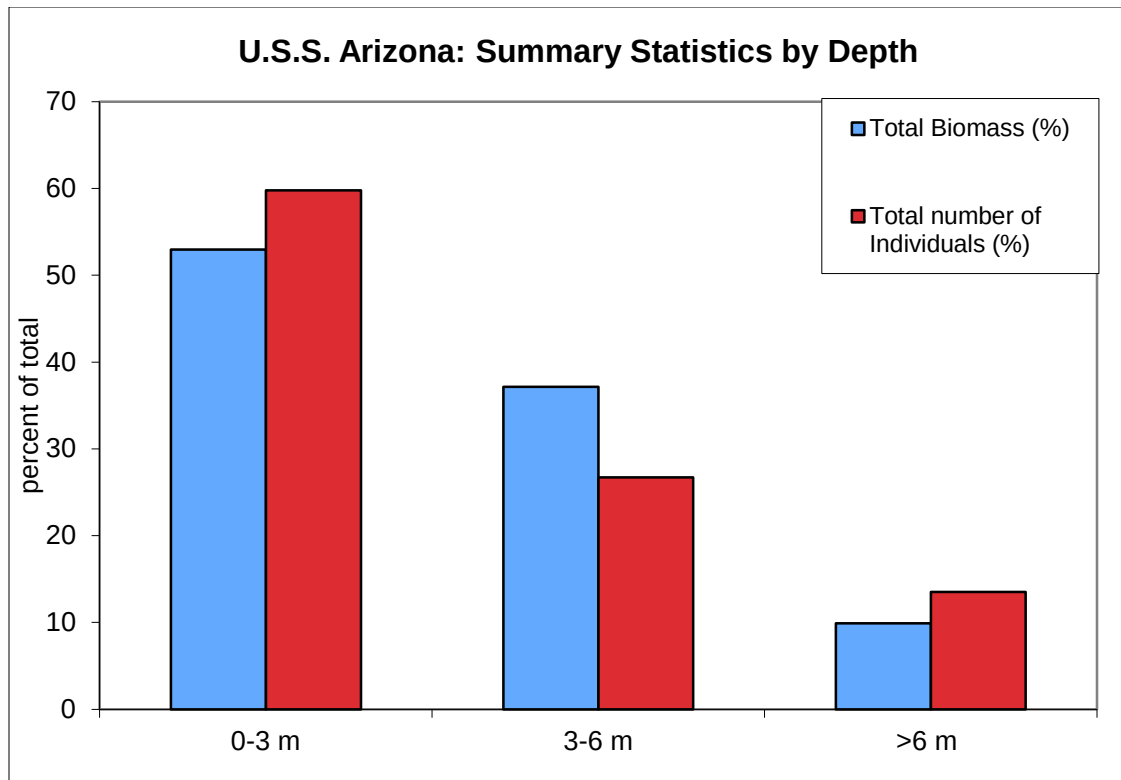


Figure 43. Total biomass (%) and abundance (%) by depth.

Spatial Complexity and Richness

Due to the nature of the ship there is considerable variability in special complexity throughout the survey sites (Figure 44). The port and starboard vertical surfaces on the hull of the ship lack spatial complexity and are at the deeper locations.

The horizontal sites have high vertical relief due to the extensive super structure that remains on the ship. These shallower sites are home to a larger and more diverse population of fishes. This is also evident in the amount of sites found to have no fish; 80% of these sites were on the vertical surfaces. Spatial complexity is shown to be important for fishes because it expands the available resources like food and provides refuge from predation and competition (Friedlander and Parrish 1998).

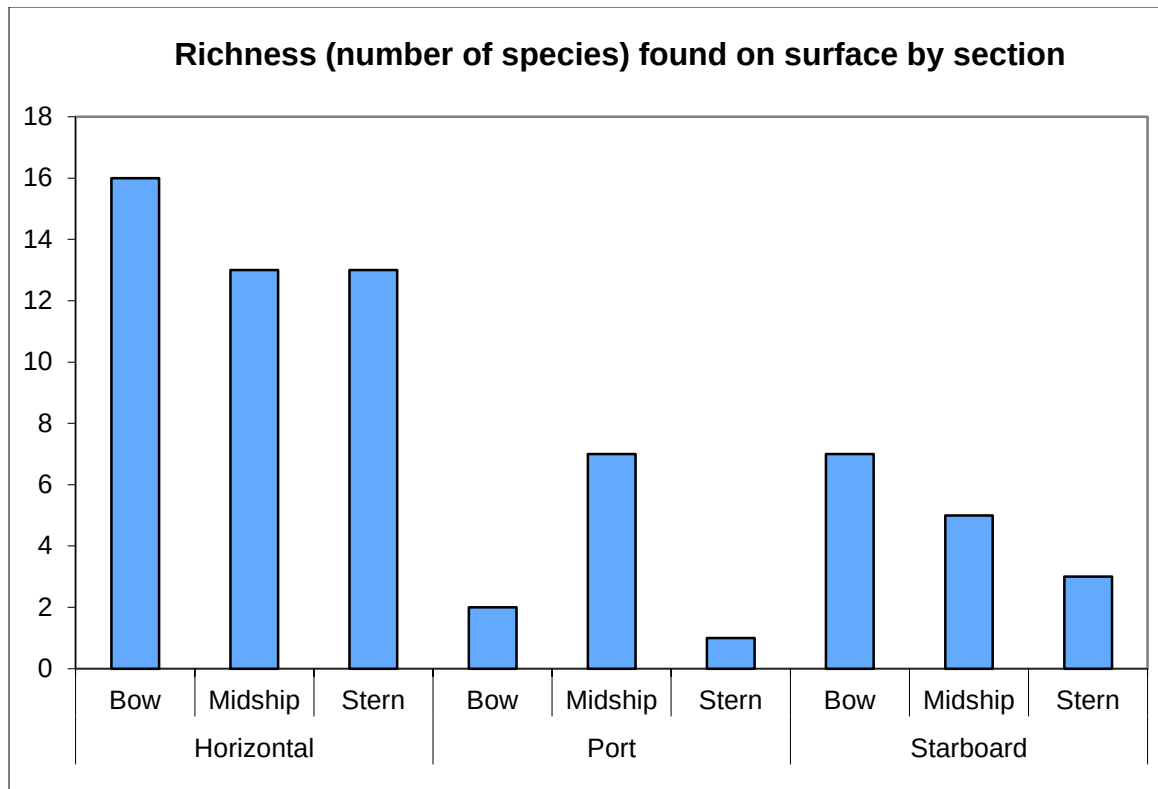


Figure 44. Species richness in different sections and surfaces of the ship. Port and starboard are both vertical surfaces.

USS Utah

Top Species

The most abundant species on the USS Utah was *Acanthurus xanthopterus*, making up 38.5% of the individuals and present on 40% of the sites (Figure 45, Table 15). *Abudefduf abdominalis* (Hawaiian name *mamo*, common name sergeant major) and *Scarus psittacus* (Hawaiian name *uhu*, common name palenose parrotfish) were also found in relatively high abundances, comprising 15.8% and 15.6% of the fish population. *Gobiidae* sp. was among the top ten most abundant species was the species present on the highest number of sites (44%). The only invasive species in the top ten most abundant fishes was *Lutjanus fulvus* with 1.7% of the individuals. *Zebrasoma flavescens* (Hawaiian name *lau'ipala*, common name yellow tang) was the only species that was also found to be in the top ten most abundant species statewide.

Greatest Biomass

Seven of the most numerically abundant species were also found to be in the top ten species by biomass (Figure 46). *A. xanthopterus* makes up the bulk of the biomass with 51.6%. The top three most numerically abundant species are found in the same order in terms of biomass with *A. abdominalis* and *S. psittacus* at second and third, constituting 11.7% and 8.9% respectively. As with numerical abundance *Z. flavescens* is the only species found to be in the top species for fish biomass statewide.

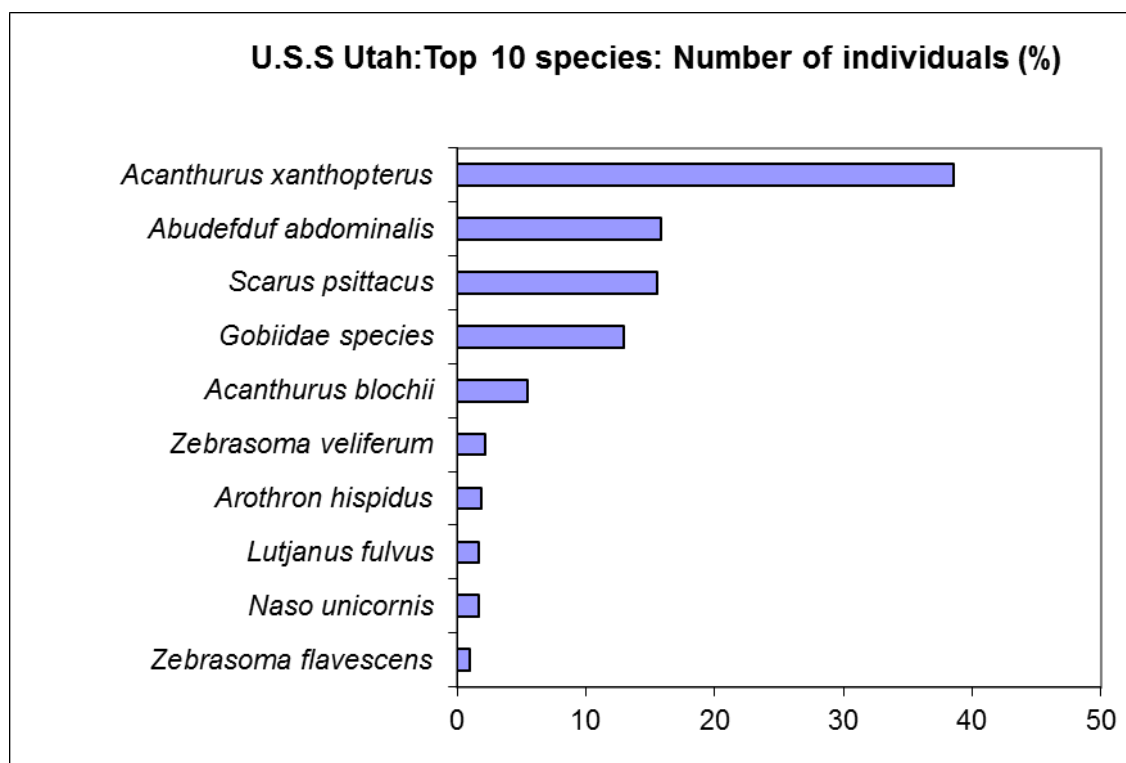


Figure 45. Top 10 species with the highest abundance (mean number of individuals (%)).

Table 15. Top ten fish species on the USS Utah with the highest abundance (mean number of individuals hax1000) are shown in descending order with associated mean biomass (t/ha) and frequency of occurrence.

Taxonomic Name	Common Name	Hawaiian Name	Mean number of individuals (hax1000)	Mean Biomass (t/ha)	Frequency of occurrence (%)
<i>Acanthurus xanthopterus</i>	Yellowfin Surgeonfish	pualu	0.26	0.016	40.0
<i>Abudefduf abdominalis</i>	Sargeant Major	mamo	0.11	0.004	28.0
<i>Scarus psittacus</i>	Palenose Parrotfish	uhu	0.10	0.003	22.0
<i>Gobiidae species</i>	Goby	'o'opu	0.09	0.000	44.0
<i>Acanthurus blochii</i>	Ringtail Surgeonfish	pualu	0.04	0.001	12.0
<i>Zebrasoma veliferum</i>	Sailfin Tang	māne'one'o	0.01	0.002	6.0
<i>Arothron hispidus</i>	Stripebelly Puffer	'o'opu hue	0.01	0.000	16.0
<i>Naso unicornis</i>	Bluespine Unicornfish	kala	0.01	0.002	4.0
<i>Lutjanus fulvus</i>	Blacktail Snapper	to'au	0.01	0.000	8.0
<i>Zebrasoma flavescens</i>	Yellow Tang	lau'īpala	0.01	0.001	6.0

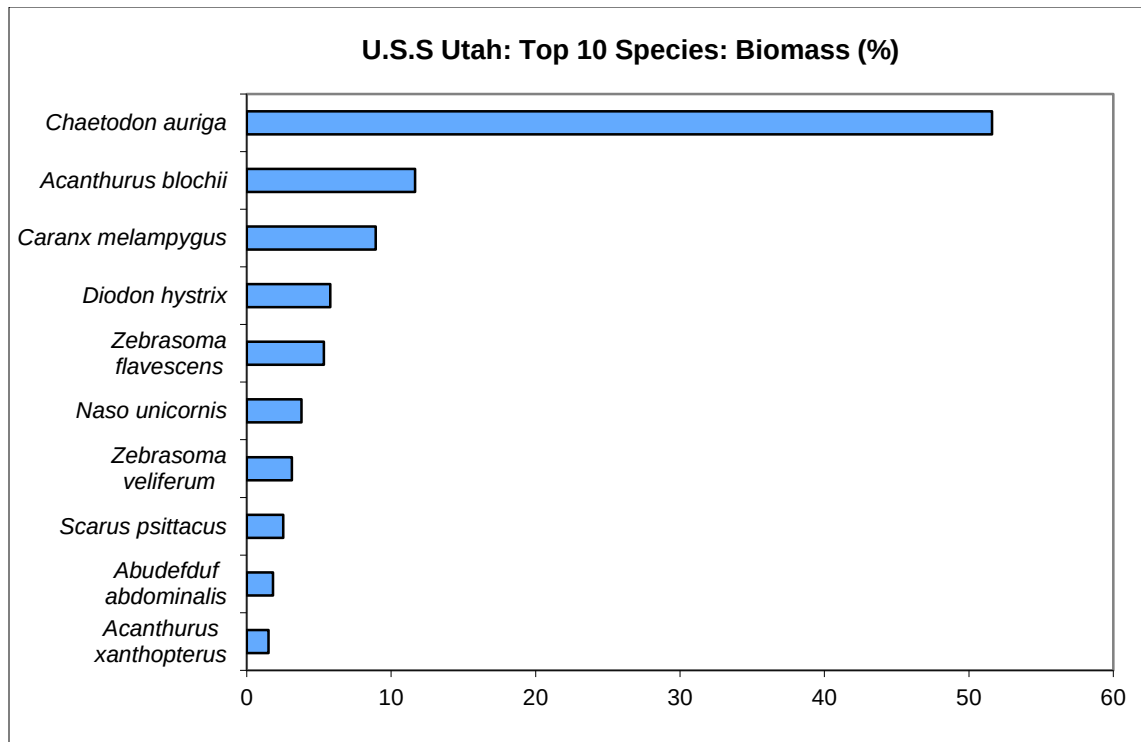


Figure 46. Top 10 species with the greatest mean biomass (%).

Families of Fishes

Acanthuridae is the most numerically dominant fish family found on the USS Utah making up 49.9% of the individual fish (Figure 47, Table 16). This family is represented by five species, but the majority of the individuals are *A. xanthopterus* making up 79.9%. Pomacentridae makes up a significant proportion of the individuals (16.4%) which is driven almost exclusively by *A. abdominalis*. The Scaridae family also had a relatively high numerical abundance consisting of 15.9% of the individuals at this location and is made up of only *S. psittacus*. These top families are similar to the state rankings except Acanthuridae and Pomacentridae are reversed. Neither Labridae nor Balistidae, which are both in the top ten listing of numerically abundant families statewide, were found on the USS Utah.

All families appearing in the top ten most numerically abundant are also ranked in the state top ten by biomass. Acanthuridae has the highest biomass of any family with 68.5% which reflects statewide data (Figure 48, Table 16). Similar to numerical abundance, biomass of Acanthuridae is primarily driven by *A. xanthopterus* constituting 75.5%. The second and third families with the highest biomass are Pomacentridae and Scaridae, comprising 11.9% and 8.9% respectively.

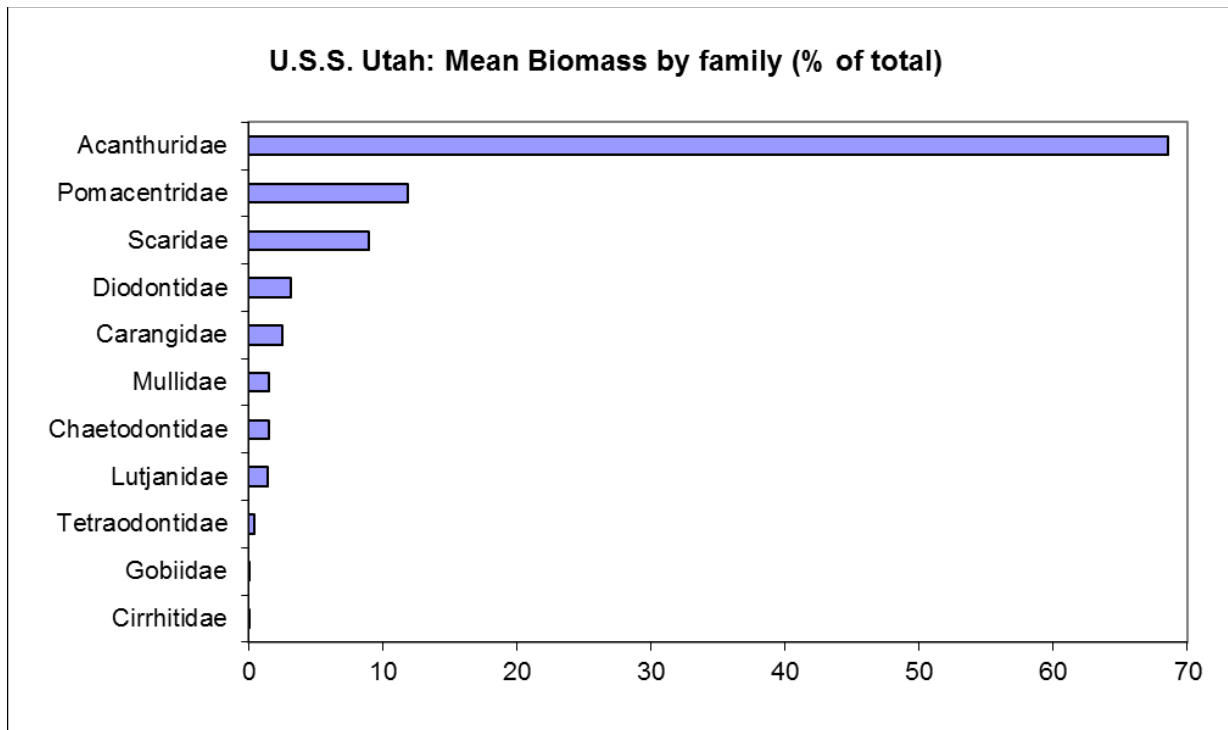


Figure 47. Top 10 fish families with the highest abundance (mean number of individuals (% of total)).

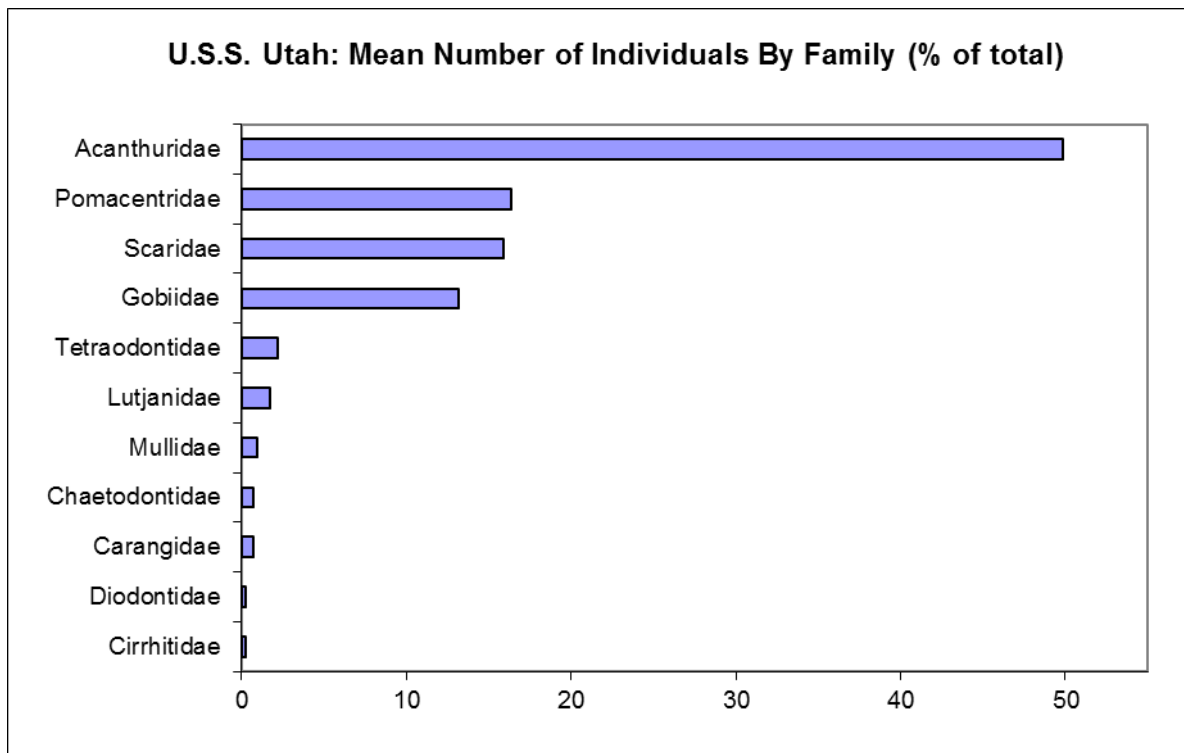


Figure 48. Top 10 fish families with the greatest mean biomass (% of total). Values for Gobiidae and Cirrhitidae are not visible because they are too small; the values are 0.05 and 0.02 respectively.

Table 16. Top ten fish families with the greatest mean biomass (t/ha) and density (mean number of individuals (ha x 1000)) and standard deviations are shown in descending order.

Family	mean biomass (t/ha)		Family	mean number (ha x 1000)	
	mean	SD		mean	SD
Acanthuridae	2.16E-02	5.16E-02	Acanthuridae	3.26E-01	6.86E-01
Pomacentridae	3.74E-03	1.17E-02	Pomacentridae	1.07E-01	2.83E-01
Scaridae	2.82E-03	8.86E-03	Scaridae	1.04E-01	2.55E-01
Diodontidae	9.89E-04	6.99E-03	Gobiidae	8.64E-02	1.61E-01
Carangidae	7.99E-04	3.60E-03	Tetraodontidae	1.44E-02	3.50E-02
Mullidae	4.78E-04	2.04E-03	Lutjanidae	1.12E-02	3.96E-02
Chaetodontidae	4.77E-04	2.06E-03	Mullidae	6.40E-03	2.19E-02
Lutjanidae	4.46E-04	1.55E-03	Carangidae	4.80E-03	1.92E-02
Tetraodontidae	1.42E-04	3.96E-04	Chaetodontidae	4.80E-03	1.92E-02
Gobiidae	1.62E-05	3.59E-05	Cirrhitidae	1.60E-03	1.13E-02

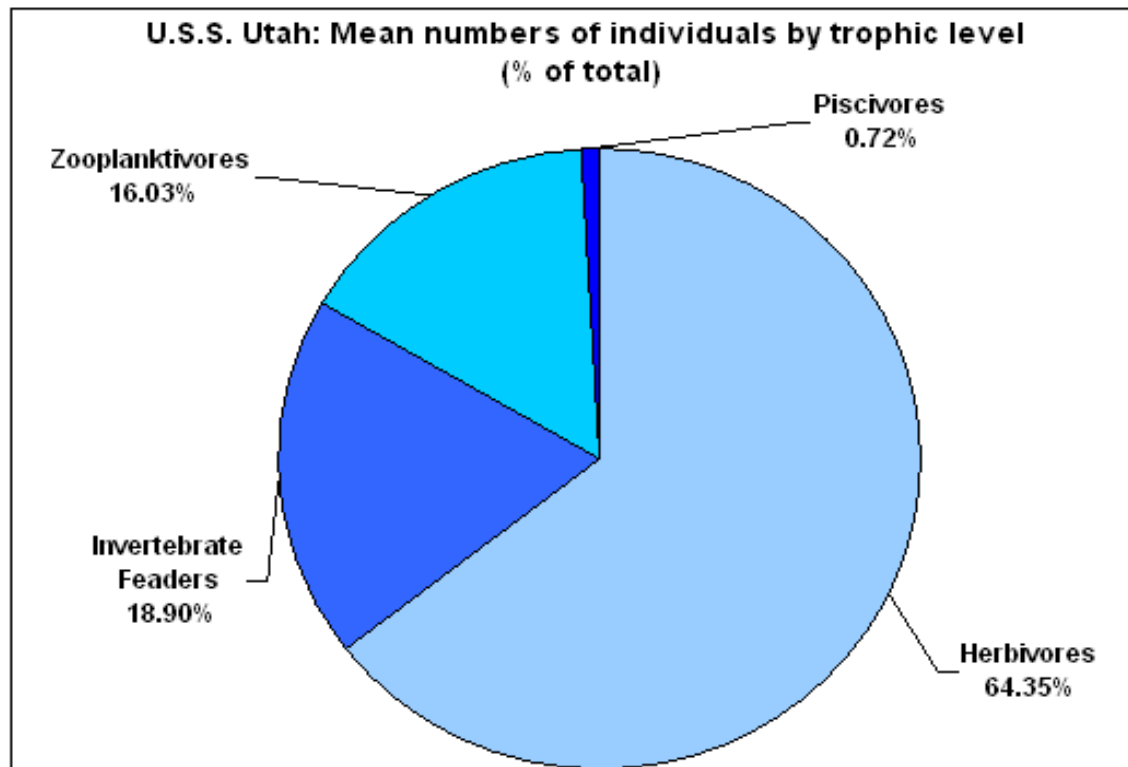


Figure 49. Numeric abundance (% of total) by trophic levels.

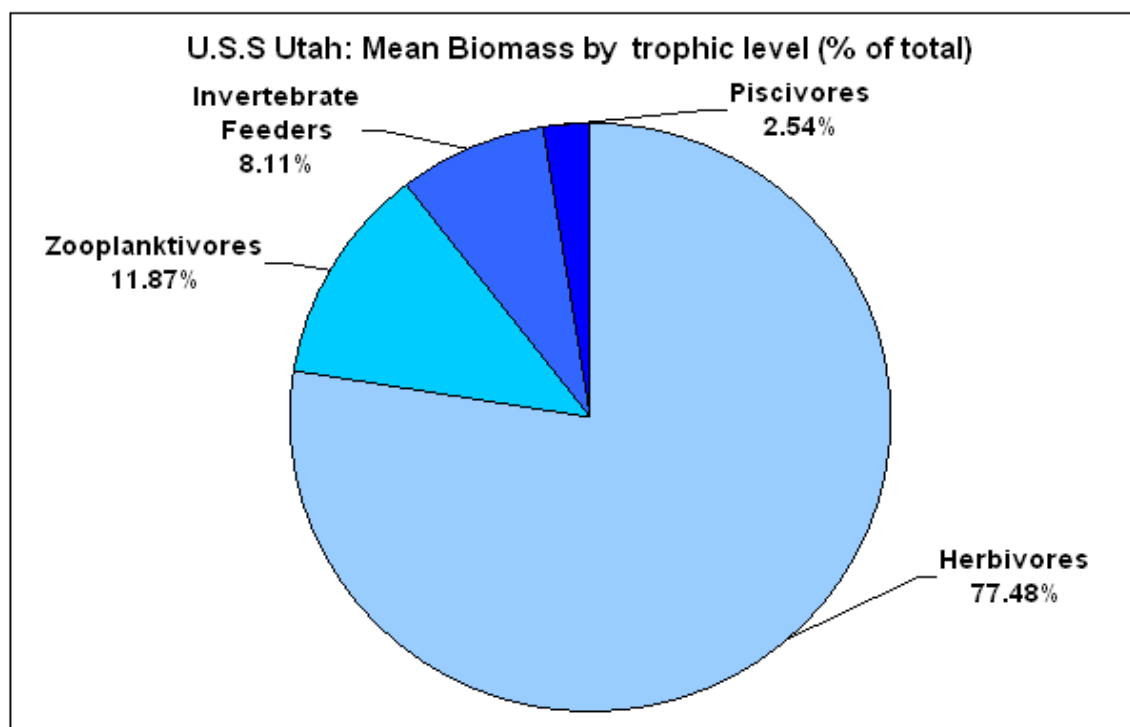


Figure 50. Mean biomass (% of total) by trophic levels.

Table 17. Mean biomass (t/ha) and density (mean number of individuals hax1000) by trophic levels and their standard deviations are shown in descending order.

Mean numbers of individuals by trophic level (hax1000)			Mean biomass by trophic level (t/ha)		
Trophic level	Mean	SD	Trophic level	Mean	SD
Herbivores	0.430	0.785	Herbivores	0.024	0.053
Invertebrate Feeders	0.126	0.175	Zooplanktivores	0.004	0.012
Zooplanktivores	0.107	0.283	Invertebrate Feeders	0.003	0.008
Piscivores	0.005	0.019	Piscivores	0.001	0.004

Trophic levels

Much like the statewide data from the Main Hawaiian Islands, the USS Utah has a large abundance of herbivorous fishes both numerically and in terms of biomass, while having very few piscivores. Piscivores make up 0.7% of the biomass and 2.5% of the individuals, which are solely represented by three *Caranx melampygus* (Figures 49 and 50, Table 17). Zooplanktivores and invertebrate feeders make up 11.9% and 8.1% of the biomass respectively, however these trophic groups represent larger portions of the number of individuals with 16.0% and 18.9%. The significant change in invertebrate feeders is mainly due to Gobiidae individuals that make up 12.9% of the fish but only 0.05% of the biomass on the entire ship. Gobiidae makes up 69.2% of the invertebrate feeder individuals but the biomass is driven by *Diodon hystrix* (Hawaiian name *kōkala*, common name porcupine fish) (38.9%), *Chaetodon auriga* (Hawaiian name *kīkākāpu*, common name threadfin butterflyfish) (18.7%), and *L. fulvus* (17.5%). The zooplanktivores are

comprised almost entirely of *A. abdominalis* comprising 98.5% of the biomass and number of individuals.

Herbivorous fishes comprise 77.5% of the total biomass and 64.5% of the individuals. The herbivorous fishes are largely composed by *A. xanthopterus* which makes up 66.8% of the biomass and 59.8% of the individuals.

Endemic status

The endemic fish population on the USS Utah is responsible for 12.8% of the biomass and 16.5% of the individuals (Figure 51, Table 18). The biomass is representative of statewide averages but the numerical abundance is less than the state's 22.9% average. There are four different endemic fish species found on the ship: *A. abdominalis*, *Dascyllus albisella* (Hawaiian name *ālo'ilo'i*, common name Hawaiian dascyllus), *P. porphyreus*, *Upeneus taeniopterus* (Hawaiian name *weke pueo*, common name nightmare goatfish). The bulk of the endemic fish population consists of *A. abdominalis* with 91.2% of the biomass and 95.7% of the individuals.

L. fulvus is the only species of non-native fish on the USS Utah with a small portion of both biomass and numerical abundance (1.4% and 1.7% respectively). The majority of the fishes are classified as indigenous, found here in Hawai'i as well as other places in the Pacific and make up 85.8% of the biomass and 81.8% of individuals. *A. xanthopterus* have the highest biomass and numerical abundance of the indigenous fish population with 60.4% and 47.1% respectively.

Size classes

The highest biomass (62.9%) is found in the largest size group (>15 cm) but is made up of relatively few fish (29.9%) (Figure 52). The opposite effect is found in the small and medium size classes, with higher numerical abundance and lower biomass. The large fish population is driven by *A. xanthopterus* which makes up 65.7% of the biomass and 78.4% of the individuals. The medium size class has the highest numerical abundance with 56.2 % of the individuals and makes up 36.9% of the biomass. Three species comprise the majority of the medium size class: *A. abdominalis* (31.6% of the biomass and 26.8% of individuals), *A. xanthopterus* (28.2% of the biomass and 26.8% of individuals), and *S. psittacus* (24.2% of the biomass and 27.7% of the individuals). The small size class was almost entirely made up of small *Gobiidae* species.

Depth Ranges

The sites on the USS Utah ranged in depth from 0.61 m to 11.89 m. Similar to the USS Arizona, the general trend was higher biomass and more individuals in the shallower waters and decreased populations as depth increased (Figure 53). Although, almost half (49.3%) the sites were considered deep sites (>6 m) they only contained 8.5% of the biomass and 10.5% of the individuals for all of the USS Utah. On the other end, the shallow sites only constituted 21.9% of the survey points but are where 53.5% of all the biomass and 51.9% of the individuals occurred.

Spatial Complexity and Richness

As with the USS Arizona, one of the contributing factors for higher fish metrics in shallower areas is the much greater spatial complexity on the horizontal portion of the USS Utah.

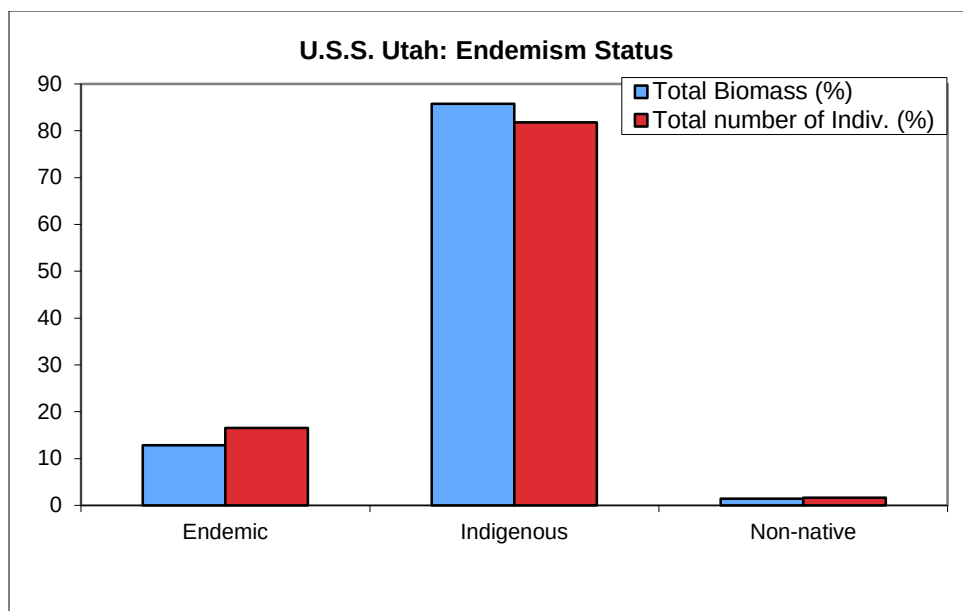


Figure 51. Biomass (%) and number of individuals (%) by endemic status.

Table 18. Mean biomass (t/ha) and mean number of individuals (ha x 1000) by endemic status.

Origin	mean biomass (t/ha)	SD	mean numbers of individuals (hax1000)	SD
Endemic	0.012	0.017	324.71	395.44
Indigenous	0.014	0.025	294.19	414.38
Non-native	0.056	0.001	140.00	40.00

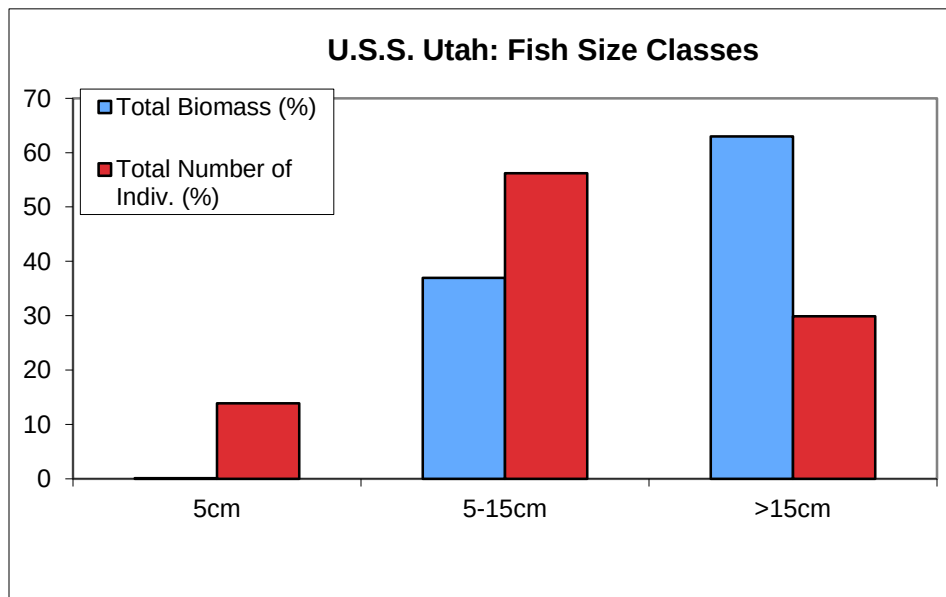


Figure 52. Size classes of fishes by biomass (% of total) and abundance (% of total). The total biomass for the small fish is not visible because of its small value of 0.08%.

The orientation of the USS Utah is such that there are two sides exposed to the environment, the vertical starboard and the horizontal deck. Thus both the port and starboard surfaces of the ship have deep and shallow survey points. The port (deck) surface has significantly more spatial complexity from the remaining superstructure of the ship explaining greater number of species or richness at those sites (Figure 54). There were also more survey points that had no fish on the starboard surface (40.0%) than on the port surface with higher and more complex topographic relief (23.8%).

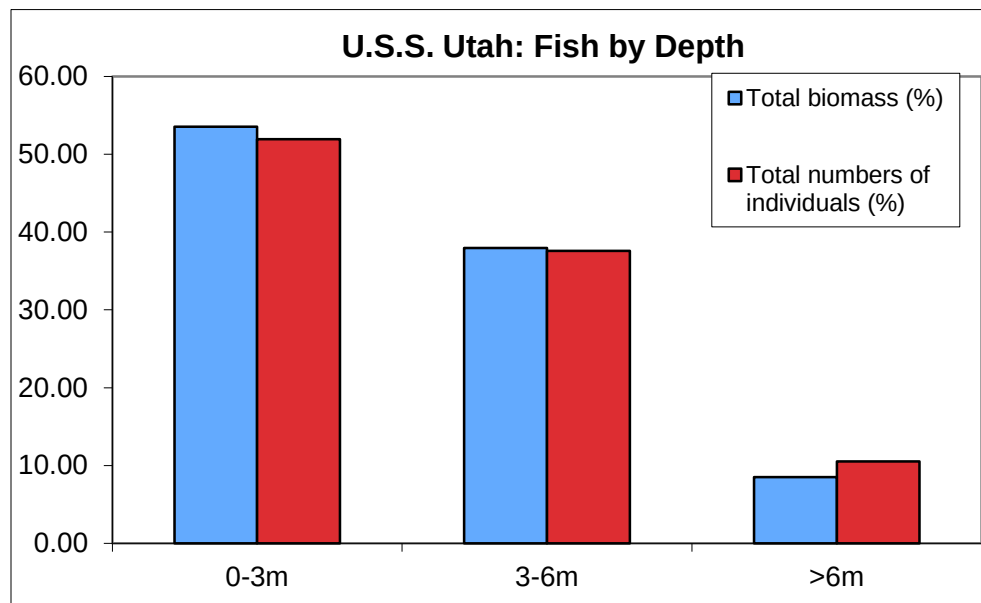


Figure 53. Summary statistics by depth.

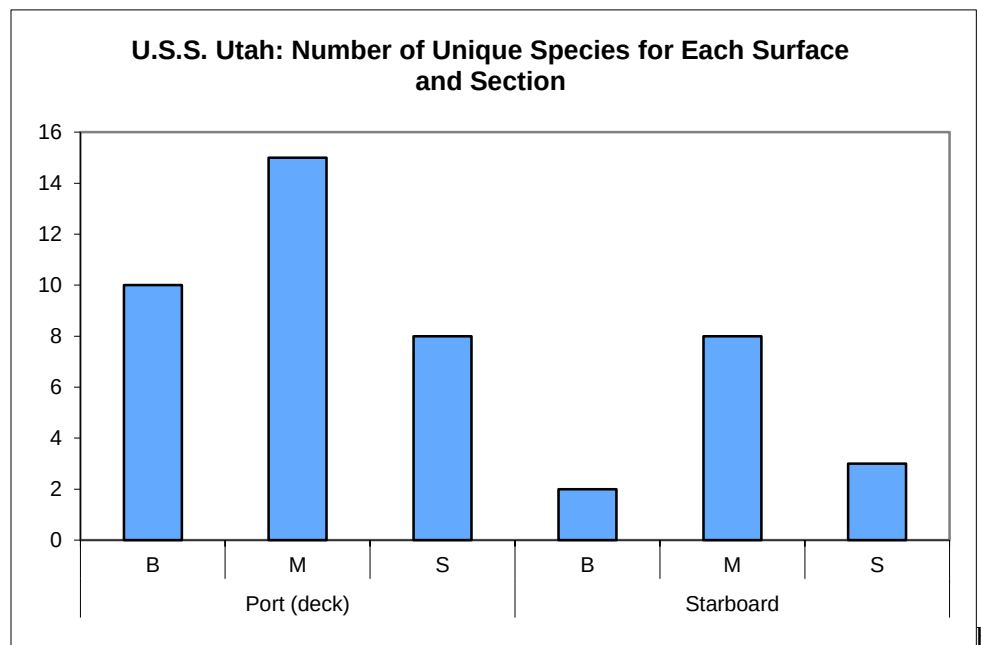


Figure 54. Differences in species richness in different sections and surfaces of the ship.

Discussion

Previous Pearl Harbor Studies

The survey of the USS Arizona conducted in 1986 (Lenihan et al. 1990) recorded 20 invertebrate and 24 fish taxa, in comparison with two algae, 43 invertebrate (Table 19) and 21 fish taxa (Table 9) found in the present survey of the Arizona. Fifteen of the benthic invertebrates found in 1986 occurred in the present study, but surprisingly, only nine of the fishes were in common with the present findings, suggesting that the fish species occupying the ship may vary substantially in either the short or the long term. Approximately 35% of the invertebrates species found in both the 1986 and the present study are considered introduced or cryptogenic (Carlton and Eldredge 2009) while only one fish found only in the present study, *L. fulvus*, is introduced.

Although no other previous surveys of the USS Arizona other than the Lenihan et al. (1990) survey have been done, biological sampling in Pearl Harbor has been conducted for over a century, and the taxa that have been reported for all available sources are listed with their sources of information in Appendix E. An annotated bibliography for the written references of Appendix E and other references pertinent to Pearl Harbor is in Appendix F. Over 4185 reports of over 1115 genera or species are reported in these previous studies. Comprehensive surveys of the biota in Pearl Harbor in 1971-73 (Evans et al. 1974), 1996 (Coles et al. 1997), 1999 (Coles 2006), and 2008-2009 (Coles et al. 2009) provide an overview of the organisms living in the harbor through the last 40 years. Focused surveys on the USS Missouri (Brock 1997, Coles et al 1999) and the floating dry-dock USS Machinist (DeFelice et al. 1999) after they were brought to Pearl Harbor, and monitoring surveys in the vicinity of the Hawaiian Electric power station outfall (Brock 2007) provide additional information on the organisms resident on or near hard surfaces in East and Middle Lochs of the harbor. Of these studies, the most relevant to the present effort are from two surveys which included observations on the USS Utah in 1996 and 2008 (Coles et al 1997, 2009). The number of taxa found for these three studies (Table 20) show similar numbers for the two previous studies; mostly invertebrates and few algae or fishes. Invertebrate species richness and abundance in the present study were less than half in either previous study, primarily because the previous surveys involved collections of material, laboratory sorting and identification with verification by taxonomic experts, which budget limitations prohibited in the present study. By contrast, substantially more fishes were recorded for the present study, because of the greater field effort and more sites that were surveyed than was the case for the Coles et al. 1996 and 2009 studies, which were limited to one survey at each sampling site by an observer who was responsible for identification of all the organisms that could be identified on site.

Sediments, Sediment Thickness, and Hull Biofouling

Both the USS Arizona and USS Utah have accumulated a thick layer of fine silt sediment on large level or near level areas of the ships' hulls. This fine silt has high levels of clay (up to 90%) and organic (up to 20%) components which are among the highest that have been determined for other nearshore locations in the Hawaiian Islands. Thickness of fine silt increases with depth on the decks of both ships and can be attributed to a continual rain of sediments from dredging, coastal construction, and terrestrial runoff into Pearl Harbor.

Sediment thickness was deepest (up to >120 cm) on the foredeck area of the Arizona that was most heavily damaged by the explosion that sunk the ship, and along the port side of deck of the

Utah (up to >200 cm) which lies partially buried in the silt. Elsewhere on the deck of the Arizona, silt grades into varying coverage and compositions of coarse sand and shells in the mid-ship areas, to thin biofouling on the stern. Biofouling of various thicknesses covers most of the vertical port and starboard surfaces of the Arizona and the starboard side of the Utah. Paired comparisons by site of data for sediment and minimum estimates for biofouling thickness measured in 1986 with the present survey found that both sediment and biofouling are less than in 1986, but mean differences are not significant. This suggests that biofouling is still providing a barrier against decomposition and breakup of the ship's hull, a major concern given that the ship still holds an estimated half million gallons of fuel oil. However, penetration by the pointed probe into the hull at one site on the port stern vertical surface during measurement of biofouling may indicate that the hull is weakening in some areas.

Benthic Communities

The surfaces of the USS Arizona and USS Utah have provided a habitat for the establishment of a rich cover of a variety of at least 45 taxa of benthic organisms dominated by sponges, principally *Mycale grandis*, *Biemna fistulosa*, and *Haliclona S. caerulea* (Table 19). Other frequently occurring organisms are the sabellid polychaetes *Sabellastarte spectabilis* and *Branchiomma* sp. The hoof-shell *Hipponix imbricatus* was intermittently abundant on the deck of the Utah, the alga *Dichotomaria marginata* on the mid-ship deck area of the Arizona where the surface was not covered with silt, and the bryozoan *Schizoporella* sp. cf. *errata* was often encountered on the vertical surfaces of both vessels. Sixteen (35%) of the total taxa identified are introduced or cryptogenic (i.e. of uncertain geographic origin) species (Carlton and Eldredge 2009), similar to the percent of total taxa found by the 1986 USS Arizona survey (Lenihan et al. 1990) and the 32% value found for the 2007-2008 more extensive survey throughout Pearl Harbor (Coles et al. 2009), but more than the 22% value estimated for the previous survey in 1996 (Coles et al. 1997, 1999). Hard corals that were not found in the 1986 survey on the USS Arizona now occur on both horizontal and vertical surfaces on both vessels and are abundant on the stern deck of the USS Arizona.

Frequency of occurrence and coverage of benthic organisms varies with location on horizontal and vertical surfaces on both vessels and is generally negatively associated with silt or sand/shell cover. Live benthos taxa frequency and cover decreased going from stern to bow on the USS Arizona and with depth on the port and starboard vertical surfaces. Although fewer total taxa and lower frequencies occurred on the USS Utah than on the USS Arizona (Table 20) similar zonation patterns in frequencies and cover of live benthos were found with silt cover and depth on the USS Utah. However, since the entire port side of the hull and much of the port side of the deck are buried in deep silt, the Utah provides less surface available for settlement and growth of benthic organisms than the Arizona.

The introduced orange keyhole sponge, *Mycale grandis*, which was first detected in Hawai'i on the 1996 survey of Pearl Harbor (Coles 1997, 1999) and is considered invasive in Kāne'ohe Bay (Coles and Bolick 2007), was the most frequently occurring benthic organism, with the highest overall cover on both vessels. This sponge also has been found to have similar invasive overgrowth on reefs of *Porites compressa* corals recently discovered in West Loch (Coles et al. 2009). Other dominant invertebrates by cover were the sponge *Haliclona (S.) caerulea* and the tubeworms *Sabellastarte spectabilis* and *Branchiomma* sp., the latter was prominent on

Table 19. Taxa found on the USS Arizona in Lenihan et al. (1990) compared with taxa in 2010-11.

PHYLUM	FAMILY	SPECIES	1986	2010-11
RHODOPHYTA	RHODOMELACEAE	<i>Acanthophora spicifera</i>		x
	GALAXAURACEAE	<i>Dichotomaria marginata</i> (=Galaxaura sp.) Unidentified blue-green, green, red algae and diatoms	x	x
PORIFERA	SUBERITIDAE	<i>Suberites auranticus</i> (=Terpios zeteki)		x
	RASPAILIIDAE	<i>Raspailia</i> sp. (Black Knobby)		x
	CRAMBIDAE	<i>Monanchora clathrata</i>		x
	TEDANIIDAE	<i>Tedania ignis</i>		x
	DESMACELLIDAE	<i>Biemna fistulosa</i>		x
		<i>Iotrochota purpurea</i>		x
	MYCALIDAE	<i>Mycale grandis</i> (=Mycale armata)		x
		<i>Mycale</i> sp.		x
	CALLYSPONGIIDAE	<i>Callyspongia</i> (<i>Callyspongia</i>) sp.		x
	NIPHATIDAE	<i>Gelliodes fibrosa</i>		x
	CHALINIDAE	<i>Haliclona</i> sp. (Black branching)		x
		<i>Haliclona</i> S. <i>caerulea</i> (=Sigmadocia caerulea)		x
		Porifera sp. (Grey)		x
		Porifera sp. (Black)		x
		Porifera Unident. sp.		x
	DYSIDEIDAE	<i>Dysidea arenaria</i>		x
		Several encrusting and erect species	x	
CNIDARIA	HALOCORDYLIDAE	<i>Pennaria disticha</i>	x	x
	AIPTASIIDAE	<i>Aiptasia pulchella</i>	x	x
	TELESTIDAE	<i>Carijoa riisei</i> (as <i>Teleshop riisei</i>)	x	
	ACROPORIDAE	<i>Montipora capitata</i>		x
	POCILLOPORIDAE	<i>Pocillopora damicornis</i>		x
	PORITIDAE	<i>Porites compressa</i>		x
	PORITIDAE	<i>Porites lobata</i>		x
	FAVIIDAE	<i>Leptastrea purpurea</i>		x
MOLUSCA	OSTREIDAE	Ostreidae sp.	x	x
		<i>Dendostrea sandvicensis</i>		x
	ANOMIIDAE	<i>Anomia nobilis</i>		x
	ISOGNOMONIDAE	<i>Isognomon</i> sp.	x	x
	PTERIIDAE	<i>Pinctada margaritifera</i>		x
	PHOLADIDAE	<i>Martesia striata</i>	x	
	TEREDINIDAE	<i>Teredo</i> sp. (as <i>Teridinid</i> sp.)	x	
	HIPPONICIDAE	<i>Hipponix imbricatus</i>		x
	VERMETIDAE	<i>Vermetus alii</i> (=Eualetes tulipa)	x	x
	CHROMODORIDIDAE	<i>Hypselodoris infucata</i>		x
ARTHROPODA	BALANIDAE	<i>Balanus</i> spp.	x	x
	CHTHAMALIDAE	<i>Chthamalus proteus</i>		x
	ALPHEIDAE	<i>Alpheus</i> sp. burrows	x	x
	SQUILLIDAE	<i>Squilla</i> sp.	x	
ANNELIDA	AMPHINOMIDAE	<i>Eurythoe complanata</i>		x
	SABELLIDAE	<i>Branchiomma</i> sp.	x	x
		<i>Sabellastarte spectabilis</i>	x	x
	SERPULIDAE	<i>Salmacina dysteri</i> <i>Hydroides</i> sp.	x x	x x

Table 19. Taxa found on the USS Arizona in Lenihan et al. (1990) compared with taxa in 2010-11 (Continued).

PHYLUM	FAMILY	SPECIES	1986	2010-11
ECTOPROCTA	CLEIDOCHASMATIDAE	<i>Diaperoforma</i> sp.		x
	SCHIZOPORELLIDAE	<i>Schizoporella</i> cf. <i>errata</i>	x	x
ECHINODERMATA	SYNAPTIDAE	<i>Opheodesoma spectabilis</i>		x
		Unidentified. Colonial tunicates, cf.		
CHORDATA	DIDEMNIDAE	<i>Didemnum</i> sp.	x	x
		Unidentified. Solitary tunicates, e.g.		
	ASCIDIIDAE	<i>Phallusia</i> sp	x	x
		Total Taxa	20	45

Table 20. Numbers of taxa found for three surveys on the USS Utah.

Study	Coles et. al. 1996	Coles et al. 2009	Present
Algae	0	2	1
Invertebrates	63	59	31
Fish	1	6	18
Total	63	67	50

the Arizona, particularly at port vertical mid-depth locations where its cover ranged up to 41%. This tubeworm was the most abundant organism reported on the Arizona for the 1986 survey (Lenihan et al. 1990), where it was listed for all of the 62 vertical sites as present to abundant with cover up to 75-80% for seven sites, and at 15 of the 55 horizontal sites with one having cover of 70%. It appears to be a less prominent component of the benthos now, perhaps because of food limitations due to less suspended organic material available in Pearl Harbor water.

Coral Surveys

Probably the most significant finding of the present study is the presence of a thriving and relatively abundant community of hard corals on both the USS Arizona and USS Utah. No corals were observed on the previous 1986 survey, nor were any found at 10 locations in Pearl Harbor's main channel, East and Middle Lochs and into West Loch during extensive baseline surveys in 1971-73. From that study Grovhoug (in Evans et al 1974) noted that "stony corals were conspicuously absent...". About 20 years later Brock (1994) reported small colonies of *Leptastrea purpurea* corals from the west shore of Ford Island in 1993, and (Coles et al. 1997, 1999a) found five coral species at eight locations throughout East Loch and at the entrance to West Loch. All colonies found were small, suggesting them to be less than 5 years old. Later, Smith (2002) reported eight coral species occurring at five of the Evans (1974) sites and eleven species from a 2005 survey throughout the perimeter of much of the harbor (Smith et al. 2006). The most recent survey in Pearl Harbor in 2007-2008 (Coles et al. 2009) found corals at four of the sites previously surveyed in 1996, including the USS Utah, where none had previously been reported. Moreover, extensive snorkeling surveys done as part of the 2008-9 study showed small corals, especially *Pocillopora damicornis* and *Leptastrea purpurea*, to be intermittently abundant along the both sides of the entrance channel, along the east sides of Waiawa and Waipi'o Peninsulas and the northwest shore of Ford Island. Four large *Porites compressa* reefs were

found well into West Loch as part of that study that indicated that this hardy species had been in Pearl Harbor for much longer than previously assumed (Coles et al. 2009).

Coral growing on the USS Arizona has recently been reported in the local news media (Kakesako 2009), but the present study is the first to quantify colony abundance and size distributions for both the USS Arizona and Utah. A total of 637 corals were counted on the Arizona, and coverage was abundant and extensive, especially on the mid-ship deck area, with *Pocillopora damicornis* occurring at 58% of the 55 deck sites and 21% of the starboard or port vertical sites, and *Leptastrea purpurea* at 10% of the deck sites and 21% of the vertical sites. On the Utah only 60 corals were counted, with *Pocillopora damicornis* occurring at 17% of the deck sites and 10% of the starboard sites, and *Leptastrea purpurea* at 7% of the deck sites and 36% of the starboard vertical sites. *Pocillopora damicornis* ranged up to 40 cm in diameter on the deck and 15-20 cm diameter on the port or starboard sides of the Arizona, and up to 10 cm on the deck of the Utah. *Leptastrea purpurea* ranged up to 10 cm with a peak at 2-3 cm on the Utah's starboard side. Only three *Porites* colonies were found on the Arizona and two on the Utah, but those on the Utah ranged 20-50 cm in diameter, the largest corals found on the survey.

This development of a flourishing community of reef corals on the SS Arizona and Utah and elsewhere in Pearl Harbor in apparently the last 25 years suggests that water quality in the harbor has improved dramatically prior to or during that time, promoting the settlement and growth of organisms that are not favored by high sedimentation, turbidity, or organic/nutrient levels. Polluted conditions have been largely reduced with the removal of sewage effluents from the harbor and changes in naval operations (Grovhoug 1992). 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 (Grovhoug 1992) except for the Fort Kamehameha outfall that discharged treated sewage into the main channel near the harbor entrance until January 2005, when the point of discharge was moved outside of the harbor entrance to a depth of 45 m in Māmalala Bay. Sediment and pesticides from sugar cane production decreased through the years, ending in the 1990s, urbanization of hillsides of the East and Middle Loch watersheds are moderating as developments are completed, and better land management practices during construction have helped to alleviate surface runoff-related sedimentation. 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 found that water quality parameters were within state water quality standards, that there was no substantial difference between surface and bottom water oxygen concentrations, and that metal concentrations in sediments were significantly less than 1972 values for most metals (Grovhoug 1992).

Fish Surveys

Given that the USS Arizona and USS Utah are similar vessels sunken nearshore on the same day in a harbor subject to high sedimentation and high turbidity with limited circulation, it is not unexpected that they have similar fish assemblages occupying the habitat that is formed by the ships' structures. Numbers of fishes and biomasses on both ships (Table 21) are dominated by herbivores primarily composed of two species of acanthurids, *Acanthurus xanthopterus* and *A. blochii*, and by a single pomacentrid zooplanktivore, *Abudefduf abdominalis*. Carnivores made up of just two *Caranx* species are an even smaller percentage of the ships' fish numbers and biomass than is the case for the main Hawaiian Islands, where they have been depleted by

fishing. None of these species correspond with the statewide most numerically abundant species, probably due to the fact that statewide fish surveys focus on coral reef environment greatly contrasting with conditions in Pearl Harbor. The fish populations do resemble state ratios of endemism, and indigenous species, with only a single introduced species found on both ships, *Lutjanus fulvus*. On both vessels, numbers and biomass decreased with depth due to the lack of three dimensional structures on the ships' vertical surfaces.

The present study identified 21 species of fishes on the USS Arizona, compared with 25 that were reported for the 1986 surveys (Lenihan et al. 1990). Interestingly, there was little overlap in species composition, with only nine species reported in both 1986 and 2010. These were *Caranx melampygus*, *Mulloidichthys flavolineatus* (as *M. samoensis*), *Upeneus taeniopterus* (as *U. arge*), *Chaetodon auriga*, *Abudefduf abdominalis*, *Scarus* sp., *Acanthurus blochii* (as *A. mata*), *Acanthurus xanthopterus*, and *Zebrasoma veliferum*. No quantitative data are provided for the 1986 survey that could be used for further comparison, but it appears that there may have been a substantial shift in resident fishes on the USS Arizona in 25 years.

Table 21. Comparison of USS Arizona and USS Utah fish population parameters with Hawai'i statewide values (Rodgers 2005).

Mean species count	Species count SD	Mean number/ha x (1000)	Number/ha x (1000) SD	Mean Biomass (t/ha)	Biomass (t/ha) SD	Mean Diversity (H')	Diversity SD	Mean evenness
USS Arizona								
2.75	1.62	1.06	1.00	0.15	0.24	0.62	0.55	0.49
USS Utah								
2.14	1.62	0.67	0.86	0.03	0.06	0.44	0.50	0.41
Statewide								
16.91	6.75	9.82	7.91	0.60	1.28	1.94	0.59	0.70

The overall mean values and standard deviations for numbers of species, numbers of individuals, biomass diversity and evenness are compared for the vessels with statewide values in Table 21. Values for all parameters are lower for the Utah than for the Arizona, probably reflecting less structure and habitat that is provided by the Utah. All parameters for both vessels are well below statewide values, indicating that although both ships do provide habitat for fishes that would not be otherwise available in Pearl Harbor, the populations that have utilized this habitat are a small fraction of those occurring on open ocean reefs in Hawai'i.

Conclusions

The USS Arizona and USS Utah are among the most iconic monuments in the US National Park Service system, attracting more than 1.5 million visitors a year to the Arizona. The small portions of both vessels that are exposed above the waterline provide a mere hint of the ships' structures that are submerged and have provided a habitat for sessile and motile marine organisms for nearly 70 years. Two biological studies that the NPS has conducted or funded have provided baseline information through time of the organisms on the vessels that can be used to compare with future studies of the condition of the vessels and the organisms that reside on or near them.

Comparing the results of this study with those of the previous one in 1986 suggests that substantial changes in the marine community on the USS Arizona have occurred in the last 35 years. The fish community has apparently undergone a change in species composition that may be related to improved water quality from conditions of 35 years ago. The most remarkable change has been the development of an apparently thriving coral community on the ship, especially on the stern section of the deck. Some structures in this area are highly covered with coral, and settlement and growth appear to be proceeding rapidly. At the present rate of accumulation and continuation of present water quality conditions in Pearl Harbor, it is possible that large sections of the Arizona and the Utah may become largely encased in coral, which may require a decision of whether to allow coral accumulation to progress, or to do selective removal to maintain the structural integrity of the ships, especially the Arizona.

Another concern for the maintenance of the USS Arizona is whether the hull will continue to remain sufficiently intact so that it will not collapse to the point that the oil remaining in hull is released in a massive spill. A comprehensive review of measurements of the Arizona's hull (Murphy and Russell 2008, 2010) concluded that such collapse and massive release was not imminent. One factor that has been considered to prevent this is the coating by biofouling organisms that retard corrosion and oxidation of the metal hull and restriction of wood-boring organisms from the teak deck. Estimates of hull corrosion were not within the scope of this study, but observations and measurements of biofouling thickness suggest that the ship remains, for the most part, intact and is likely to be so for some time. Although there appears to have been a change in the character of the dominant fouling organisms from massive coverage of suspension feeding tubeworms to a complex assemblage of sponges and algae/silt, the hull remains covered by fouling organisms where they are not restricted by sediments of sand/shell rubble.

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Appendix A: Sediment Composition and Grain Sizes on the USS Arizona and the USS Utah

USS Arizona

Sediment composition

On the USS Arizona the sediment compositions on horizontal surfaces have analogous profiles that are dissimilar to those on the vertical surfaces (Figure A-1, Table A-1). The horizontal sediments have a large carbonate component (83.1-90.1%) and relatively small terrigenous and organic proportions. When compared to proportions of organic sediments statewide, the USS Arizona's horizontal surfaces (3-4%) are similar to 86% of locations in the main Hawaiian Islands (2- 5%) (Rodgers 2005). The vertical surfaces are characterized by higher terrigenous (34.9-66.3%) and organic (10.9-20.0%) components than the horizontal surfaces. This is comparable to statewide locations with high freshwater input and low water motion such as Kāneʻohe Bay, Oʻahu and Pelekane Bay, Hawaiʻi. On vertical surfaces there is also a slight composition difference between the sections on the side facing the waterway (port) and the sections facing Ford Island (starboard) (Figure A-1, Table 1.).

Principal components analysis using three variables including organic content, CaCO_3 , and terrigenous material at nine stations revealed three distinctive groupings and one outlier (Figure A-2). The nearer the stations are to one another in ordination space the more similar they are in sediment composition as a whole. The horizontal stations clearly group together on the left in Figure A-2, driven by low organics and high carbonate compared to vertical surfaces. The second grouping on the far right of the figure shows vertical port stations (VP) are similar due to high organics and terrigenous matter and low carbonate. The third grouping clusters between the other two. These include the vertical, starboard, mid-ship and bow (VSM, VSB). The vertical starboard stern (VSS) falls closer to the vertical port stations (VP) with high organics and low carbonate material.

Horizontal sediments were collected from the deck of the ship where an abundance of mollusk shells was the major contributor to the high carbonate percentages. Slightly higher carbonate fractions in the mid-ship section may be attributed to the higher coral cover and shallower depths with more spatial complexity where shells reside as compared to the bow and stern. Vertical sediments with higher levels of organics were all collected on the benthos where sediment and detritus settle at deeper depths.

Sediment Grain Size

Grain-size characteristics were determined from the same samples collected for composition using the same delineations by vertical and horizontal surfaces, with further division by direction (starboard, port) and ship section (bow, mid-ship, stern) (Figure A-3, Table A-2). The horizontal sediments are comprised primarily of coarse sediments that make up an average of 62.7% of the total. This is in concert with the carbonate composition also due to a large percentage of shells and shallower depths on the horizontal surfaces. Both vertical surfaces have sediment that is driven by the silt/clay component which averages 89% on the port side and 80% on the starboard side. The starboard side of the ship is more sheltered from channel dynamics than the port side where fine grain sediments are deposited and re-suspended. These locations have extremely high

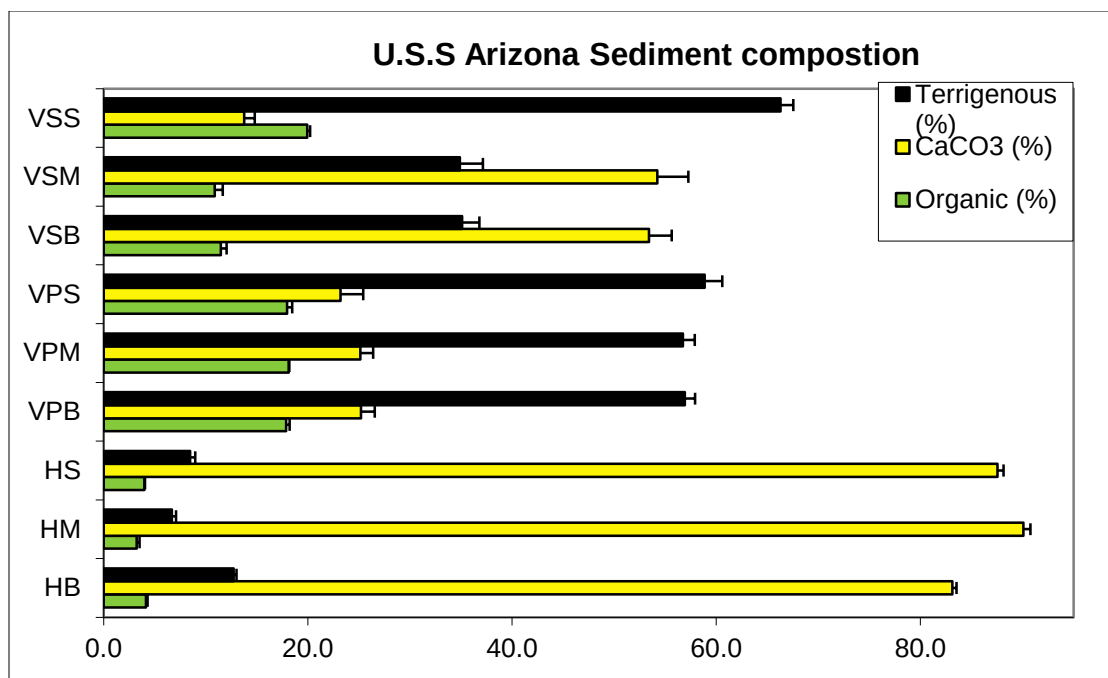


Figure A-1. Sediment composition (%) at locations on the U.S.S Arizona with standard deviations. Location abbreviations: first letter represents surface (vertical or horizontal), for vertical surfaces second letter signifies the side of the ship (starboard/port) and the last letter denotes the section of the ship (bow, mid-ship or stern) sediments were collected.

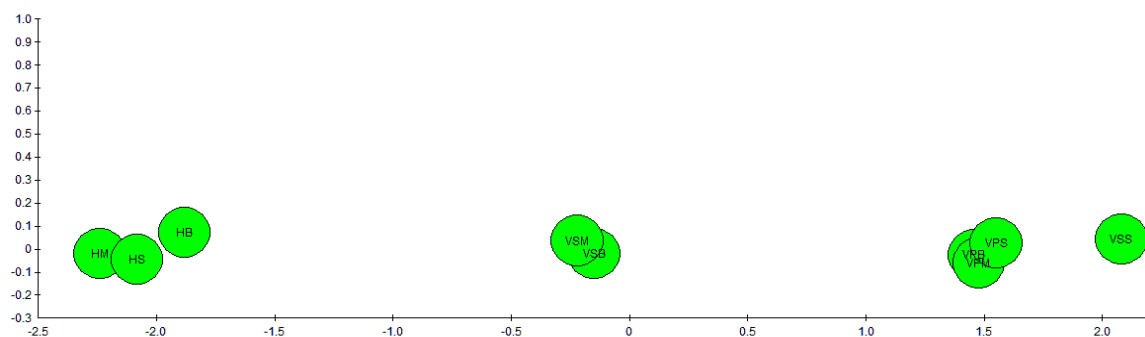


Figure A-2. Principal Components Analysis (PCA). Location abbreviations: first letter represents surface (vertical or horizontal), for vertical surfaces second letter signifies the side of the ship (starboard/port) and the last letter denotes the section of the ship (bow, mid-ship or stern) sediments were collected.

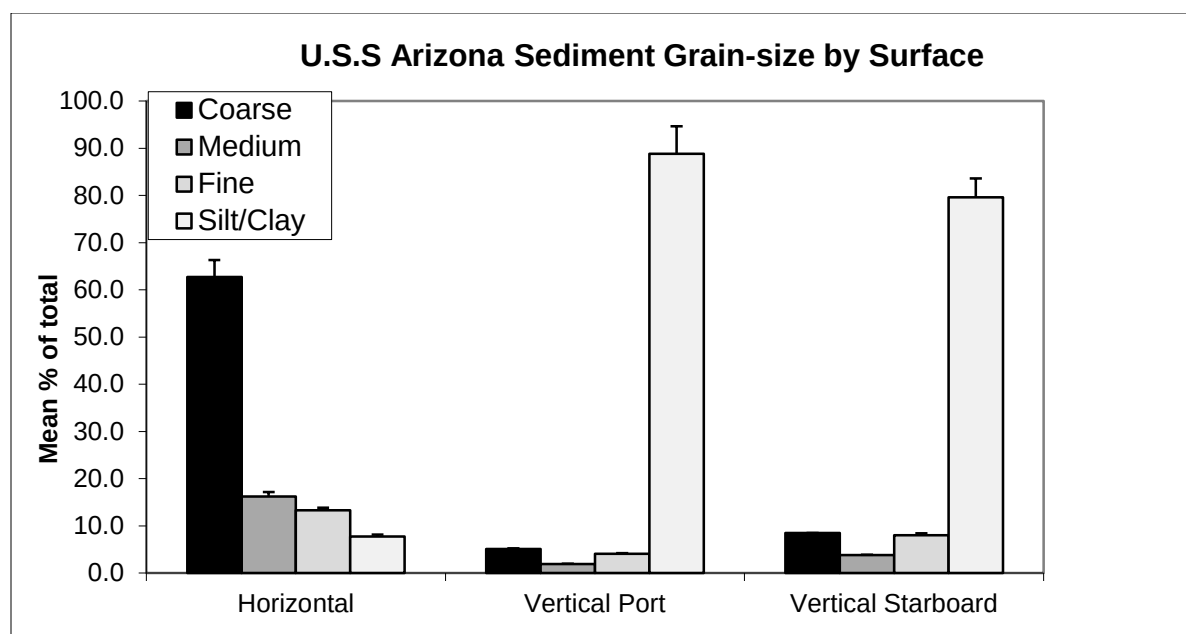


Figure A-3. Sediment grain-size at locations on the USS Arizona. Location abbreviations: first letter represents surface (vertical or horizontal), for vertical surfaces second letter signifies the side of the ship (starboard/port) and the last letter denotes the section of the ship (bow, mid-ship or stern) sediments were collected.

Table A-1. Sediment composition summary for nine stations on the USS Arizona. Location abbreviations: first letter represents surface (vertical or horizontal), for vertical surfaces second letter signifies the side of the ship (starboard/port) and the last letter denotes the section of the ship (bow, mid-ship or stern).

Location	Organic (%)	SD	CaCO ₃ (%)	SD	Terrigenous (%)	SD
HB	4.1	0.1	83.1	0.4	12.7	0.3
HM	3.2	0.3	90.1	0.7	6.7	0.4
HS	4.0	0.1	87.5	0.6	8.5	0.5
VPB	17.9	0.3	25.2	1.3	56.9	1.0
VPM	18.1	0.1	25.1	1.2	56.7	1.2
VPS	18.0	0.5	23.2	2.2	58.9	1.7
VSB	11.5	0.6	53.4	2.2	35.1	1.7
VSM	10.9	0.8	54.2	3.0	34.9	2.3
VSS	20.0	0.3	13.8	1.0	66.3	1.3

Table A-2. Sediment grain-size summary for nine stations on the USS Arizona. Location abbreviations: first letter represents surface (vertical or horizontal), for vertical surfaces second letter signifies the side of the ship (starboard/port) and the last letter denotes the section of the ship (bow, mid-ship or stern).

Location	Coarse and very coarse sand	SD	Medium sand	SD	Fine and very sand	SD	Silt/clay	SD
HB	67.5	5.8	18.4	2.4	10.1	1.3	4.1	0.3
HM	61.2	0.6	12.7	0.0	14.8	0.0	11.3	0.2
HS	59.5	4.3	17.5	0.5	15.1	0.3	7.9	0.8
VPB	3.6	0.1	1.1	0.0	2.8	0.1	92.5	3.5
VPM	7.1	0.0	3.3	0.1	5.6	0.2	84.0	11.0
VPS	4.6	0.2	1.4	0.0	3.9	0.1	90.1	2.8
VSB	12.6	0.1	5.7	0.0	15.3	0.9	66.3	4.2
VSM	12.2	0.0	5.3	0.0	6.5	0.1	76.0	0.6
VSS	0.6	0.0	0.5	0.0	2.3	0.1	96.5	7.1

silt/clay components when compared to Coral Reef Assessment and Monitoring Program (CRAMP) locations throughout the main Hawaiian Islands using identical methodology. 80% of CRAMP locations have sediments with only 1-2% of the silt/clay fraction (Rodgers 2005). The locations with high levels of silt and clay are Kāneʻohe Bay (41-63%), Oʻahu and Pelekane Bay, Hawaiʻi (51%). These upper statewide levels are considerably lower than the levels of fine grain sediment at the vertical stations on the USS Arizona (66-97%). This is likely due to the poor circulation, high water residency times, and re-suspension of sediments by passing boat traffic. Similar to Kāneʻohe and Pelekane Bays, Pearl Harbor has a history of past dredging, coastal construction, and terrigenous input which creates fine grained mud.

USS Utah

Sediment Composition

All the USS Utah sample sites are characterized by high organic proportions (7-20%) (Figure A-4, Table A-3) similar to the vertical stations on the USS Arizona (11-20%). This is high relative to statewide numbers of which 86% of locations have only 2-5% organic sediment (Rodgers 2005). Statewide locations with comparable organic fractions include Kāneʻohe Bay, Oʻahu, Hakioawa, Kahoʻolawe, Pelekane Bay, Hawaiʻi and Kakahaiʻa, Molokaʻi (7% to 24%). These four locations exhibit the highest organic values among the 91 stations from 50 locations throughout the state. Both port (deck) and starboard locations show relatively high CaCO₃ percent values, intermediate between the horizontal and vertical values found for the USS Arizona.

Sediment Grain-size

Similar contrasts were found with grain-size at all USS Utah stations. These stations are characterized by high silt/clay percentages (32-86%) that make this location atypical of the majority of sites statewide (Figure A-5, Table A-4.).

The only pattern emerging is that the silt/clay component is higher in the deeper sections of the ship than the shallower sections that conversely have a larger coarse sediment element. This is similar to the USS Arizona where deeper vertical surfaces have finer grain-sizes. Unlike the USS Arizona, stronger patterns were not observed in part due to the orientation of the ship lying on its side with no contrasting horizontal surface sediments. No visible differences between the starboard and port sides of the ship were observed (Figure A-6). This may be due to the difference in location with the USS Utah located further within the harbor and with the limited boat traffic which minimizes water motion and re-suspension of sediments. Similar to Pearl Harbor, statewide locations with the largest proportion of organics and fine grain-size have been heavily impacted by chronic disturbances from sedimentation. Terrigenous organics are derived from land-based biotic material contributed through runoff. Kahoʻolawe has a history of sediment loading due to vegetation removal from feral goats and bombing target practice (Te 2001). Sediment samples from Hakioawa, Kahoʻolawe have a high percentage of fine grain particles and organic material, reflecting its past history of terrestrial sediment loading influenced by topography, vegetative cover and soil composition. Contributory anthropogenic stress factors such as sewage discharge and urbanization are not present at this location as they are at the other heavily sedimented locations throughout the state. South Molokaʻi also has a long history of vegetation loss due to overgrazing (Roberts 2000). Pelekane and Kāneʻohe Bays

have limited circulation allowing accumulation and re-suspension of sediments. Kāneʻohe Bay has an extensive history of dredging and sewage discharge with considerable urbanization in the surrounding watershed (Jokiel et al. 1991). The main source of terrigenous materials into Pelekane Bay is through Luahine Gulch. Kawaihae harbor, adjacent to Pelekane Bay, has had extensive harbor development and modification that has interrupted long-shore sediment transport. These locations represent the regions in the State of Hawaiʻi most similar to Pearl Harbor with high levels of organic matter and fine grain materials. Pearl Harbor has experienced a similar historical past of degradation through dredging, coastal construction, terrestrial runoff, and marine pollution.

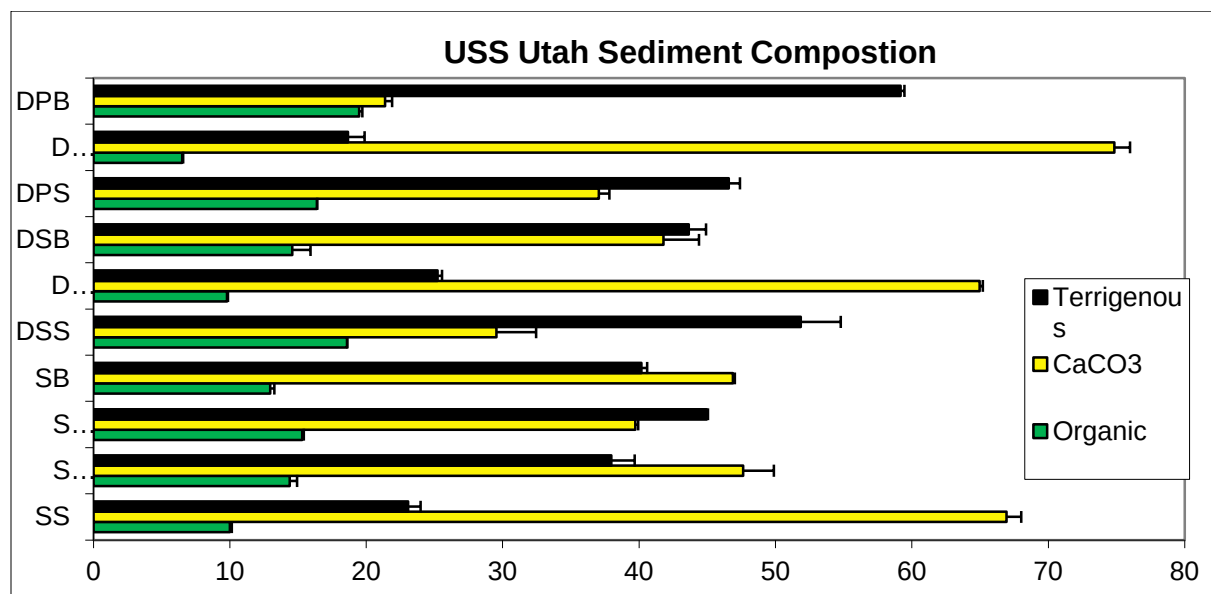


Figure A-4. Sediment composition (%) averages with standard deviations at locations on the USS Utah. Location abbreviations: first letter represents surface (vertical or horizontal), for vertical surfaces second letter signifies the side of the ship (starboard/port) and the last letter denotes the section of the ship (bow, mid-ship or stern) sediments were collected.

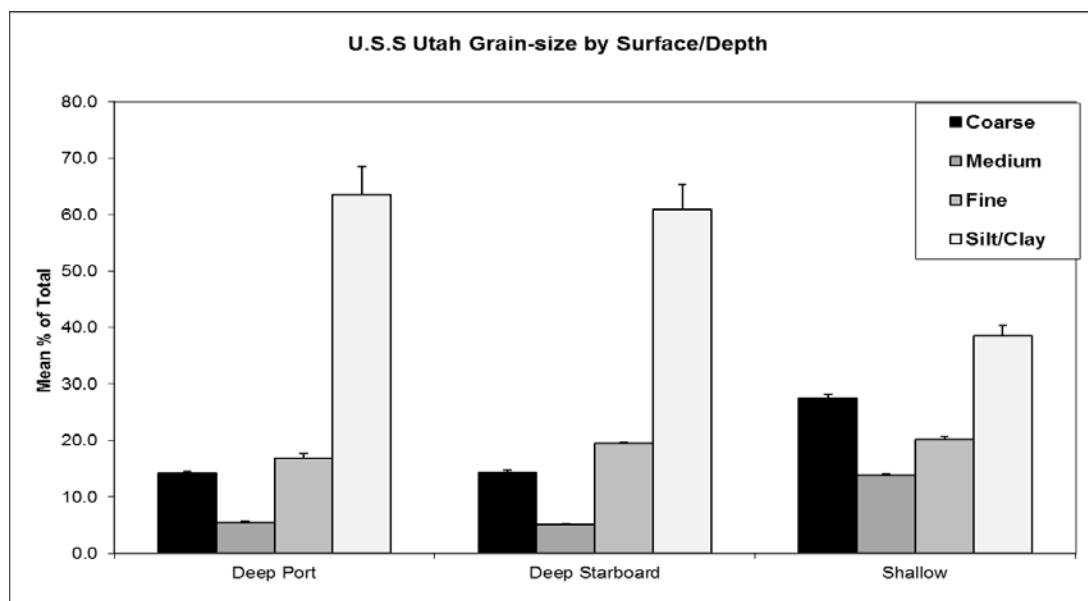


Figure A-5. Sediment grain-size at locations on the USS Utah.

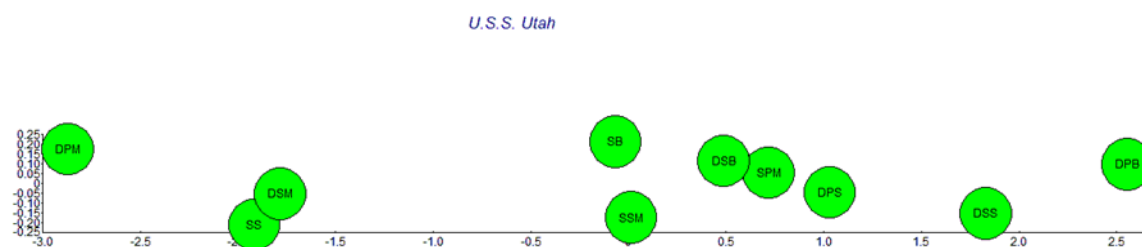


Figure A-6. Principal Components Analysis (PCA). Location abbreviations: first letter represents depth (deep or shallow), second letter signifies the side of the ship (starboard/port) and the last letter denotes the section of the ship (bow, mid-ship or stern) where sediments were collected. Locations with only two letters symbolize depth and section.

Table A-3. USS Utah sediment composition summary. Station abbreviations: first letter denotes depth (deep or shallow) the second letter represents the side of the ship (starboard or port) and the last letter depicts the section (bow, mid-ship or stern). Locations with only two letters symbolize depth and section.

Location	Organic (%)	SD	CaCO ₃ (%)	SD	Terrigenous (%)	SD
DPB	19.5	0.2	21.4	0.5	59.2	0.3
DPM	6.5	0.1	74.8	1.2	18.7	1.2
DPS	16.4	0.0	37.0	0.8	46.6	0.8
SB	13.0	0.3	46.9	0.1	40.2	0.4
SPM	15.3	0.1	39.7	0.2	45.0	0.1
SSM	14.4	0.5	47.6	2.2	38.0	1.7
SS	10.0	0.1	66.9	1.1	23.1	0.9
DSB	14.6	1.3	41.8	2.6	43.6	1.3
DSM	9.8	0.1	65.0	0.2	25.2	0.3
DSS	18.6	0.0	29.6	2.9	51.9	2.9

Table A-4. USS Utah sediment grain-size summary. Station abbreviations: first letter denotes depth (deep or shallow) the second letter represents the side of the ship (starboard or port) and the last letter depicts the section (bow, mid-ship or stern). Locations with only two letters symbolize depth and section.

Location	Coarse and very coarse sand	SD	Medium sand	SD	Fine and very sand	SD	Silt/clay	SD
DPB	3.9	0.0	5.0	0.5	31.9	2.1	59.2	7.0
DPM	30.1	0.2	7.9	0.1	14.1	0.2	48.0	3.0
DPS	8.6	0.7	3.4	0.1	4.6	0.1	83.4	4.8
SB	23.7	0.4	12.1	0.1	20.3	0.1	43.9	2.5
SPM	19.5	0.5	15.2	0.4	26.4	1.0	39.0	1.3
SSM	29.4	1.2	17.2	0.6	21.4	0.7	32.1	1.8
SS	37.4	0.6	10.8	0.1	12.7	0.3	39.1	1.9
DSB	9.4	0.3	5.1	0.3	25.9	0.1	59.6	3.7
DSM	26.9	0.6	8.3	0.0	28.0	0.0	36.8	1.3
DSS	6.7	0.4	2.2	0.1	4.8	0.1	86.3	8.4

Appendix B: Coverage by Benthic Category and Taxa at USS Arizona

Arizona Horizontal Bow

Site	39	40	41	42	43	44	45	46	47	48	49	50	51	52	54	55	56	Mn	SD.	SE
MACROALGAE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SPONGES	0.0	5.4	6.2	0.0	15.8	1.0	0.0	0.0	0.0	0.0	0.0	0.0	15.9	0.0	8.9	13.1	16.2	5.3	7.1	1.0
CNIDARIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CORALS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MOLLUSCS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLYCHAETES	0.0	0.0	0.0	0.0	21.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6	0.0	5.7	0.0	5.4	2.4	6.7	1.0
ASCIDIANS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BRYOZOANS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silt/Algae	0.0	30.3	33.3	0.0	58.1	28.3	0.0	0.0	0.0	0.0	0.0	0.0	78.4	0.0	28.5	55.5	38.4	22.4	30.3	4.4
Pavement	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shell/Sand	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silt	100	21.6	7.5	100	1.0	70.7	100	100	100	100	100	100	0.0	4.4	0.0	0.0	0.0	49.3	48.5	7.1
MACROALGAE																				
Acanthophora spicifera	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dichotomaria marginata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unident. Algae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SPONGES																				
Biemna fistulosa	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.1	0.7	0.1
Callyspongia sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dysidea arenaria	0.0	0.0	3.1	0.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.5	1.9	0.3
Gelliodes fibrosa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haliclona (S.) caerulea	0.0	3.2	1.0	0.0	2.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	2.2	0.0	2.2	0.8	1.7	0.2
Haliclona sp. (Black branching)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	0.2	1.4	0.2
Monanchora clathratha	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mycale grandis	0.0	0.0	1.0	0.0	6.3	1.0	0.0	0.0	0.0	0.0	0.0	0.0	6.5	0.0	6.7	6.6	6.6	2.2	3.5	0.5
Mycale sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Porifera Unident. sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.1	0.5	0.1
Porifera sp. (Grey)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Porifera sp.(Black)	0.0	0.0	1.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.1	1.1	0.3	1.0	0.1
Raspailia sp. (Black Knobby)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Subrites auranticus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.1	0.5	0.1
Tedania ignis	0.0	1.1	0.0	0.0	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.2	0.0	0.0	3.3	2.1	0.9	2.6	0.4
CNIDARIA																				

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Arizona Horizontal Mid Ship

[illegible]

Arizona Horizontal Mid Ship

Site	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	MN	SD	SE
Dichotomaria marginata	0.0	28.1	0.0	24.0	56.1	0.0	0.0	13.5	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	6.6	20.9	3.0
Unident. Algae	0.0	0.0	0.0	2.1	3.0	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.9	0.3
SPONGES																			
Biemna fistulosa	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	2.5	0.0	0.3	1.2	0.2
Callyspongia sp.	9.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	0.0	0.8	4.3	0.6
Dysidea arenaria	0.0	0.0	1.0	1.0	0.0	1.1	1.1	0.0	1.0	0.0	1.4	0.0	1.0	0.0	2.3	2.1	0.8	1.4	0.2
Haliclona (S.) caerulea	0.0	0.0	3.3	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	14.0	7.3	1.6	6.8	1.0
Haliclona sp. (Black branching)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Iotrochota purpurea	3.1	2.3	3.2	2.1	0.0	1.1	3.1	3.2	5.1	0.0	3.2	5.3	0.0	0.0	7.8	8.3	3.1	3.4	0.5
Monanchora clathrata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mycale sp.	0.0	0.0	0.0	0.0	0.0	0.0	5.2	0.0	3.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.6	2.1	0.3
Mycale grandis	2.1	0.0	2.2	4.2	0.0	3.2	6.1	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	1.2	3.2	0.5
Porifera Unident. sp.	0.0	0.0	0.0	0.0	0.0	1.1	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.1
Porifera sp. (Grey)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Porifera sp.(Black)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Raspailia sp. (Black Knobby)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Suberites auranticus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tedania ignis	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	0.1
CNIDARIA																			
Aiptasia pulchella	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	1.1	0.1	0.7	0.1
Pennaria disticha	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CORALS																			
Leptastrea purpurea	1.0	0.0	1.1	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	2.1	0.0	0.0	0.0	0.0	0.3	1.0	0.1
Pocillopora damicornis	0.0	0.0	1.1	1.0	0.0	0.0	0.0	4.0	1.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.5	1.9	0.3
Porites compressa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MOLLUSCS																			
Hipponix imbricatus	0.0	4.6	0.0	0.0	0.0	2.2	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	2.3	0.3
POLYCHAETES																			
Branchiomma sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.1
Eurythoe complanata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sabellastarte spectabilis	2.1	4.6	0.0	0.0	0.0	1.1	2.2	0.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.8	2.4	0.4
ASCIDIANS																			
Phallusia sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ECHINODERMS																			

Arizona Horizontal Mid Ship

Site	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	MN	SD	SE
Opheodesoma spectabilis	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.1

Arizona Horizontal Stern

Site	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Mn	SD	SE
MACROALGAE	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	1.1	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.1	0.1
SPONGES	18.0	16.7	23.8	33.9	10.4	14.6	15.9	23.7	11.6	15.2	18.7	12.1	16.2	7.7	12.8	4.1	19.2	7.1	7.1	15.2	16.9	59.6	17.2	14.7	1.8
CNIDARIA	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.2	1.1	0.1
CORALS	0.0	1.1	0.0	0.0	0.0	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.7	0.0	0.0	8.1	0.0	0.0	1.1	4.0	0.5
MOLLUSCS (M)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
POLYCHATES	2.2	4.2	1.1	2.3	0.0	2.1	2.2	5.2	1.1	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	2.5	0.3
ASCIDIANS	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.1
ECHINODERMS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silt/Algae	68.1	51.5	74.0	32.2	74.2	47.8	30.7	30.2	14.8	0.0	29.5	70.3	7.6	36.5	34.1	9.2	49.8	10.1	10.1	14.1	28.9	22.8	34.6	27.8	3.4
Pavement	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.2	0.2
Shell/Sand	4.3	20.1	1.1	29.3	15.4	18.9	51.3	40.9	72.6	84.8	39.8	14.3	76.2	48.1	47.8	85.7	17.7	22.2	22.2	47.5	47.6	17.6	38.6	33.7	4.1
Silt	5.3	6.5	0.0	2.3	0.0	9.2	0.0	0.0	0.0	0.0	12.0	3.3	0.0	2.2	3.2	0.0	4.4	60.6	60.6	11.1	6.6	0.0	6.8	17.6	2.2
MACROALGAE																									
Acanthophora spicifera	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.0	0.1
Dichotomaria marginata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0
Unident. Algae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SPONGES																									
Biemna fistulosa	2.2	0.0	0.0	0.0	0.0	0.0	8.4	8.4	1.1	1.0	1.0	0.0	1.1	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	3.4	1.1	3.1	0.4
Callyspongia sp.	1.1	0.0	1.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.7	0.1
Dysidea arenaria	1.0	6.3	1.1	18.4	0.0	0.0	0.0	1.7	0.0	0.0	3.0	0.0	0.0	0.0	3.2	0.0	0.0	6.1	6.1	0.0	0.0	2.3	2.0	7.6	0.9
Haliclona (S.) caerulea	2.1	0.0	3.2	1.1	2.1	4.2	0.0	3.4	4.2	2.0	3.2	2.2	10.8	3.4	1.0	2.0	2.3	0.0	0.0	10.1	4.3	40.3	4.7	9.4	1.2
Haliclona sp. lotrochota	0.0	0.0	1.0	1.1	0.0	0.0	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	1.0	5.1	0.0	0.5	2.0	0.3
lotrochota purpurea	0.0	0.0	6.7	1.1	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	2.3	0.0	0.0	2.0	1.0	8.0	1.1	4.0	0.5
Monanchora clathrata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.1	0.6	0.1
Mycale sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mycale grandis	6.4	2.1	3.2	6.6	3.1	5.1	5.4	3.4	4.2	5.1	10.3	5.5	3.3	4.3	6.4	2.1	4.5	0.0	0.0	2.0	3.5	4.5	4.3	3.4	0.4
Porifera Unident. sp.	0.0	0.0	0.0	2.3	0.0	0.0	0.0	1.7	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.0	0.1
Porifera sp. (Grey)	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.7	0.1

Arizona Horizontal Stern

Site	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Mn	SD	SE	
Porifera sp.(Black)	0.0	1.1	0.0	0.0	1.0	3.2	1.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.1	0.4	1.2	0.2	
Raspailia sp. Suberites auranticus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.4	0.0	
	4.2	7.3	5.3	0.0	2.1	2.1	0.0	0.0	1.1	7.1	1.2	2.2	0.0	0.0	1.1	0.0	4.4	0.0	0.0	0.0	0.0	0.0	1.9	3.3	0.4	
Tedania ignis	1.1	0.0	2.2	1.1	1.0	0.0	1.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	1.0	1.0	0.0	0.0	0.0	0.6	2.1	0.3	
CNIDARIA																										
Aiptasia pulchella	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.2	1.1	0.1	
Pennaria disticha	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
CORALS																										
Leptastrea purpurea	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.1	
Pocillopora damicornis	0.0	0.0	0.0	0.0	0.0	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.7	0.0	0.0	8.1	0.0	0.0	1.0	4.0	0.5	
Porites compressa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
MOLLUSCS																										
Hipponix imbricatus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	
POLYCHAETES																										
Branchiomma sp. Eurythoe complanata	0.0	0.0	0.0	0.0	0.0	1.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.1	
Sabellastarte spectabilis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	2.2	4.2	1.1	2.3	0.0	1.0	1.0	5.2	1.1	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	2.4	0.3	
ASCIDIANS																										
Phallusia sp.	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.1	

Arizona Starboard Vertical Shallow

Site	VS01	VS04	VS11	VS14	VS15	VS17	VS18	VS20	VS23	VS26	VS29	Mn	SD	SE
MACROALGAE	2.2	5.6	6.1	4.2	0.0	0.0	0.0	6.5	13.5	6.9	1.3	4.2	6.7	1.2
SPONGES	94.5	64.2	48.1	27.2	17.7	21.8	13.7	36.8	4.9	32.7	33.5	35.6	27.1	4.7
CNIDARIA	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.8	0.1
CORALS	0.0	0.0	2.9	0.0	1.6	0.0	1.1	0.0	0.0	0.0	0.0	0.3	1.5	0.3
MOLLUSCS	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	5.2	0.0	0.0	0.7	2.5	0.4
POLYCHAETES	0.0	0.0	5.7	12.9	1.9	0.0	0.0	0.0	0.0	9.8	3.8	3.8	6.9	1.2
ASCIDIANS	0.0	2.7	2.5	0.0	0.0	0.0	0.0	1.1	1.1	1.1	1.1	1.0	1.9	0.3
BRYOZOANS	0.0	17.1	9.8	4.2	0.0	0.0	0.0	0.0	0.0	7.8	0.0	3.5	6.8	1.2
Silt/Algae	0.0	0.0	17.6	51.6	77.2	78.2	66.8	52.5	58.9	41.7	60.3	38.0	28.3	4.9
Pavement	3.3	7.4	4.1	0.0	0.0	0.0	2.2	3.2	16.3	0.0	0.0	3.1	6.7	1.2

Arizona Starboard Vertical Shallow

[illegible]

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Arizona Starboard Vertical Mid depth

[illegible]

Arizona Starboard Vertical Mid depth

Site	VS02	VS05	VS09	VS10	VS16	VS19	VS21	VS24	VS27	VS30	Mn	SD	SE
Porifera Unident. sp.	12.8	3.8	0.0	1.1	0.0	2.5	1.0	0.0	5.4	1.3	3.8	6.1	1.4
Porifera sp. (Grey)	7.0	7.7	2.1	0.0	1.1	0.0	0.0	0.0	1.3	0.0	1.6	3.8	0.8
Porifera sp.(Black)	5.6	11.5	6.3	1.1	0.0	0.0	4.2	0.0	2.7	0.0	2.4	3.8	0.9
Raspailia sp. (Black Knobby)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Suberites auranticus	0.0	0.0	0.0	0.0	0.0	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tedania ignis	0.0	0.0	0.0	1.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CNIDARIA													
Aiptasia pulchella	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pennaria disticha	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CORALS													
Leptastrea purpurea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.6	1.4	0.3
Pocillopora damicornis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.4	1.1	0.3
Porites compressa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MOLLUSCS													
Hipponix imbricatus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLYCHAETES													
Branchiomma sp.	2.3	3.8	4.2	3.3	4.2	1.2	1.0	31.3	23.6	36.3	12.8	18.4	4.1
Eurythoe complanata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sabellastarte spectabilis	1.2	0.0	1.0	1.1	0.0	0.0	5.2	0.0	1.4	0.0	1.4	3.6	0.8
Salmacina dysteri (SDIST)	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	0.2
ASCIDIANS													
Phallusia sp.	2.3	3.8	1.0	0.0	0.0	1.1	1.0	0.0	4.1	0.0	1.3	1.8	0.4
BRYOZOANS													
Schizoporella sp.	0.0	11.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	2.6	0.6

Arizona Starboard Vertical Deep

Site	VS03	VS06	VS07	VS08	VS22	VS25	VS31	MN	SD	SE
MACROALGAE	4.6	80.0	82.1	43.3	0.0	1.6	0.0	13.5	25.9	5.6
SPONGES	6.5	0.0	0.0	23.0	4.4	9.3	12.7	11.5	10.1	2.2
CNIDARIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CORALS	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	0.2
MOLLUSCS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLYCHAETES	1.1	0.0	0.0	5.0	0.0	18.2	61.0	11.9	22.1	4.8
ASCIDIANS	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.0	0.2
BRYOZOANS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silt/Algae	85.6	0.0	0.0	21.0	63.4	70.9	26.3	54.5	30.9	6.7

Arizona Starboard Vertical Deep

Site	VS03	VS06	VS07	VS08	VS22	VS25	VS31	MN	SD	SE
Pavement	0.0	20.0	17.9	7.7	0.0	0.0	0.0	3.5	7.2	1.6
Shell/Sand	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silt	0.0	0.0	0.0	0.0	32.2	0.0	0.0	4.6	14.2	3.1
MACROALGAE										
Acanthophora spicifera	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dichotomaria marginata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unident. Algae	4.6	80.0	82.1	43.3	0.0	1.6	0.0	13.5	25.9	5.6
SPONGES										
Biemna fistulosa	2.2	0.0	0.0	0.0	0.0	4.6	0.0	1.3	2.0	0.4
Callyspongia sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dysidea arenaria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gelliodes fibrosa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haliclona (S.) caerulea	1.1	0.0	0.0	2.0	0.0	0.0	0.0	0.7	1.8	0.4
Haliclona sp. (Black branching)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Monanchora clathrata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	3.0	0.7
Mycale grandis	2.1	0.0	0.0	8.7	1.1	0.0	0.0	3.6	5.7	1.2
Mycale sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Porifera Unident. sp.	1.1	0.0	0.0	3.3	1.1	4.7	10.3	2.9	5.1	1.1
Porifera sp. (Grey)	0.0	0.0	0.0	7.0	0.0	0.0	0.0	0.8	2.4	0.5
Porifera sp.(Black)	0.0	0.0	0.0	2.0	1.1	0.0	2.4	0.7	1.8	0.4
Raspailia sp. (Black Knobby)	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.2	0.7	0.2
Suberites auranticus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	2.4	0.5
Tedania ignis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	0.2
CNIDARIA										
Aiptasia pulchella	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pennaria disticha	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CORALS										
Leptastrea purpurea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pocillopora damicornis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Porites compressa	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	0.2
MOLLUSCS										
Hipponix imbricatus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLYCHAETES										
Branchiomma sp.	1.1	0.0	0.0	5.0	0.0	18.2	61.0	11.9	22.1	4.8

Arizona Starboard Vertical Deep

Site	VS03	VS06	VS07	VS08	VS22	VS25	VS31	MN	SD	SE
Eurythoe complanata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sabellastarte spectabilis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Salmacina dysteri (SDIST)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ASCIDIANS										
Phallusia sp.	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.0	0.2
BRYOZOANS										
Schizoporella sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Arizona Port Vertical Shallow

Site	VP32	VP36	VP39	VP42	VP45	VP48	VP51	VP57	VP60	MN	SD	SE
MACROALGAE	17.3	19.9	35.0	3.1	4.4	2.1	7.2	22.4	15.7	11.4	15.9	2.8
SPONGES	31.2	30.6	38.6	18.3	30.6	13.8	39.8	68.4	63.1	33.9	22.2	3.9
CNIDARIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CORALS	1.1	0.0	1.3	0.0	0.0	6.7	0.0	0.0	0.0	0.9	3.6	0.6
MOLLUSCS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLYCHAETES	6.8	8.1	2.5	3.3	2.2	1.1	0.0	0.0	0.0	3.1	4.6	0.8
ASCIDIANS	0.0	0.0	0.0	1.1	3.2	0.0	1.2	1.3	1.5	0.9	1.5	0.3
BRYOZOANS	3.6	0.0	0.0	0.0	1.0	2.1	10.6	1.3	16.7	2.9	6.7	1.2
Silt/Algae	33.0	41.4	22.7	74.2	58.5	73.3	36.6	2.6	0.0	45.2	30.6	5.4
Pavement	1.2	0.0	0.0	0.0	0.0	1.0	3.4	4.0	3.0	1.1	2.3	0.4
Shell/Sand	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.1	0.6	0.1
Silt	5.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	3.0	0.5
MACROALGAE												
Acanthophora spicifera	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dichotomaria marginata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unident. Algae	17.3	19.9	35.0	3.1	4.4	2.1	7.2	22.4	15.7	11.4	15.9	2.8
SPONGES												
Biemna fistulosa	0.0	3.3	0.0	2.2	3.4	0.0	0.0	1.3	0.0	1.3	2.7	0.5
Callyspongia sp.	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.1
Dysidea arenaria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gelliodes fibrosa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.5	28.6	3.1	10.8	1.9
Haliclona (S.) caerulea	7.1	4.6	12.0	1.0	7.3	1.1	2.5	11.8	17.3	6.9	9.1	1.6

Arizona Port Vertical Shallow

Site	VP32	VP36	VP39	VP42	VP45	VP48	VP51	VP57	VP60	MN	SD	SE
Haliclona sp. (Black branching)	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	1.8	1.1	3.9	0.7
Monanchora clathrata	0.0	0.0	7.5	0.0	6.3	0.0	0.0	8.0	0.0	2.0	6.5	1.1
Mycale grandis	21.9	18.1	3.9	10.8	11.6	9.5	37.3	10.3	12.4	13.4	12.6	2.2
Mycale sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.1
Porifera Unident. sp.	0.0	2.2	3.8	0.0	1.0	0.0	0.0	13.3	1.5	2.1	4.9	0.9
Porifera sp. (Grey)	0.0	0.0	0.0	2.1	1.0	0.0	0.0	7.9	0.0	1.2	2.8	0.5
Porifera sp.(Black)	1.2	1.3	2.4	2.2	0.0	0.0	0.0	1.3	1.5	1.2	2.1	0.4
Raspailia sp. (Black Knobby)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Suberites auranticus	0.0	0.0	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.5	2.6	0.5
Tedania ignis	0.0	1.1	0.0	0.0	0.0	3.1	0.0	0.0	0.0	0.8	1.9	0.3
CNIDARIA												
Aiptasia pulchella	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pennaria disticha	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CORALS												
Leptastrea purpurea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pocillopora damicornis	1.1	0.0	1.3	0.0	0.0	6.7	0.0	0.0	0.0	0.9	3.6	0.6
Porites compressa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MOLLUSCS												
Hipponix imbricatus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLYCHAETES												
Branchiomma sp.	6.8	5.7	2.5	2.2	1.0	1.1	0.0	0.0	0.0	2.3	3.9	0.7
Eurythoe complanata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sabellastarte spectabilis	0.0	2.4	0.0	1.1	1.1	0.0	0.0	0.0	0.0	0.8	1.5	0.3
ASCIDIANS												
Phallusia sp.	0.0	0.0	0.0	1.1	3.2	0.0	1.2	1.3	1.5	0.9	1.5	0.3
BRYOZOANS												
Schizoporella sp.	3.6	0.0	0.0	0.0	1.0	2.1	10.6	1.3	16.7	2.9	6.7	1.2

Arizona Port Vertical Mid depths

[illegible]

Arizona Port Vertical Mid depths

Site	VP33	VP37	VP40	VP43	VP46	VP49	VP53	VP54	MN	SD	SE
CORALS	27.1	0.0	0.0	0.0	0.0	1.1	0.0	0.0	3.6	16.6	3.8
MOLLUSCS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLYCHAETES	1.5	25.3	41.1	4.2	7.8	18.7	5.6	3.5	19.1	16.6	3.8
ASCIDIANS	1.5	2.3	0.0	0.0	0.0	2.2	1.0	1.0	1.2	2.2	0.5
BRYOZOANS	0.0	9.3	0.0	0.0	0.0	8.8	0.0	1.2	3.0	6.1	1.4
Silt/Algae	6.3	26.2	48.3	84.2	74.1	51.1	75.4	64.1	53.2	24.1	5.5
Pavement	4.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.8	0.2
Shell/Sand	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MACROALGAE											
Acanthophora spicifera	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dichotomaria marginata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unident. Algae	20.5	8.4	4.2	0.0	0.0	10.4	0.0	0.0	4.4	6.2	1.4
SPONGES											
Biemna fistulosa	1.2	3.9	0.0	0.0	0.0	2.3	2.1	1.0	1.0	2.0	0.5
Callyspongia sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dysidea arenaria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gelliodes fibrosa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haliclona (S.) caerulea	0.0	0.0	2.2	0.0	1.1	1.1	5.3	9.7	1.5	3.4	0.8
Haliclona sp. (Black branching)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.2	0.0	0.0	0.0
Monanchora clathrata	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.2	0.8	0.2
Mycale grandis	2.7	9.9	4.3	11.6	13.6	1.1	6.2	5.5	8.1	7.6	1.8
Mycale sp.	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0
Porifera Unident. sp.	33.2	11.1	0.0	0.0	0.0	1.2	0.0	1.0	3.0	5.8	1.3
Porifera sp. (Grey)	1.5	3.6	0.0	0.0	0.0	0.0	1.1	1.1	0.6	2.3	0.5
Porifera sp.(Black)	0.0	0.0	0.0	0.0	2.2	1.1	1.0	2.2	0.7	1.6	0.4
Raspailia sp. (Black Knobby)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Suberites auranticus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.8	0.2
Tedania ignis	0.0	0.0	0.0	0.0	0.0	1.1	1.1	3.5	0.2	0.7	0.2
CNIDARIA											
Aiptasia pulchella	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pennaria disticha	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CORALS											
Leptastrea purpurea	2.1	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.4	1.4	0.3

Site	VP33	VP37	VP40	VP43	VP46	VP49	VP53	VP54	MN	SD	SE
<i>Pocillopora damicornis</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Porites compressa</i>	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1	15.3	3.5
MOLLUSCS											
<i>Hipponix imbricatus</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLYCHAETES											
<i>Branchiomma</i> sp.	1.5	25.3	41.1	4.2	6.7	18.7	3.4	2.3	17.7	16.4	3.8
<i>Eurythoe complanata</i>	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<i>Sabellastarte spectabilis</i>	0.0	0.0	0.0	0.0	1.1	0.0	2.2	1.2	0.3	1.0	0.2
<i>Salmacina dysteri</i> (SDIST)	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	3.6	0.8
ASCIDIANS											
<i>Phallusia</i> sp.	1.5	2.3	0.0	0.0	0.0	2.2	0.0	1.2	1.2	2.2	0.5
BRYOZOANS											
<i>Schizoporella</i> sp.	0.0	9.3	0.0	0.0	0.0	8.8	75.4	64.1	3.0	6.1	1.4

[illegible]

Arizona Port Vertical Deep

Site	VP34	VP38	VP41	VP44	VP47	VP50	VP52	VP55	VP56	VP59	VP61	VP62	MN	SD	SE
Dysidea arenaria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Geliodes fibrosa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haliclona (S.) caerulea	0.0	0.0	7.7	0.0	1.0	3.2	0.0	12.8	15.7	6.6	6.5	1.0	5.3	7.5	1.4
Haliclona sp. (Black branching)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Monanchora clathrata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mycale grandis	7.7	3.4	6.8	0.0	19.4	2.2	3.8	3.5	1.2	18.2	10.6	3.3	7.5	11.0	2.1
Mycale sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Porifera Unident. sp.	0.0	0.0	2.2	6.5	0.0	3.2	0.0	7.1	14.5	10.4	7.6	2.1	5.3	7.3	1.4
Porifera sp. (Grey)	3.8	6.9	0.0	0.0	1.1	0.0	0.0	0.0	1.5	0.0	0.0	0.0	0.7	1.7	0.3
Porifera sp.(Black)	23.1	0.0	2.2	0.0	0.0	0.0	0.0	6.7	7.0	8.7	1.0	4.2	3.9	6.9	1.3
Raspailia sp. (Black Knobby)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Suberites auranticus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0
Tedania ignis	0.0	0.0	3.3	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.7	1.6	0.3
CNIDARIA															
Aiptasia pulchella	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pennaria disticha	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CORALS															
Leptastrea purpurea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.1	0.6	0.1
Pocillopora damicornis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Porites compressa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MOLLUSCS															
Hipponix imbricatus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLYCHAETES															
Branchiomma sp.	7.7	3.4	3.3	0.0	1.0	1.1	3.8	0.0	0.0	0.0	14.0	0.0	1.1	2.5	0.5
Eurythoe complanata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sabellastarte spectabilis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0	0.0
Salmacina dysteri	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.1	0.0	0.0	0.0	0.0
ASCIDIANS															
Phallusia sp.	0.0	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.6	1.0	0.5	1.1	0.2
BRYOZOANS															
Schizoporella sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.8	0.0	1.0	0.0	0.0	0.9	4.4	0.8

Appendix C: Coverage by Benthic Category and Taxa at USS Utah

Utah Port (Deck) Shallow																
Site	H02	H04	H07	H10	H13	H14	H16	H19	H22	H25	H28	H31	H34	MN	SD	SE
MACROALGAE	1.0	0.0	1.0	6.9	0.0	0.0	8.3	0.0	0.0	0.0	0.0	0.0	0.0	1.5	4.8	0.8
SPONGES	18.9	23.0	14.9	21.1	12.5	20.7	7.9	20.7	0.0	20.0	10.8	9.5	17.4	14.9	10.7	1.8
CNIDARIA	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.1
CORALS	0.0	0.0	0.0	1.1	1.0	0.0	2.2	0.0	0.0	0.0	1.1	0.0	2.2	0.7	1.6	0.3
MOLLUSCS	0.0	0.0	0.0	1.2	6.1	0.0	5.3	0.0	0.0	0.0	0.0	0.0	0.0	1.1	3.2	0.5
POLYCHAETES	0.0	3.4	4.5	0.0	1.0	3.3	1.1	2.1	0.0	1.0	1.1	1.7	0.0	1.3	2.6	0.4
ASCIDIANS	1.0	0.0	2.4	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0	1.6	3.3	0.7	1.3	0.2
BRYOZOANS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.1	0.6	0.1
Silt/Algae	75.9	46.5	73.8	67.3	72.1	28.5	71.8	6.4	0.0	71.9	85.9	77.5	72.8	59.7	30.0	5.1
Pavement	0.0	0.0	2.3	1.2	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.4	0.2
Shell/Sand	3.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77.4	0.0	0.0	0.0	0.0	6.9	22.6	3.8
Silt	0.0	25.9	1.1	1.1	6.2	45.4	3.3	70.8	22.6	7.1	0.0	9.8	4.3	12.8	22.0	3.7
MACROALGAE																
Acanthophora spicifera	1.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	0.1
Dichotomaria marginata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unident. Algae	0.0	0.0	0.0	6.9	0.0	0.0	8.3	0.0	0.0	0.0	0.0	0.0	0.0	1.3	4.8	0.8
SPONGES																
Biemna fistulosa	1.0	1.1	1.1	0.0	0.0	0.0	0.0	0.0	0.0	2.2	0.0	0.0	1.0	0.6	1.2	0.2
Callyspongia sp.	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.1
Dysidea arenaria	2.1	0.0	0.0	0.0	0.0	9.1	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.3	1.2	0.2
Gelliodes fibrosa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haliclona (S.) caerulea	6.3	5.6	2.2	2.3	3.1	3.2	2.3	1.0	0.0	9.2	2.2	1.6	5.3	3.5	4.1	0.7
Haliclona sp. (Black branching)	0.0	0.0	2.5	0.0	0.0	0.0	0.0	3.3	0.0	0.0	0.0	1.6	0.0	0.6	1.8	0.3
Monanchora clathrata	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.1
Mycale grandis	3.1	10.7	3.5	4.7	0.0	2.0	0.0	2.2	0.0	3.3	4.3	6.4	4.4	3.5	5.1	0.9
Mycale sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Porifera Unident. sp.	2.1	1.1	1.0	4.8	0.0	0.0	1.1	0.0	0.0	1.0	0.0	0.0	1.1	1.1	2.7	0.4
Porifera sp. (Grey)	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.1	0.5	0.1
Porifera sp.(Black)	1.0	4.4	0.0	3.4	8.3	0.0	4.5	6.6	0.0	2.3	0.0	0.0	0.0	2.6	5.6	0.9
Raspailia sp. (Black Knobby)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Suberites auranticus	3.1	0.0	2.4	1.2	0.0	4.3	0.0	6.5	0.0	1.0	2.2	0.0	2.2	1.6	3.2	0.5

Utah Port (Deck) Shallow

Site	H02	H04	H07	H10	H13	H14	H16	H19	H22	H25	H28	H31	H34	MN	SD	SE
Tedania ignis	0.0	0.0	1.0	3.4	1.0	1.0	0.0	1.1	0.0	0.0	1.1	0.0	3.3	0.9	2.1	0.4
CNIDARIA																
Aiptasia pulchella	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.1
Pennaria disticha	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CORALS																
Leptastrea purpurea	0.0	0.0	0.0	1.1	1.0	0.0	1.1	0.0	0.0	0.0	1.1	0.0	0.0	0.4	1.1	0.2
Pocillopora damicornis	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	2.2	0.3	1.2	0.2
Porites compressa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MOLLUSCS																
Hipponix imbricatus	0.0	0.0	0.0	1.2	6.1	0.0	5.3	0.0	0.0	0.0	0.0	0.0	0.0	1.1	3.2	0.5
POLYCHAETES																
Branchiomma sp.	0.0	0.0	0.0	0.0	0.0	2.2	1.1	0.0	0.0	0.0	0.0	1.7	0.0	0.2	0.8	0.1
Eurythoe complanata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sabellastarte spectabilis	0.0	3.4	4.5	0.0	1.0	1.1	0.0	2.1	0.0	1.0	1.1	0.0	0.0	1.1	2.6	0.4
Salmacina dysteri (SDIST)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ASCIDIANS																
Phallusia sp.	1.0	0.0	2.4	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0	1.6	3.3	0.7	1.3	0.2
BRYOZOANS																
Schizoporella sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.1	0.6	0.1

Utah Port (Deck) Mid depths

Site	H01	H03	H05	H08	H11	H14	H17	H20	H23	H26	H29	H32	H35	H37	H38	H39	MN	SD	SE
MACROALGAE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SPONGES	20.0	31.3	11.2	28.1	0.0	5.2	5.2	15.0	0.0	25.1	15.4	0.0	16.4	34.4	26.6	0.0	14.1	13.6	2.0
CNIDARIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CORALS	0.0	1.1	0.0	0.0	2.2	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.5	0.2
MOLLUSCS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLYCHAETES	5.4	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.2	5.4	0.0	2.2	1.7	15.4	0.0	2.4	5.2	0.8
ASCIDIANS	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.2	1.1	0.0	3.3	0.0	0.0	0.0	0.7	1.4	0.2
BRYOZOANS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.1
Silt/Algae	56.6	30.7	86.8	70.9	9.7	33.6	33.6	42.1	2.2	52.0	72.5	0.0	71.5	52.7	57.9	0.0	42.2	31.6	4.8
Pavement	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	2.6	0.4

Utah Port (Deck) Mid depths

Site	H01	H03	H05	H08	H11	H14	H17	H20	H23	H26	H29	H32	H35	H37	H38	H39	MN	SD	SE
Shell/Sand	0.0	1.1	0.0	0.0	0.0	0.0	0.0	26.5	65.6	8.6	0.0	93.5	0.0	0.0	0.0	0.0	13.2	29.7	4.5
Silt	17.0	35.7	2.0	0.0	88.0	61.1	61.1	8.1	28.0	11.9	5.4	6.5	6.6	11.1	0.0	100.0	26.4	34.1	5.1
MACROALGAE																			
Acanthophora spicifera	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dichotomaria marginata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unident. Algae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SPONGES																			
Biemna fistulosa	0.0	1.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	1.6	1.0	0.0	0.4	1.1	0.2
Callyspongia sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dysidea arenaria	6.5	0.0	0.0	2.3	0.0	0.0	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	5.6	0.8
Gelliodes fibrosa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haliclona (S.) caerulea	3.1	13.6	3.1	10.5	0.0	0.0	0.0	2.4	0.0	3.8	10.1	0.0	4.4	28.0	14.3	0.0	5.0	7.8	1.2
Haliclona sp. (Black branching)	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.0	0.0	1.7	0.0	0.0	0.4	1.6	0.2
Monanchora clathrata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.1	0.5	0.1
Mycale grandis	2.1	12.4	0.0	2.2	0.0	0.0	0.0	11.4	0.0	2.4	3.2	0.0	8.6	3.1	3.2	0.0	2.5	5.1	0.8
Mycale sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Porifera Unident. sp.	3.0	3.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	1.1	0.0	1.1	0.0	2.3	0.0	0.6	1.9	0.3
Porifera sp. (Grey)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.1
Porifera sp.(Black)	2.1	0.0	1.0	12.0	0.0	0.0	0.0	0.0	0.0	10.3	1.0	0.0	0.0	0.0	4.6	0.0	2.1	4.8	0.7
Raspailia sp. (Black Knobby)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Suberites auranticus	1.1	0.0	7.1	0.0	0.0	5.2	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	4.1	0.6
Tedania ignis	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.1
CNIDARIA																			
Aiptasia pulchella	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pennaria disticha	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CORALS																			
Leptastrea purpurea	0.0	1.1	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.0	0.2
Pocillopora damicornis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.1	0.2
Porites compressa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MOLLUSCS																			
Hipponix imbricatus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLYCHAETES																			
Branchiomma sp.	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	0.0	1.1	1.7	13.1	0.0	1.5	4.0	0.6
Eurythoe complanata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Utah Port (Deck) Mid depths

Site	H01	H03	H05	H08	H11	H14	H17	H20	H23	H26	H29	H32	H35	H37	H38	H39	MN	SD	SE
Sabellastarte spectabilis	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	2.1	0.0	1.1	0.0	2.3	0.0	0.9	2.8	0.4
Salmacina dysteri (SDIST)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ASCIDIANS																			
Phallusia sp.	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.2	1.1	0.0	3.3	0.0	0.0	0.0	0.7	1.4	0.2
BRYOZOANS																			
Schizoporella sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.1

Utah Port (Deck) Deep

Site	H06	H09	H12	H15	H18	H21	H24	H27	H30	H33	H36	H41	H42	MN	SD	SE
MACROALGAE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SPONGES	5.0	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.4	32.5	6.9	13.8	2.2
CNIDARIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CORALS	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	0.1
MOLLUSCS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLYCHAETES	0.0	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.0	0.5	1.4	0.2
ASCIDIANS	1.6	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.2	0.8	0.1
BRYOZOANS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silt/Algae	26.7	70.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.8	29.4	12.9	23.3	3.6
Pavement	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shell/Sand	53.4	0.0	100.0	10.8	100.0	33.2	100.0	0.0	0.0	0.0	28.3	0.0	2.1	30.1	43.8	6.8
Silt	11.7	18.6	0.0	89.2	0.0	66.8	0.0	100.0	100.0	100.0	71.7	49.7	34.0	49.3	41.9	6.5
MACROALGAE																
Acanthophora spicifera	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dichotomaria marginata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unident. Algae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SPONGES																
Biemna fistulosa	1.7	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	2.1	0.9	1.9	0.3
Callyspongia sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dysidea arenaria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.3	4.3	0.8	3.9	0.6
Gelliodes fibrosa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haliclona (S.) caerulea	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.1	1.3	5.5	0.9

Utah Port (Deck) Deep

[illegible]

Utah Starboard Vertical Shallow

Site	UTVS01	UTVS04	UTVS07	UTV10	UTVS13	UTVS16	UTVS19	UTVS22	Mn	SD	SE
MACROALGAE	0.0	2.2	0.0	1.0	3.7	0.0	0.0	1.0	0.8	2.0	0.4
SPONGES	13.1	10.2	21.3	16.7	10.0	22.6	15.9	33.2	19.4	12.0	2.2
CNIDARIA	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.1	0.7	0.1
CORALS	0.0	0.0	0.0	1.0	6.7	4.4	4.2	0.0	1.8	4.6	0.9
MOLLUSCS	0.0	0.0	0.0	0.0	0.0	0.0	12.6	0.0	1.3	5.5	1.0
POLYCHAETES	3.2	0.0	0.0	2.3	0.0	0.0	0.0	7.2	1.9	4.7	0.9
ASCIDIANS	1.7	2.2	0.0	2.1	0.0	1.1	0.0	0.0	0.8	1.8	0.3
BRYOZOANS	0.0	4.4	0.0	1.0	3.6	0.0	1.1	2.6	1.3	3.4	0.6
Silt/Algae	82.0	81.0	71.3	51.3	12.0	63.2	49.4	33.9	50.2	29.1	5.4
Pavement	0.0	0.0	0.0	0.0	7.9	0.0	3.1	1.3	1.3	3.7	0.7
Shell/Sand	0.0	0.0	0.0	0.0	56.2	0.0	6.4	0.0	14.0	28.0	5.2
Silt	0.0	0.0	6.3	24.5	0.0	8.6	7.3	20.8	7.1	14.5	2.7
MACROALGAE											
Acanthophora spicifera	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.1	0.6	0.1
Dichotomaria marginata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unident. Algae	0.0	2.2	0.0	0.0	3.7	0.0	0.0	1.0	0.7	1.9	0.4
SPONGES											
Biemna fistulosa	1.7	2.3	1.0	4.0	2.6	0.0	0.0	0.0	1.5	2.9	0.5
Callyspongia sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dysidea arenaria	0.0	0.0	4.2	5.2	0.0	0.0	4.2	9.6	2.4	6.1	1.1
Gelliodes fibrosa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haliclona (S.) caerulea	0.0	1.1	10.7	2.1	3.6	9.5	7.5	6.3	4.9	6.5	1.2
Haliclona sp. (Black branching)	0.0	0.0	0.0	1.1	0.0	0.0	0.0	6.3	0.8	3.5	0.7
Monanchora clathrata	0.0	0.0	0.0	0.0	0.0	10.0	1.0	0.0	1.1	5.0	0.9
Mycale grandis	1.7	5.5	2.1	1.0	3.8	2.0	2.1	11.1	4.1	6.4	1.2
Mycale sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Porifera Unident. sp.	3.2	0.0	1.2	2.0	0.0	0.0	1.0	0.0	0.8	1.6	0.3
Porifera sp. (Grey)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Porifera sp.(Black)	6.6	1.2	2.1	0.0	0.0	0.0	0.0	0.0	0.8	2.3	0.4
Raspailia sp. (Black Knobby)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	10.5	2.0
Suberites auranticus	0.0	0.0	0.0	1.1	0.0	1.1	0.0	0.0	0.2	0.9	0.2
Tedania ignis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CNIDARIA											
Aiptasia pulchella	0.0	0.0	1.2	0.0	0.0	0.0	0.0	0.0	0.1	0.7	0.1

Utah Starboard Vertical Shallow

Site	UTVS01	UTVS04	UTVS07	UTV10	UTVS13	UTVS16	UTVS19	UTVS22	Mn	SD	SE
Pennaria disticha	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CORALS											
Leptastrea purpurea	0.0	0.0	0.0	1.0	1.1	3.3	4.2	0.0	1.0	2.7	0.5
Pocillopora damicornis	0.0	0.0	0.0	0.0	5.6	1.1	0.0	0.0	0.7	3.1	0.6
Porites compressa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.1
MOLLUSCS											
Hipponix imbricatus	0.0	0.0	0.0	0.0	0.0	0.0	12.6	0.0	1.3	5.5	1.0
POLYCHAETES											
Branchiomma sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.8	3.6	0.7
Eurythoe complanata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sabellastarte spectabilis	3.2	0.0	0.0	2.3	0.0	0.0	0.0	6.2	1.1	3.2	0.6
Salmacina dysteri (SDIST)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ASCIDIANS											
Phallusia sp.	1.7	2.2	0.0	2.1	0.0	1.1	0.0	0.0	0.8	1.8	0.3
BRYOZOANS											
Schizoporella sp.	0.0	4.4	0.0	1.0	3.6	0.0	1.1	2.6	1.3	3.4	0.6

Utah Starboard Vertical Mid depths

Site	VS02	VS05	VS08	VS09	VS11	VS14	VS17	VS20	VS21	VS23	VS25	Mn	SD	SE
MACROALGAE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.1
SPONGES	21.4	21.2	17.7	7.4	15.7	12.0	10.5	19.9	6.7	12.6	27.1	18.6	11.6	2.2
CNIDARIA	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.1
CORALS	0.0	1.0	1.6	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.3	1.0	0.2
MOLLUSCS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLYCHAETES	4.7	1.1	0.0	1.0	0.0	0.0	0.0	1.1	1.1	2.0	0.0	1.9	3.5	0.7
ASCIDIANS	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.1
BRYOZOANS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silt/Algae	73.9	63.9	55.7	89.3	83.2	74.2	84.4	69.6	63.7	85.4	0.0	72.3	14.2	2.7
Pavement	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shell/Sand	0.0	0.0	0.0	0.0	0.0	4.3	0.0	7.3	0.0	0.0	72.9	1.3	3.5	0.7
Silt	0.0	11.7	24.9	2.3	0.0	9.5	4.0	2.0	28.5	0.0	0.0	5.2	8.2	1.6
MACROALGAE														

Utah Starboard Vertical Mid depths

Site	VS02	VS05	VS08	VS09	VS11	VS14	VS17	VS20	VS21	VS23	VS25	Mn	SD	SE
Acanthophora spicifera	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dichotomaria marginata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unident. Algae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.1
SPONGES														
Biemna fistulosa	3.3	3.2	0.0	3.2	2.1	0.0	0.0	1.1	1.1	1.1	0.0	1.7	1.9	0.4
Callyspongia sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dysidea arenaria	0.0	0.0	12.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	4.9	0.9
Gelliodes fibrosa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haliclona (S.) caerulea	1.7	2.1	0.0	2.1	3.1	3.2	2.1	9.9	2.3	0.0	0.0	4.0	5.3	1.0
Haliclona sp. (Black branching)	0.0	1.1	0.0	0.0	0.0	3.3	0.0	0.0	0.0	0.0	0.0	0.5	1.2	0.2
Monanchora clathrata	7.8	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	3.0	0.6
Mycale grandis	1.7	6.5	0.0	1.0	4.0	2.1	2.1	5.5	1.1	3.2	0.0	5.4	7.7	1.5
Mycale sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Porifera Unident. sp.	0.0	3.1	3.2	1.0	1.1	0.0	2.0	1.1	0.0	7.2	0.0	2.4	3.1	0.6
Porifera sp. (Grey)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Porifera sp.(Black)	6.9	5.2	0.0	0.0	5.3	0.0	1.0	2.2	2.2	1.0	0.0	2.3	3.5	0.7
Raspailia sp. (Black Knobby)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27.1	0.0	0.0	0.0
Suberites auranticus	0.0	0.0	0.0	0.0	0.0	3.4	3.2	0.0	0.0	0.0	0.0	0.7	2.3	0.4
Tedania ignis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CNIDARIA														
Aiptasia pulchella	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.1
Pennaria disticha	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CORALS														
Leptastrea purpurea	0.0	1.0	1.6	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.3	1.0	0.2
Pocillopora damicornis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Porites compressa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MOLLUSCS														
Hipponix imbricatus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLYCHAETES														
Branchiomma sp.	0.0	1.1	0.0	1.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.8	1.9	0.4
Eurythoe complanata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sabellastarte spectabilis	4.7	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	2.0	0.0	1.1	2.7	0.5
Salmacina dysteri (SDIST)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ASCIDIANS														

Utah Starboard Vertical Mid depths

Site	VS02	VS05	VS08	VS09	VS11	VS14	VS17	VS20	VS21	VS23	VS25	Mn	SD	SE
Phallusia sp.	0.0	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.1
BRYOZOANS														
Schizoporella sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Utah Starboard Vertical Deep

Site	VS03	VS06	VS15	VS18	VS24	VS26	VS27	VS28	VS29	VS30	MN	SD	SE
MACROALGAE	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SPONGES	9.7	15.1	0.0	38.0	5.1	25.5	8.7	21.5	30.0	6.5	9.2	11.0	2.1
CNIDARIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CORALS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0
MOLLUSCS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
POLYCHAETES	7.5	7.0	0.0	0.0	0.0	4.2	12.2	6.5	5.9	0.0	4.8	10.8	2.1
ASCIDIANS	0.0	1.0	0.0	1.7	0.0	0.0	0.0	1.1	0.0	0.0	0.2	0.9	0.2
BRYOZOANS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silt/Algae	69.0	60.5	0.0	50.9	6.9	68.2	60.3	68.8	59.5	3.2	47.6	33.0	6.4
Pavement	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Shell/Sand	0.0	0.0	100.0	0.0	0.0	1.0	0.0	0.0	0.0	2.0	11.3	32.0	6.2
Silt	13.9	16.4	0.0	9.4	88.0	0.0	18.8	1.1	4.6	88.3	26.8	32.2	6.2
MACROALGAE													
Acanthophora spicifera	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dichotomaria marginata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unident. Algae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SPONGES													
Biemna fistulosa	3.2	6.3	0.0	1.9	3.4	3.2	3.3	3.2	2.2	0.0	2.3	2.8	0.5
Callyspongia sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dysidea arenaria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gelliodes fibrosa	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haliclona (S.) caerulea	0.0	1.4	0.0	0.0	0.0	0.0	0.0	6.5	6.6	1.1	0.8	1.7	0.3
Haliclona sp. (Black branching)	0.0	0.0	0.0	1.7	0.0	3.2	1.1	0.0	0.0	0.0	0.2	0.9	0.2
Monanchora clathrata	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mycale grandis	2.2	4.9	0.0	28.8	1.6	3.2	1.1	10.8	17.6	5.4	4.0	8.4	1.6
Mycale sp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Porifera Unident. sp.	3.2	2.5	0.0	3.8	0.0	6.5	3.3	1.1	2.2	0.0	1.4	2.4	0.5

[illegible]

Appendix D: Summary Statistics for Fish Community Factors for the USS Arizona and Utah Stations

Summary statistics by station for the USS Arizona: Survey dates: Dec. 14-16 2010

Location	Site	Depth (m)	Number of species	Number	Total biomass (g)	Number ha x (1000)	biomass (t/ha)	Diversity (H')	Evenness
HB	29	1.82	4	12	1716.54	0.96	1.37E-01	1.119	0.807
HB	30	2.13	6	32	4752.01	2.56	3.80E-01	1.435	0.801
HB	31	1.82	6	23	2058.02	1.84	1.65E-01	1.647	0.919
HB	32	3.96	4	8	1235.18	0.64	9.88E-02	1.213	0.875
HB	33	4.57	4	5	773.10	0.4	6.18E-02	1.332	0.961
HB	34	2.74	5	19	3335.64	1.52	2.67E-01	1.411	0.877
HB	35	5.79	1	1	57.51	0.08	4.60E-03	0.000	0.000
HB	36	6.70	1	2	76.59	0.16	6.13E-03	0.000	0.000
HB	37	3.04	3	16	534.23	1.28	4.27E-02	0.831	0.756
HB	38	3.04	4	9	748.27	0.72	5.99E-02	1.003	0.723
HB	39	6.70	3	28	1236.69	2.24	9.89E-02	0.656	0.597
HB	40	5.79	3	31	19164.21	2.48	1.53E+00	0.380	0.345
HB	41	7.62	1	1	46.47	0.08	3.72E-03	0.000	0.000
HB	42	8.53	0	0	0.00	0	0.00E+00	0.000	0.000
HB	43	3.65	1	10	661.71	0.8	5.29E-02	0.000	0.000
HB	44	7.62	0	0	0.00	0	0.00E+00	0.000	0.000
HB	45	7.01	3	9	2059.57	0.72	1.65E-01	0.684	0.622
HB	46	8.84	0	0	0.00	0	0.00E+00	0.000	0.000
HB	47	9.14	0	0	0.00	0	0.00E+00	0.000	0.000
HB	48	9.14	0	0	0.00	0	0.00E+00	0.000	0.000
HB	49	9.14	0	0	0.00	0	0.00E+00	0.000	0.000
HB	50	5.79	4	8	996.26	0.64	7.97E-02	1.213	0.875
HB	51	3.96	4	40	2433.75	3.2	1.95E-01	0.805	0.581
HB	52	1.52	3	26	694.68	2.08	5.56E-02	0.516	0.470
HB	54	1.52	5	28	9389.57	2.24	7.51E-01	1.110	0.690
HB	55	8.83	2	9	2465.17	0.72	1.97E-01	0.349	0.503
HB	56	8.83	2	10	1628.12	0.8	1.30E-01	0.325	0.469
HM	16	3.04	4	12	680.37	0.96	5.44E-02	0.983	0.709
HM	17	2.74	2	2	34.93	0.16	2.79E-03	0.693	1.000
HM	18	3.35	1	6	4.82	0.48	3.86E-04	0.000	0.000
HM	19	2.43	2	4	140.23	0.32	1.12E-02	0.562	0.811
HM	20	2.74	4	8	544.77	0.64	4.36E-02	1.213	0.875
HM	21	1.82	4	16	1984.37	1.28	1.59E-01	1.143	0.825
HM	22	0.91	3	8	614.49	0.64	4.92E-02	0.736	0.670
HM	23	2.13	0	0	0.00	0	0.00E+00	0.000	0.000
HM	24	1.52	7	34	6834.92	2.72	5.47E-01	1.598	0.821
HM	25	1.21	2	7	466.89	0.56	3.74E-02	0.410	0.592
HM	26	2.74	5	13	898.84	1.04	7.19E-02	1.418	0.881
HM	27	2.74	0	0	0.00	0	0.00E+00	0.000	0.000
HM	28	2.13	4	21	3539.04	1.68	2.83E-01	0.567	0.409
HS	1	2.43	1	2	1.61	0.16	1.29E-04	0.000	0.000
HS	2	2.13	3	6	453.42	0.48	3.63E-02	0.868	0.790
HS	3	2.44	0	0	0.00	0	0.00E+00	0.000	0.000
HS	4	2.43	5	10	444.31	0.8	3.55E-02	1.505	0.935
HS	5	2.43	1	2	115.02	0.16	9.20E-03	0.000	0.000
HS	6	2.43	3	28	9938.13	2.24	7.95E-01	0.307	0.279
HS	7	2.43	3	26	3645.32	2.08	2.92E-01	0.766	0.697
HS	8	2.74	3	40	4192.73	3.2	3.35E-01	0.233	0.212
HS	9	2.74	4	25	3236.49	2	2.59E-01	1.185	0.855
HS	10	3.04	3	13	339.09	1.04	2.71E-02	1.093	0.995
HS	11	2.43	4	64	1834.66	5.12	1.47E-01	1.107	0.799
HS	12	2.43	2	35	3917.15	2.8	3.13E-01	0.660	0.952
HS	13	2.44	0	0	0.00	0	0.00E+00	0.000	0.000

Location	Site	Depth (m)	Number of species	Number	Total biomass (g)	Number ha x (1000)	biomass (t/ha)	Diversity (H')	Evenness
HS	14	2.13	5	19	1761.32	1.52	1.41E-01	1.337	0.831
HS	15	3.04	1	2	1.61	0.16	1.29E-04	0.000	0.000
VPB	51	3.05	0	0	0.00	0	0.00E+00	0.000	0.000
VPB	52	7.92	0	0	0.00	0	0.00E+00	0.000	0.000
VPB	53	5.18	0	0	0.00	0	0.00E+00	0.000	0.000
VPB	54	5.79	1	1	387.57	0.08	3.10E-02	0.000	0.000
VPB	55	7.92	0	0	0.00	0	0.00E+00	0.000	0.000
VPB	56	7.92	0	0	0.00	0	0.00E+00	0.000	0.000
VPB	57	5.79	1	2	76.59	0.16	6.13E-03	0.000	0.000
VPB	58	7.92	0	0	0.00	0	0.00E+00	0.000	0.000
VPB	59	9.75	0	0	0.00	0	0.00E+00	0.000	0.000
VPB	60	3.66	0	0	0.00	0	0.00E+00	0.000	0.000
VPB	61	7.92	0	0	0.00	0	0.00E+00	0.000	0.000
VPM	42	4.26	1	7	6649.53	0.56	5.32E-01	0.000	0.000
VPM	43	7.92	0	0	0.00	0	0.00E+00	0.000	0.000
VPM	44	9.14	0	0	0.00	0	0.00E+00	0.000	0.000
VPM	45	3.05	0	0	0.00	0	0.00E+00	0.000	0.000
VPM	46	4.27	0	0	0.00	0	0.00E+00	0.000	0.000
VPM	47	7.92	1	11	488.63	0.88	3.91E-02	0.000	0.000
VPM	48	3.04	6	14	10321.23	1.12	8.26E-01	1.475	0.823
VPM	49	5.18	0	0	0.00	0	0.00E+00	0.000	0.000
VPM	50	8.23	0	0	0.00	0	0.00E+00	0.000	0.000
VPS	32	3.05	0	0	0.00	0	0.00E+00	0.000	0.000
VPS	33	7.01	0	0	0.00	0	0.00E+00	0.000	0.000
VPS	34	9.14	1	1	1.65	0.08	1.32E-04	0.000	0.000
VPS	36	3.96	0	0	0.00	0	0.00E+00	0.000	0.000
VPS	37	6.71	0	0	0.00	0	0.00E+00	0.000	0.000
VPS	38	8.53	0	0	0.00	0	0.00E+00	0.000	0.000
VPS	39	4.57	0	0	0.00	0	0.00E+00	0.000	0.000
VPS	40	6.40	0	0	0.00	0	0.00E+00	0.000	0.000
VPS	41	8.53	0	0	0.00	0	0.00E+00	0.000	0.000
VSBS	1	3.05	1	1	119.04	0.08	9.52E-03	0.000	0.000
VSBS	2	3.05	0	0	0.00	0	0.00E+00	0.000	0.000
VSBS	3	6.40	0	0	0.00	0	0.00E+00	0.000	0.000
VSBS	4	6.40	3	4	740.98	0.32	5.93E-02	1.040	0.946
VSBS	5	7.01	0	0	0.00	0	0.00E+00	0.000	0.000
VSBS	6	6.10	1	5	970.45	0.4	7.76E-02	0.000	0.000
VSBS	7	3.35	3	22	1835.29	1.76	1.47E-01	0.845	0.770
VSBS	8	8.53	0	0	0.00	0	0.00E+00	0.000	0.000
VSBS	9	9.14	1	14	1177.84	1.12	9.42E-02	0.000	0.000
VSBS	10	9.14	1	16	946.10	1.28	7.57E-02	0.000	0.000
VSM	11	4.57	1	5	232.37	0.4	1.86E-02	0.000	0.000
VSM	12	6.71	0	0	0.00	0	0.00E+00	0.000	0.000
VSM	13	8.53	0	0	0.00	0	0.00E+00	0.000	0.000
VSM	14	1.52	4	7	1937.72	0.56	1.55E-01	1.277	0.921
VSM	15	3.35	2	2	111.68	0.16	8.93E-03	0.693	1.000
VSM	16	6.40	0	0	0.00	0	0.00E+00	0.000	0.000
VSM	17	1.83	0	0	0.00	0	0.00E+00	0.000	0.000
VSM	18	4.27	0	0	0.00	0	0.00E+00	0.000	0.000
VSM	19	6.71	1	1	146.57	0.08	1.17E-02	0.000	0.000
VSS	20	3.35	1	2	115.02	0.16	9.20E-03	0.000	0.000
VSS	21	6.71	0	0	0.00	0	0.00E+00	0.000	0.000
VSS	22	8.23	0	0	0.00	0	0.00E+00	0.000	0.000
VSS	23	4.27	1	1	33.28	0.08	2.66E-03	0.000	0.000
VSS	24	5.79	0	0	0.00	0	0.00E+00	0.000	0.000
VSS	25	7.92	0	0	0.00	0	0.00E+00	0.000	0.000
VSS	26	3.05	1	13	503.18	1.04	4.03E-02	0.000	0.000
VSS	27	6.40	2	6	826.69	0.48	6.61E-02	0.451	0.650
VSS	28	8.53	0	0	0.00	0	0.00E+00	0.000	0.000

Location	Site	Depth (m)	Number of species	Number	Total biomass (g)	Number ha x (1000)	biomass (t/ha)	Diversity (H')	Evenness
VSS	29	3.05	0	0	0.00	0	0.00E+00	0.000	0.000
VSS	30	6.71	0	0	0.00	0	0.00E+00	0.000	0.000

Summary statistics by station for the USS Utah: Survey dates: Apr. 14, 2011

Location	Site	Depth (m)	Number of species	Number	Total biomass (g)	Number ha x (1000)	biomass (t/ha)	Diversity (H')	Evenness
HB	1	4.27	2	6	4.52	0.48	3.61E-04	0.45	0.65
HB	2	2.74	1	4	25.72	0.32	2.06E-03	0.00	0.00
HB	2	2.74	2	12	360.69	0.96	2.89E-02	0.29	0.41
HB	3	6.10	3	5	57.58	0.40	4.61E-03	0.95	0.86
HB	4	1.83	2	8	143.41	0.64	1.15E-02	0.66	0.95
HB	5	4.57	3	20	370.09	1.60	0.029607	0.82	0.75
HB	6	8.23	0	0	0.00	0.00	0.00E+00	0.00	0.00
HB	7	1.22	4	20	448.01	1.60	3.58E-02	1.35	0.97
HB	8	3.66	2	8	107.48	0.64	8.60E-03	0.56	0.81
HB	9	8.23	1	1	285.64	0.08	2.29E-02	0.00	0.00
HB	10	0.61	1	1	5.50	0.08	4.40E-04	0.00	0.00
HB	11	4.88	1	1	31.88	0.08	2.55E-03	0.00	0.00
HB	12	9.45	0	0	0.00	0.00	0.00E+00	0.00	0.00
HB	13	1.22	1	5	50.01	0.40	4.00E-03	0.00	0.00
HB	14	3.05	4	8	353.26	0.64	2.83E-02	1.21	0.88
HB	15	9.75	0	0	0.00	0.00	0.00E+00	0.00	0.00
HM	16	2.13	6	24	1746.83	1.92	0.139746	1.62	0.90
HM	17	4.57	5	7	458.76	0.56	3.67E-02	1.55	0.96
HM	18	8.53	1	1	0.80	0.08	6.43E-05	0.00	0.00
HM	19	2.13	1	7	2.71	0.56	2.17E-04	0.00	0.00
HM	20	4.57	3	15	1539.46	1.20	0.123157	0.88	0.80
HM	21	9.75	2	2	254.93	0.16	2.04E-02	0.69	1.00
HM	22	2.44	9	59	4204.51	4.72	0.336361	1.05	0.48
HM	23	4.88	4	5	336.40	0.40	2.69E-02	1.33	0.96
HM	24	9.75	0	0	0.00	0.00	0.00E+00	0.00	0.00
HM	25	2.74	1	12	459.52	0.96	3.68E-02	0.00	0.00
HM	26	4.57	2	27	1319.38	2.16	0.105551	0.66	0.95
HM	27	10.67	0	0	0.00	0.00	0.00E+00	0.00	0.00
HM	28	2.44	1	5	604.08	0.40	4.83E-02	0.00	0.00
HM	29	4.27	1	7	845.71	0.56	0.067656	0.00	0.00
HM	30	10.67	0	0	0.00	0.00	0.00E+00	0.00	0.00
HM	31	3.66	4	25	1263.69	2.00	0.101095	0.86	0.62
HM	32	7.62	0	0	0.00	0.00	0.00E+00	0.00	0.00
HM	33	10.67	0	0	0.00	0.00	0	0.00	0.00
HS	34	3.66	2	2	38.61	0.16	3.09E-03	0.69	1.00
HS	35	6.40	2	8	370.44	0.64	0.029635	0.38	0.54
HS	36	11.28	0	0	0.00	0.00	0.00E+00	0.00	0.00
HS	37	6.10	3	4	11.83	0.32	9.47E-04	1.04	0.95
HS	38	10.97	3	5	125.71	0.40	1.01E-02	0.95	0.86
HS	39	11.89	1	1	106.96	0.08	8.56E-03	0.00	0.00
HS	40	6.40	2	2	31.45	0.16	2.52E-03	0.69	1.00
HS	41	10.67	0	0	0.00	0.00	0.00E+00	0.00	0.00
HS	42	10.06	1	2	0.17	0.16	1.37E-05	0.00	0.00
VSB	1	4.27	1	2	63.76	0.16	5.10E-03	0.00	0.00
VSB	2	6.71	0	0	0.00	0.00	0.00E+00	0.00	0.00
VSB	3	9.45	0	0	0.00	0.00	0.00E+00	0.00	0.00
VSB	4	3.05	0	0	0.00	0.00	0.00E+00	0.00	0.00
VSB	5	6.40	1	1	0.09	0.08	6.85E-06	0.00	0.00
VSB	6	8.84	0	0	0.00	0.00	0.00E+00	0.00	0.00
VSB	7	1.52	0	0	0.00	0.00	0.00E+00	0.00	0.00
VSB	8	4.57	1	2	0.07	0.16	5.41E-06	0.00	0.00
VSB	9	6.40	0	0	0.00	0.00	0.00E+00	0.00	0.00
VSM	10	1.22	1	1	0.09	0.08	6.85E-06	0.00	0.00
VSM	11	4.57	0	0	0.00	0.00	0.00E+00	0.00	0.00
VSM	12	7.32	1	3	0.95	0.24	7.61E-05	0.00	0.00
VSM	13	1.83	4	31	1011.63	2.48	8.09E-02	0.92	0.66
VSM	14	3.96	1	3	0.49	0.24	3.91E-05	0.00	0.00

Location	Site	Depth (m)	Number of species	Number	Total biomass (g)	Number ha x (1000)	biomass (t/ha)	Diversity (H')	Evenness
VSM	15	7.92	0	0	0.00	0.00	0.00E+00	0.00	0.00
VSM	16	2.13	1	4	68.16	0.32	5.45E-03	0.00	0.00
VSM	17	3.96	0	0	0.00	0.00	0.00E+00	0.00	0.00
VSM	18	8.23	2	2	1.71	0.16	1.37E-04	0.69	1.00
VSM	19	2.44	4	24	1410.15	1.92	0.112812	0.82	0.59
VSM	20	4.27	1	11	0.94	0.88	7.53E-05	0.00	0.00
VSM	21	7.32	1	1	0.09	0.08	6.85E-06	0.00	0.00
VSS	22	3.35	3	5	375.56	0.40	3.00E-02	0.95	0.86
VSS	23	5.49	1	3	362.45	0.24	2.90E-02	0.00	0.00
VSS	24	7.62	1	1	5.50	0.08	4.40E-04	0.00	0.00
VSS	25	7.01	1	4	420.31	0.32	3.36E-02	0.00	0.00
VSS	26	8.23	0	0	0.00	0.00	0.00E+00	0.00	0.00
VSS	27	9.45	0	0	0.00	0.00	0.00E+00	0.00	0.00
VSS	28	7.92	1	1	0.09	0.08	6.85E-06	0.00	0.00
VSS	29	9.14	0	0	0.00	0.00	0.00E+00	0.00	0.00
VSS	30	9.75	0	0	0.00	0.00	0.00E+00	0.00	0.00

Appendix E: Listing of Marine or Estuarine Organisms Collected or Observed in Pearl Harbor from all Available Sources prior to Present Study

Pearl Harbor - Species Report

KINGDOM: MONERA

Phylum: CYANOPHYCOTA

Class: CYANOPHYCEAE

Order: NOSTOCALES

Family: OSCILLATORIACEAE

Genus: *Lyngbya*

Lyngbya sp.

1996 Legacy Project (Coles et al., 1997)

Lyngbya majuscula (Dillwyn) Harv. Ex Gomont

2007 Ref - Brock, 2007

Genus: *Phormidium*

Phormidium crosbyamum

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

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

Pearl Harbor - 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

Family: Derbesiaceae

Genus: *Derbesia*

Derbesia tenuissima

2007 Ref - Brock, 2007

(Moris & De Notaris) Crouan & Crouan

Recorded as *Derbesia tenuissima*.

Class: CHLOROPHYCEAE

Order: ULOTRICHALES

Family: ULVACEAE

Genus: *Enteromorpha*

Enteromorpha intestinalis

1972 Ref - Long, 1974

1979 Ref - AECOS, 1979

((Linnaeus) Link, 1820)

Off Pearl Harbor.

Off Pearl Harbor.

Genus: *Ulva*

Ulva sp.

1943 Ref - Hutchins, 1949

Ulva fasciata

1973 Ref - Evans et al., 1974

1978 Ref - Grovhoug, 1979

1979 Ref - AECOS, 1979

Delile, 1813

Off Pearl Harbor.

Ulva lactuca

1973 Ref - Evans et al., 1974

Linnaeus, 1753 Indigenous. Hawaiian name: kohu/ lipehe.

Ulva reticulata

1973 Ref - Evans et al., 1974

1979 Ref - AECOS, 1979

Forsskal, 1775

Off Pearl Harbor.

Order: CLADOPHORALES

Family: CLADOPHORACEAE

Genus: *Chaetomorpha*

Chaetomorpha indica

1979 Ref - AECOS, 1979

Kützting

Off Pearl Harbor.

Genus: *Cladophora*

Cladophora sp.

1973 Ref - Evans et al., 1974

1996 Legacy Project (Coles et al., 1997)

2007 Legacy II Project (Coles et al., 2009)

Indigenous.

Cladophora fascicularis

1979 Ref - AECOS, 1979

(Mertens)

Off Pearl Harbor.

Order: CAULERPALES

Family: CAULERPACEAE

Genus: *Caulerpa*

Caulerpa racemosa

1979 Ref - AECOS, 1979

(Forsskal) J. Agardh, 1872

Off Pearl Harbor.

Caulerpa sertularioides

Unknown Spec - BPBM-AL 515478

1973 Ref - Evans et al., 1974

(Gmelin) Howe, 1905

Middle Loch.

Pearl Harbor - Species Report (Cont.)

1996 Legacy Project (Coles et al., 1997)

Caulerpa verticillata J. Agardh, 1847

1973 Ref - Evans et al., 1974

Family: CODIACEAE

Genus: *Chlorodesmis*

Chlorodesmis caespitosa J. Agardh

1996 Legacy Project (Coles et al., 1997)

Genus: *Codium*

Codium arabicum Kützinger, 1856

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Codium dichotomum (Hudson, 1762)

1972 Ref - Long, 1974 Off Pearl Harbor.

Codium edule Silva, 1952

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

Codium reediae Silva, in Egerod, 1952

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Genus: *Halimeda*

Halimeda discoidea Decaisne, 1842

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Order: SIPHONOCCLADALES

Family: SIPHONOCCLADACEAE

Genus: *Cladophoropsis*

Cladophoropsis luxurians Gilbert, 1962

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Family: VALONIACEAE

Genus: *Boodlea*

Boodlea composita ((Harvey & Hooker) Brand, 1905)

Unknown Spec - BPBM-AL 92645

1996 Legacy Project (Coles et al., 1997)

Boodlea hiloense (Pilsbry & Vanatta, 1908)

1973 Ref - Evans et al., 1974

Genus: *Dictyosphaeria*

Dictyosphaeria versluysii Weber-van Bosse, 1905 Indigenous.

1996 Legacy Project (Coles et al., 1997)

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

Pearl Harbor - Species Report (Cont.)

Order: PERIDINIALES

Family: CERATIACEAE

Genus: *Ceratium*

Ceratium ferka (Ehrenberg)

1973 Ref - Evans et al., 1974

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 & Kofoed)

1973 Ref - Evans et al., 1974

Family: PERIDINIACEAE

Genus: *Peridinium*

Peridinium crassipes (Kofoed)

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 sp. Indigenous.

2007 Legacy II Project (Coles et al., 2009)

Dictyota sp.? Indigenous.

1978 Ref - Grovhoug, 1979 Recorded as Dictyocha.

Dictyota acutiloba J. Agardh, 1848

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Dictyota bartayresii Lamouroux

2007 Ref - Brock, 2007

Dictyota divaricata Lamouroux, 1809

1972 Ref - Long, 1974 Off Pearl Harbor.

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Genus: *Lobophora*

Lobophora variegata (Lamouroux) Indigenous.

1979 Ref - AECOS, 1979 Off Pearl Harbor.

1996 Legacy Project (Coles et al., 1997)

2008 Legacy II Project (Coles et al., 2009)

Pearl Harbor - Species Report (Cont.)

Genus: <i>Padina</i>			
<i>Padina</i> sp.		Indigenous.	
2008	Legacy II Project (Coles et al., 2009)		
<i>Padina japonica</i>		Boergesen	
1979	Ref - AECOS, 1979		Off Pearl Harbor.
<i>Padina pavonica</i>		(Linnaeus, 1758)	
1972	Ref - Long, 1974		Off Pearl Harbor.
Order: FUCALES			
Family: SARGASSACEAE			
Genus: <i>Sargassum</i>			
<i>Sargassum echinocarpum</i>		J. Agardh	
1979	Ref - AECOS, 1979		Off Pearl Harbor.
<i>Sargassum obtusifolium</i>		J. Agardh	
1979	Ref - AECOS, 1979		Off Pearl Harbor.
<i>Sargassum polyphyllum</i>		J. Agardh	
1979	Ref - AECOS, 1979		Off Pearl Harbor.
Order: SCYTOSIPHONALES			
Family: SCYTOSIPHONACEAE			
Genus: <i>Colpomenia</i>			
<i>Colpomenia sinuosa</i>		(Roth)	
1979	Ref - AECOS, 1979		Off Pearl Harbor.
Genus: <i>Hydroclathrus</i>			
<i>Hydroclathrus clathratus</i>		(C. Agardh)	
1979	Ref - AECOS, 1979		Off Pearl Harbor.
Phylum: RHODOPHYCOTA			
Family: GELIDIACEAE			
Genus: <i>Gelidium</i>			
<i>Gelidium</i> sp.			
1996	Legacy Project (Coles et al., 1997)		
<i>Gelidium arenaria</i>		Kylin	
1996	Legacy Project (Coles et al., 1997)		
<i>Gelidium pusillum</i>		(Stackhouse) Lejolis, 1863	
1996	Legacy Project (Coles et al., 1997)		
Family: PEYSONNELIACEAE			
Genus: <i>Peysonnelia</i>			
<i>Peysonnelia</i> sp.			
1996	Legacy Project (Coles et al., 1997)		
Class: RHODOPHYCEAE			
Order: NEMALIALES			
Family: BONNEMAISONIACEAE			
Genus: <i>Asparagopsis</i>			
<i>Asparagopsis taxiformis</i>		(Delile)	
1979	Ref - AECOS, 1979		Off Pearl Harbor.
Family: GELIDIELLACEAE			
Genus: <i>Gelidiella</i>			
<i>Gelidiella</i> sp.		Indigenous.	
1982	Spec - BPBM-AL 585470		E shore of entrance; reef at Fort Kamehameha.
2007	Legacy II Project (Coles et al., 2009)		
<i>Gelidiella</i> sp. 1			
1996	Legacy Project (Coles et al., 1997)		

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Gelidiella sp. 2

1996 Legacy Project (Coles et al., 1997)

Gelidiella myrocladia (Borgesen) Feldmann & Hamel, 1934

1996 Legacy Project (Coles et al., 1997)

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;

1978 Spec - BPBM-AL 561795 opposite the National Guard hanger area.
Reef flat between W end of the Reef Runway & entrance to Pearl Harbor;

1979 Ref - AECOS, 1979 opposite the National Guard hanger area.
Off Pearl Harbor.

Gracilaria lichenoides Linnaeus

1973 Ref - Evans et al., 1974

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 Introduced. Common name: Gorilla Ogo.

1996 Legacy Project (Coles et al., 1997)
2006 Ref - Smith et al., 2006
2007 Ref - Brock, 2007
2007 Legacy II Project (Coles et al., 2009)
2008 Legacy II Project (Coles et al., 2009)

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) Kützinger, 1849

1996 Legacy Project (Coles et al., 1997)

Hypnea valentiae (Turner) Montagne, 1841

1996 Legacy Project (Coles et al., 1997)

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.

Pearl Harbor - Species Report (Cont.)

Genus: *Lithothamnium*

Lithothamnium byssoides

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Genus: *Porolithon*

Porolithon onkodes (Heydrich) Foslie, 1909

1979 Ref - AECOS, 1979 Off Pearl Harbor.

1996 Legacy Project (Coles et al., 1997)

Family: CRYPTONEMIACEAE

Genus: *Halymenia*

Halymenia formosa Harvey

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Family: RHIZOPHYLLIDACEAE

Genus: *Chondrococcus*

Chondrococcus hornemannii (Harvey)

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Order: RHODYMENIALES

Family: CHAMPIACEAE

Genus: *Champia*

Champia parvula (C. Agardh)

1979 Ref - AECOS, 1979 Off Pearl Harbor.

1996 Legacy Project (Coles et al., 1997)

Family: RHODYMENIACEAE

Genus: *Coelothrix*

Coelothrix irregularis (Harv.) Børgesen

2007 Ref - Brock, 2007

Coelothrix irregularis (Harvey)

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Order: CERAMIALES

Family: CERAMIACEAE

Genus: *Aglaothamnion*

Aglaothamnion sp. 1

1996 Legacy Project (Coles et al., 1997)

Aglaothamnion sp. 2

1996 Legacy Project (Coles et al., 1997)

Genus: *Anotricium*

Anotricium sp.

1996 Legacy Project (Coles et al., 1997)

Anotricium secundum Caormaci, Funari & Pizzuto

1996 Legacy Project (Coles et al., 1997)

Genus: *Centroceras*

Centroceras clavulatum (C. Agardh)

1973 Ref - Evans et al., 1974

1979 Ref - AECOS, 1979 Off Pearl Harbor.

1996 Legacy Project (Coles et al., 1997)

Genus: *Centrocerus*

Centrocerus sp.

1996 Legacy Project (Coles et al., 1997)

Genus: *Ceramium*

Ceramium sp.

1979 Ref - AECOS, 1979

1996 Legacy Project (Coles et al., 1997) Off Pearl Harbor.

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Ceramium sp. 1

1996 Legacy Project (Coles et al., 1997)

Ceramium sp. 2

1996 Legacy Project (Coles et al., 1997)

Ceramium clarionense

Setchell and Gardner, 1930

1996 Legacy Project (Coles et al., 1997)

Genus: *Griffithsia*

Griffithsia sp.

1973 Ref - Evans et al., 1974

Recorded as Griffithsia.

1979 Ref - AECOS, 1979

Off Pearl Harbor. Recorded as Griffithsia.

Griffithsia heteromorpha

Kützing, 1863

1996 Legacy Project (Coles et al., 1997)

Genus: *Spyridia*

Spyridia sp.

Indigenous.

2007 Legacy II Project (Coles et al., 2009)

Spyridia filamentosa

(Wulfen)

1973 Ref - Evans et al., 1974

1979 Ref - AECOS, 1979

Off Pearl Harbor.

Genus: *Tolypocladia*

Tolypocladia sp.

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

1996 Legacy Project (Coles et al., 1997)

Tolypocladia glomerulata

(C. Agardh) Schmitz, 1897

1996 Legacy Project (Coles et al., 1997)

Family: RHODOMELACEAE

Genus: *Acanthophora*

Acanthophora spicifera

(Vahl, 1802) Introduced. Common name(: Spiny Seaweed; Hawaiian name: 'o'opu-hue.

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 Legacy Project (Coles et al., 1997)

2006 Ref - Smith et al., 2006

2007 Ref - Brock, 2007

2007 Legacy II Project (Coles et al., 2009)

2008 Legacy II Project (Coles et al., 2009)

Genus: *Laurencia*

Laurencia brachyclados

Pilger

1996 Legacy Project (Coles et al., 1997)

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 Legacy Project (Coles et al., 1997)

Polysiphonia mollis

J. Hooker & Harvey in Harvey, 1847

Unknown Spec - BPBM-AL 189658

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Unknown Spec - BPBM-AL 189659 West Loch.
Polysiphonia scopulorum (Harvey) Hollenberg, 1968
1996 Legacy Project (Coles et al., 1997)
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.
2008 Legacy II Project (Coles et al., 2009)

Family: AMPHISTEGINIDAE

Genus: *Amphistegina*

Amphistegina lessonii

1977 Spec - BPBM-A 160 d'Orbigny, 1826 Off Pearl Harbor. Identified by Philip Papish, 1980.

Amphistegina lobifera

1977 Spec - BPBM-A 161 Larsen, 1976 Off Pearl Harbor. Identified by Philip Papish, 1980.

Class: CILIATEA

Family: FOLLICULINIDAE

Genus: *Parafolliculina*

Parafolliculina violaceae

1975 Ref - Grovhoug, 1976 Giard, 1888

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 mangle

1996 Legacy Project (Coles et al., 1997) Linnaeus Introduced. Common name: Red Mangrove.
2007 Ref - Brock, 2007
2007 Legacy II Project (Coles et al., 2009)
2008 Legacy II Project (Coles et al., 2009)

Pearl Harbor - Species Report (Cont.)

KINGDOM: ANIMALIA

Phylum: PORIFERA

Unidentified Porifera

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

Family: CRAMBEIDAE

Genus: *Monanchora*

<i>Monanchora clathrata</i>	Carter, 1883	New record for Hawaii. Cryptogenic.
2008	Legacy II Project (Coles et al., 2009)	

Family: DESMACIDIDAE

Genus: *Iotrochota*

<i>Iotrochota</i> sp.	Indigenous.	Common name: Black Staining Sponge.
2007	Legacy II Project (Coles et al., 2009)	
2008	Legacy II Project (Coles et al., 2009)	

<i>Iotrochota purpurea</i>	(Bowerbank,, 875)	New record for Hawaii. Cryptogenic.
2008	Legacy II Project (Coles et al., 2009)	

Family: PETROSIIDAE

Genus: *Petrosia*

<i>Petrosia</i> sp.	Indigenous.
2008	Legacy II Project (Coles et al., 2009)

Family: PHORIOSPONGIIDAE

Genus: *Strongylacidon*

<i>Strongylacidon kaneohe</i>	(de Laubenfels, 1950)	Indigenous.
2008	Legacy II Project (Coles et al., 2009)	

Class: CALCAREA

Order: LEUCETTIDA

Family: LEUCASCIDAE

Genus: *Leucetta*

<i>Leucetta solida</i>	de Laubenfels, 1950	Indigenous.
2008	Legacy II Project (Coles et al., 2009)	

Order: LEUCOLENIIIDA

Family: LEUCOLENIIIDAE

Genus: *Leuconia*

<i>Leuconia</i> n. sp.	Known only from Hawaii.
1996	Legacy Project (Coles et al., 1997)

Order: SYCETTIDA

Family: HETEROPIIDAE

Genus: *Heteropia*

<i>Heteropia glomerosa</i>	(Bowerbank, 1873)	Cryptogenic.
1996	Legacy Project (Coles et al., 1997)	
1999	USS Missouri Project (Coles et al. 1999)	

Family: SYCETTIDAE

Genus: *Sycon*

<i>Sycon</i> sp.		
1972	Ref - Long, 1974	Off Pearl Harbor.

Pearl Harbor - Species Report (Cont.)

Class: DEMOSPONGIAE

Order: DICTYOCERATIDA

Family: SPONGIIDAE

Genus: *Hyatella*

Hyatella intestinalis Lamarck, 1814 Cryptogenic.
1996 Legacy Project (Coles et al., 1997)

Genus: *Spongia*

Spongia oceanica de Laubenfels, 1950
1993 Ref - Brock, 1994
1994 Ref - Brock, 1995

Order: DENDROCERATIDA

Family: APLYSELLIDAE

Genus: *Aplysilla*

Aplysilla cf. rosea Barrois, 1876
1996 Legacy Project (Coles et al., 1997)

Genus: *Chelonaplysilla*

Chelonaplysilla violacea Lendenfeld, 1883 Indigenous.
1996 Legacy Project (Coles et al., 1997)
2007 Legacy II Project (Coles et al., 2009)
2008 Legacy II Project (Coles et al., 2009)

Family: DICTYODEDRILLIDAE

Genus: *Dictyodendrilla*

Dictyodendrilla n. sp. Known only from Hawaii.
1996 Legacy Project (Coles et al., 1997)
1999 USS Missouri Project (Coles et al. 1999)

Dictyodendrilla sp. Indigenous.
2008 Legacy II Project (Coles et al., 2009)

Family: DYSIDEIDAE

Genus: *Dendrilla*

Dendrilla cactus (Selenka, 1867)
1993 Ref - Brock, 1994
1994 Ref - Brock, 1995

Genus: *Dysidea*

Dysidea n. sp. 1 Known only from Hawaii.
1996 Legacy Project (Coles et al., 1997)

Dysidea n. sp. 2 Known only from Hawaii.
1996 Legacy Project (Coles et al., 1997)

Dysidea n. sp. 3 Cryptogenic.
1996 Legacy Project (Coles et al., 1997)

Dysidea sp. Indigenous.
2008 Legacy II Project (Coles et al., 2009)

Dysidea arenaria (Schmidt, 1862) Introduced. Common name: Acquisitive Sponge.
2007 Legacy II Project (Coles et al., 2009)
2008 Legacy II Project (Coles et al., 2009)

Dysidea avara sensu de Laubenfels 1950
1996 Legacy Project (Coles et al., 1997)

Dysidea cf. arenaria Bergquist, 1965 Cryptogenic.
1996 Legacy Project (Coles et al., 1997)

Dysidea herbacea (Keller, 1889)
1993 Ref - Brock, 1994
1994 Ref - Brock, 1995

Pearl Harbor - Species Report (Cont.)

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 Legacy Project (Coles et al., 1997)

1999 USS Missouri Project (Coles et al. 1999)

Family: CHALINIDAE

Genus: *Cladocroce*

Cladocroce burapha Putchakarn, de Weerd, Sonchaeng & van Soest, 2004 New record for Hawaii. Cryptogenic.

2007 Legacy II Project (Coles et al., 2009)

2008 Legacy II Project (Coles et al., 2009)

Genus: *Toxiclona*

Toxiclona n. sp. Known only from Hawaii.

1996 Legacy Project (Coles et al., 1997)

1999 USS Missouri Project (Coles et al. 1999)

Family: HALICLONIDAE

Genus: *Gellius*

Gellius n. sp.

1996 Legacy Project (Coles et al., 1997)

1999 USS Missouri Project (Coles et al. 1999)

Genus: *Haliclona*

Haliclona sp. Indigenous.

2007 Legacy II Project (Coles et al., 2009)

Haliclona (Reniera) sp. 1 Indigenous.

2008 Legacy II Project (Coles et al., 2009)

Haliclona (Reniera) sp. 2 Indigenous.

2008 Legacy II Project (Coles et al., 2009)

Haliclona (Soestella) caerulea (Hechtel, 1965) Introduced.

1996 Legacy Project (Coles et al., 1997)

2007 Legacy II Project (Coles et al., 2009)

2008 Legacy II Project (Coles et al., 2009)

Haliclona aquaeducta Schmidt, 1862

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

2007 Ref - Brock, 2007

Recorded as *H. aquaedactyla*.

Recorded as *H. aquaedactyla*.

Family: NIPHATIDAE

Genus: *Gelliodes*

Gelliodes sp. Indigenous.

2008 Legacy II Project (Coles et al., 2009)

Gelliodes fibrosa (Wilson) Introduced.

1996 Legacy Project (Coles et al., 1997)

2008 Legacy II Project (Coles et al., 2009)

Order: POECILOSCLERIDA

Family: ADOCIIDAE

Unidentified Adociidae n. gen. n. sp.

1996 Legacy Project (Coles et al., 1997)

Pearl Harbor - Species Report (Cont.)

Genus: *Pellina*

Pellina eusiphonia

Ridley, 1884

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

Genus: *Toxadocia*

Toxadocia violacea

de Laubenfels, 1950

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

Family: AMPHILECTIDAE

Genus: *Biemna*

Biemna fistulosa

Topsent, 1897 Cryptogenic. Common name: Tubular Biemna.

1996 Legacy Project (Coles et al., 1997)

2007 Legacy II Project (Coles et al., 2009)

2008 Legacy II Project (Coles et al., 2009)

Family: Coelosphaeridae

Genus: *Lissodendoryx*

Lissodendoryx (Lissodendoryx) similis New record for Hawaii. Cryptogenic.

2008 Legacy II Project (Coles et al., 2009)

Family: Hymedesmiidae

Genus: *Hamigera*

Hamigera sp.

Indigenous. Common name: Red Boring Sponge.

2007 Legacy II Project (Coles et al., 2009)

Family: MICROCIONIDAE

Genus: *Clathria*

Clathria sp.

Indigenous. Common name: Vermilion Clathria.

2008 Legacy II Project (Coles et al., 2009)

1999 USS Missouri Project (Coles et al. 1999)

Clathria (Microciona) n. sp.

Known only from Hawaii.

1996 Legacy Project (Coles et al., 1997)

Clathria (Microciona) maunaloa

de Laubenfels, 1951

1993 Ref - Brock, 1994

Recorded as Microciona maunaloa.

1994 Ref - Brock, 1995

Recorded as Microciona maunaloa.

2007 Ref - Brock, 2007

Recorded as Microciona maunaloa.

Family: MYCALIDAE

Genus: *Mycale*

Mycale sp.

Cryptogenic.

1973 Ref - McCain, 1974

1973 Ref - McCain, 1975

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 Legacy Project (Coles et al., 1997)

1999 USS Missouri Project (Coles et al. 1999)

2007 Ref - Brock, 2007

Recorded as Mycale cecilia.

2008 Legacy II Project (Coles et al., 2009)

Mycale (Carmia) contarenii

sensu de Laubenfels, 1951

1996 Legacy Project (Coles et al., 1997)

Mycale (Carmia) maunakea

de Laubenfels, 1936 Known only from Hawaii.

1996 Legacy Project (Coles et al., 1997)

Mycale (Mycale) grandis

Gray, 1867 Introduced. Common name: Orange Keyhole Sponge.

1996 Legacy Project (Coles et al., 1997) Recorded as Mycale armata

1999 USS Missouri Project (Coles et al. 1999)

2007 Ref - Brock, 2007

Recorded as Mycale armata.

Pearl Harbor - Species Report (Cont.)

2007 Legacy II Project (Coles et al., 2009)
 2008 Legacy II Project (Coles et al., 2009)

Mycale (Zygomycale) parishii **Bowerbank, 1875** **Introduced.**
 1947 Ref - de Laubenfels, 1950 Recorded as *Zygomycale parishii*.
 1973 Ref - McCain, 1974 Recorded as *Zygomycale parishii*.
 1973 Ref - McCain, 1975 Recorded as *Zygomycale parishii*.
 1993 Ref - Brock, 1994 Recorded as *Zygomycale parishii*.
 1994 Ref - Brock, 1995 Recorded as *Zygomycale parishii*.
 1996 Legacy Project (Coles et al., 1997) Recorded as *Zygomycale parishii*.
 1999 USS Missouri Project (Coles et al. 1999) Recorded as *Zygomycale parishii*.
 2007 Ref - Brock, 2007 Recorded as *Zygomycale parishii*.
 2008 Legacy II Project (Coles et al., 2009)

Mycale phyllophila **Hentschel, 1911** **New record for Hawaii. Cryptogenic.**
 2008 Legacy II Project (Coles et al., 2009)

Genus: *Stylinos*
***Stylinos* sp.** **Indigenous. Common name: Orange Stylinos.**
 2008 Legacy II Project (Coles et al., 2009)

Family: MYXILLIDAE

Genus: *Tedania*

Tedania (Tedania) ignis **(Duchassaing & Michelotti, 1864)** **Cryptogenic. Common name: Fire Sponge.**
 1973 Ref - McCain, 1974 Recorded as *Tedania ignis*.
 1973 Ref - McCain, 1975 Recorded as *Tedania ignis*.
 1993 Ref - Brock, 1994 Recorded as *Tedania ignis*.
 1994 Ref - Brock, 1995 Recorded as *Tedania ignis*.
 2007 Ref - Brock, 2007 Recorded as *Tedania ignis*.
 2007 Legacy II Project (Coles et al., 2009)
 2008 Legacy II Project (Coles et al., 2009)

Tedania macrodactyla **(Lamarck, 1814)** **Cryptogenic.**
 1993 Ref - Brock, 1994
 1994 Ref - Brock, 1995

Tedania reticulata **Thiele, 1903**
 1996 Legacy Project (Coles et al., 1997)

Family: PHORBASIDAE

Genus: *Damiriana*

Damiriana hawaiiiana **de Laubenfels, 1951**
 1993 Ref - Brock, 1994
 1994 Ref - Brock, 1995

Family: RASPAILIIDAE

Genus: *Echinodictyum*

Echinodictyum asperum **Ridley and Dendy, 1886** **Cryptogenic.**
 1996 Legacy Project (Coles et al., 1997)

Genus: *Phycopsis*

Phycopsis aculeata **(Wilson)**
 1973 Ref - Evans et al., 1974

Genus: *Raspailia*

Raspailia (Clathriodendron) darwinensis **Hooper, 1991** **New record for Hawaii. Indigenous.**
 2008 Legacy II Project (Coles et al., 2009)

Pearl Harbor - Species Report (Cont.)

Order: HALICHONDRIIDA

Family: HALICHONDRIIDAE

Genus: *Amorphinopsis*

Amorphinopsis n. sp. Known only from Hawaii.

1996 Legacy Project (Coles et al., 1997)

Genus: *Ciocalypa*

Ciocalypa sp. Cryptogenic.

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

2008 Legacy II Project (Coles et al., 2009)

Ciocalypa sp. 1 Indigenous.

2008 Legacy II Project (Coles et al., 2009)

Genus: *Halichondria*

Halichondria sp. Indigenous.

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

2007 Legacy II Project (Coles et al., 2009)

Halichondria coerulea

Bergquist, 1967 Cryptogenic.

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

2007 Ref - Brock, 2007

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 Legacy Project (Coles et al., 1997)

2007 Ref - Brock, 2007

Genus: *Topsentia*

Topsentia sp. Indigenous.

2008 Legacy II Project (Coles et al., 2009)

Topsentia cf. halichondrioides

Dendy, 1905 Cryptogenic.

1996 Legacy Project (Coles et al., 1997)

Topsentia dura

Lindgren, 1897

2007 Ref - Brock, 2007

Recorded as *Halichondria dura*.

Topsentia halichondrioides

(Dendy, 1905) New record for Hawaii. Cryptogenic.

2007 Legacy II Project (Coles et al., 2009)

2008 Legacy II Project (Coles et al., 2009)

Family: HYMENIACIDONIDAE

Genus: *Hymeniacidon*

Hymeniacidon sp.

1973 Ref - Evans et al., 1974

Order: HADROMERIDA

Family: CLIONIDAE

Genus: *Cliona*

Cliona sp. Introduced.

1996 Legacy Project (Coles et al., 1997)

Cliona vastifica

Hancock, 1849

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

Pearl Harbor - Species Report (Cont.)

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 Known only from Hawaii.

1996 Legacy Project (Coles et al., 1997)
1999 USS Missouri Project (Coles et al. 1999)

Genus: *Pseudosuberites*

Pseudosuberites sp. Indigenous.

2008 Legacy II Project (Coles et al., 2009)

Genus: *Suberites*

Suberites aurantiacus (Duchassaing & Michelotti, 1864) 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 Legacy Project (Coles et al., 1997)
2007 Ref - Brock, 2007 Recorded as *Terpios zeteki*.
2007 Legacy II Project (Coles et al., 2009)
2008 Legacy II Project (Coles et al., 2009)

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
2007 Ref - Brock, 2007

Family: STELLETTIDAE

Genus: *Stelletta*

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

1996 Legacy Project (Coles et al., 1997)

Phylum: CNIDARIA

Unidentified Cnidaria

1996 Legacy Project (Coles et al., 1997)

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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	Legacy Project (Coles et al., 1997)	

Order: HYDROIDA

Unidentified Hydroida

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

Family: BOUGAINVILLIIDAE

Unidentified Bougainvilliidae

1999	USS Missouri Project (Coles et al. 1999)
2007	Legacy II Project (Coles et al., 2009)
2008	Legacy II Project (Coles et al., 2009)

Genus: *Garveia*

<i>Garveia humilis</i>	(McCrady, 1856)	Cryptogenic.
1975	Ref - Grovhoug, 1976	

Family: CAMPANULARIIDAE

Unidentified Campanulariidae

2008	Legacy II Project (Coles et al., 2009)
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Genus: *Clytia*

<i>Clytia cf. gracilis</i>	(M. Sars, 1850)	New record for Hawaii. Cryptogenic.
2007	Legacy II Project (Coles et al., 2009)	
2008	Legacy II Project (Coles et al., 2009)	

Clytia hemisphaerica (Linnaeus, 1767) Introduced.

1978	Ref - Grovhoug, 1979
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Clytia latithecata Millard and Bouillon, 1973 Cryptogenic.

2008	Legacy II Project (Coles et al., 2009)
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Genus: *Obelia*

Obelia sp.

1972	Ref - Long, 1974	Off Pearl Harbor.
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Obelia bidentata? Introduced.

1978	Ref - Grovhoug, 1979
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Obelia dichotoma (Linnaeus, 1758) Introduced.

1975	Ref - Grovhoug, 1976
1978	Ref - Grovhoug, 1979
2007	Legacy II Project (Coles et al., 2009)
2008	Legacy II Project (Coles et al., 2009)

Family: CLAVIDAE

Genus: *Corydendrium*

<i>Corydendrium parasiticum</i>	(Linnaeus, 1767)	New record for Hawaii. Cryptogenic.
2008	Legacy II Project (Coles et al., 2009)	

Genus: *Turritopsis*

<i>Turritopsis nutricula</i>	(McCrady, 1856)	Introduced.
1975	Ref - Grovhoug, 1976	

Family: HALECIIDAE

Genus: *Halecium*

<i>Halecium sp.</i>	Indigenous.
2008	Legacy II Project (Coles et al., 2009)

Pearl Harbor - Species Report (Cont.)

<i>Halecium</i> sp.?		Indigenous.	
1948	Spec - BPBM-D 288		Drydock #2.
Family: PENNARIIDAE			
Genus: <i>Pennaria</i>			
<i>Pennaria disticha</i>		(Goldfuss, 1820)	Introduced. Common Name: Christmas Tree Hydroid.
1929	Spec - BPBM-D 183		
1943	Ref - Hutchins, 1949		Recorded as <i>Pennaria</i> sp..
1944	Spec - BPBM-D 250		Off Pearl Harbor.
1948	Spec - BPBM-D 289		Drydock #4.
1972	Ref - Long, 1974		Recorded as <i>Pennaria tiarella</i> McCrady.
1973	Ref - Evans et al., 1974		Recorded as <i>Pennaria tiarella</i> McCrady.
1978	Ref - Grovhoug, 1979		Recorded as <i>Halocordyle disticha</i> .
1986	Ref - Lenihan, 1990		Recorded as <i>Pennaria tiarella</i> .
1993	Ref - Brock, 1994		Recorded as <i>Halocordyle disticha</i> .
1994	Ref - Brock, 1995		Recorded as <i>Halocordyle disticha</i> .
1996	Legacy Project (Coles et al., 1997)		Recorded as <i>Halocordyle disticha</i> .
1999	USS Missouri Project (Coles et al. 1999)		Recorded as <i>Halocordyle disticha</i> .
2007	Ref - Brock, 2007		Recorded as <i>Halocordyle disticha</i> .
2008	Legacy II Project (Coles et al., 2009)		
Family: PLUMULARIIDAE			
Unidentified Plumulariidae			
1948	Spec - BPBM-D 290		Drydock #4.
Genus: <i>Plumularia</i>			
<i>Plumularia goodei</i> ?		Nutting, 1900	
1972	Ref - Long, 1974		Off Pearl Harbor.
Family: TUBULARIIDAE			
Genus: <i>Tubularia</i>			
<i>Tubularia</i> 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: <i>Aurelia</i>			
<i>Aurelia labiata</i> ?		Chamisso & Eysenhardt, 1820	
1973	Ref - Evans et al., 1974		Recorded as <i>Balanus labiata</i> .
Order: RHIZOSTOMEAE			
Family: CASSIOPEIDAE			
Genus: <i>Cassiopea</i>			
<i>Cassiopea medusa</i>		Light, 1914	Introduced.
1941	Ref - Doty, 1961		
Family: MASTIGIIDAE			
Genus: <i>Phyllorhiza</i>			
<i>Phyllorhiza punctata</i>		von Ledenfeld, 1884	Introduced.
1941	Ref - Doty, 1961		Recorded as <i>Cotylorhizoides pacificus</i> .
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.

Pearl Harbor - Species Report (Cont.)

Genus: *Actiniaria*

Actiniaria

Indigenous.

2008 Legacy II Project (Coles et al., 2009)

Order: TELESTACEA

Family: TELESTIDAE

Genus: *Carijoa*

Carijoa aff. riisei

Duchassaing & Michelotti, 1860 Introduced. Common name: Snowflake Coral.

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	Legacy Project (Coles et al., 1997)	Recorded as Carijoa (Telestea) riisei
1999	USS Missouri Project (Coles et al. 1999)	Recorded as Carijoa (riisei)
2007	Ref - Brock, 2007	Recorded as Telesto riisei.
2008	Legacy II Project (Coles et al., 2009)	

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: *Protopalythoa*

Protopalythoa sp.

Indigenous.

2008 Legacy II Project (Coles et al., 2009)

Genus: *Zoanthus*

Zoanthus pacificus

Walsh & Bowers, 1971

1993	Ref - Brock, 1994
1994	Ref - Brock, 1995
2007	Ref - Brock, 2007

Zoanthus sp. (white)

Indigenous. Common name: White Zoanthid.

2007	Legacy II Project (Coles et al., 2009)
2008	Legacy II Project (Coles et al., 2009)

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 Indigenous. Common name: Glass Anemone.

1978 Ref - Grovhoug, 1979

Pearl Harbor - Species Report (Cont.)

1986 Ref - Lenihan, 1990
 1993 Ref - Brock, 1994
 1994 Ref - Brock, 1995
 1996 Legacy Project (Coles et al., 1997)
 2007 Ref - Brock, 2007
 2008 Legacy II Project (Coles et al., 2009)

Family: DIADUMENIDAE

Genus: *Diadumene*

Diadumene leucolena (Verrill, 1866) Introduced.
 1977 Ref - Cuttress, 1977

Family: HORMATHIIDAE

Genus: *Calliactis*

Calliactis polypus? (Forsskål, 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 capitata (Dana, 1846) Indigenous. Common name: Rice Coral.
 2006 Ref - Smith et al., 2006
 2008 Legacy II Project (Coles et al., 2009)

Montipora flabellata Studer, 1902
 2006 Ref - Smith et al., 2006

Montipora patula Verrill, 1864 Indigenous. Common name: Sandpaper Rice Coral.
 1996 Legacy Project (Coles et al., 1997)
 2006 Ref - Smith et al., 2006

Family: AGARICIIDAE

Genus: *Leptoseris*

Leptoseris incrustans (Quelch, 1886)
 2006 Ref - Smith et al., 2006

Genus: *Pavona*

Pavona varians Verrill, 1864 Indigenous. Common name: Corrugated Coral.
 2006 Ref - Smith et al., 2006

Family: SIDERASTREIDAE

Genus: *Psammocora*

Psammocora explanulata Van der Horst, 1922
 2006 Ref - Smith et al., 2006

Family: DENDROPHYLLIIDAE

Genus: *Tubastraea*

Tubastraea sp.
 1950 Spec - BPBM-SC 340 Pearl Harbor drydock.

Family: FAVIIDAE

Genus: *Leptastrea*

Leptastrea purpurea Dana, 1846 Indigenous. Common name: Crust Coral.
 1993 Ref - Brock, 1994
 1994 Ref - Brock, 1995
 1996 Legacy Project (Coles et al., 1997)
 1999 USS Missouri Project (Coles et al. 1999)
 2006 Ref - Smith et al., 2006
 2007 Ref - Brock, 2007
 2007 Legacy II Project (Coles et al., 2009)
 2008 Legacy II Project (Coles et al., 2009)

Pearl Harbor - Species Report (Cont.)

Family: FUNGIIDAE

Genus: *Fungia*

Common name: mushroom coral; Hawaiian names: ko`akohe; hu`ahu`a akai.

Fungia sp.

Unknown Spec - BPBM-SC 399

Family: POCILLOPORIDAE

Genus: *Pocillopora*

Pocillopora damicornis

Linnaeus, 1758 Indigenous. Common name: Lace Coral; Hawaiian name: `ako`ako`a.

1972 Ref - Long, 1974 Off Pearl Harbor. Recorded as *Pocillopora cespitosa*
laysanensis Vaughan.
 1996 Legacy Project (Coles et al., 1997)
 2006 Ref - Smith et al., 2006
 2008 Legacy II Project (Coles et al., 2009)

Pocillopora ligulata

1904 Spec - BPBM-SC 142

Pocillopora meandrina

Dana, 1846 Indigenous. Common name: Cauliflower Coral.

1972 Ref - Long, 1974 Off Pearl Harbor.
 1973 Ref - Evans et al., 1974 Off Pearl Harbor.
 1996 Legacy Project (Coles et al., 1997)
 2006 Ref - Smith et al., 2006
 2008 Legacy II Project (Coles et al., 2009)

Family: PORITIDAE

Genus: *Porites*

Porites compressa

Dana, 1846 Hawaiian name: pokahu puna. Indigenous. Common name: Finger Coral; Hawaiian name: `ako`ako`a.

1904 Spec - BPBM-SC 456 Outside Pearl Harbor.
 1996 Legacy Project (Coles et al., 1997)
 2006 Ref - Smith et al., 2006
 2008 Legacy II Project (Coles et al., 2009)

Porites lobata

Dana, 1846 Indigenous. Common name: Lobe Coral.

2006 Ref - Smith et al., 2006

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 Legacy Project (Coles et al., 1997)

Class: TURBELLARIA

Order: POLYCLADIDA

Family: PLANOCERIDAE

Genus: *Planocera*

Planocera sp.

1973 Ref - Evans et al., 1974

Planocera oligoglana

1999 USS Missouri Project (Coles et al. 1999)
 1973 Ref - Evans et al., 1974

Class: CESTODA

Genus: *Tylocephalum*

Tylocephalum sp.

1965 Ref - Rifkin & Cheng, 1968

Pearl Harbor - Species Report (Cont.)

Phylum: NEMATODA

Unidentified Nematoda

1996 Legacy Project (Coles et al., 1997)

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) Indigenous.

1973	Ref - Evans et al., 1974	
1979	Ref - AECOS, 1979	Off Pearl Harbor.
1996	Legacy Project (Coles et al., 1997)	
2008	Legacy II Project (Coles et al., 2009)	

Family: APHRODITIDAE

Unidentified Aphroditidae

1978 Ref - Grovhoug, 1979

Family: ARABELLIDAE

Genus: *Arabella*

Arabella sp.

1973	Ref - Evans et al., 1974
1996	Legacy Project (Coles et al., 1997)

Arabella iridescens Treadwell, 1906

1973 Ref - Evans et al., 1974

Family: CAPITELLIDAE

Unidentified Capitellidae

1978	Ref - Grovhoug, 1979
1996	Legacy Project (Coles et al., 1997)

Genus: *Dasybranchus*

Dasybranchus lumbricoides Grube, 1878

1973 Ref - Evans et al., 1974

Family: CHAETOPTERIDAE

Unidentified Chaetopteridae

1978	Ref - Grovhoug, 1979
1996	Legacy Project (Coles et al., 1997)
2007	Legacy II Project (Coles et al., 2009)
2008	Legacy II Project (Coles et al., 2009)

Genus: *Chaetopterus*

Chaetopterus sp. (Renier, 1804) Cryptogenic. Common name: Parchment Worm.

1976	Ref - Grovhoug & Rastetter, 1980	Recorded as <i>Chaetopterus variopodectus</i> .
1993	Ref - Brock, 1994	Recorded as <i>C. variopodus</i> .
1994	Ref - Brock, 1995	Recorded as <i>C. variopodus</i> .
1996	Legacy Project (Coles et al., 1997)	
1999	USS Missouri Project (Coles et al. 1999)	
2008	Legacy II Project (Coles et al., 2009)	

Chaetopterus variopodatus Renier, 1804

2007 Ref - Brock, 2007

Pearl Harbor - Species Report (Cont.)

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

2007 Legacy II Project (Coles et al., 2009)

2008 Legacy II Project (Coles et al., 2009)

Genus: *Cirratulus*

Cirratulus sp.

1929 Spec - BPBM-R 1451

1973 Ref - Evans et al., 1974

Genus: *Cirriformia*

Cirriformia sp.

Indigenous.

1973 Ref - Evans et al., 1974

2008 Legacy II Project (Coles et al., 2009)

Cirriformia hawaiiensis

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 Legacy Project (Coles et al., 1997)

1999 USS Missouri Project (Coles et al. 1999)

Family: COSSURIDAE

Unidentified Cossuridae

1978 Ref - Grovhoug, 1979

Family: DORVILLEIDAE

Unidentified Dorvilleidae

1996 Legacy Project (Coles et al., 1997)

2007 Legacy II Project (Coles et al., 2009)

Genus: *Dorvillea*

Dorvillea sp.

1973 Ref - Evans et al., 1974

1973 Ref - McCain, 1974

1973 Ref - McCain, 1975

Genus: *Schistomeringos*

Schistomeringos sp.

Indigenous.

2008 Legacy II Project (Coles et al., 2009)

Family: EUNICIDAE

Unidentified Eunicidae

1978 Ref - Grovhoug, 1979

2007 Legacy II Project (Coles et al., 2009)

2008 Legacy II Project (Coles et al., 2009)

Genus: *Eunice*

Eunice sp.

1973 Ref - Evans et al., 1974

1999 USS Missouri Project (Coles et al. 1999)

1996 Legacy Project (Coles et al., 1997)

Eunice antennata

(Savigny, 1820) Indigenous.

1973 Ref - Evans et al., 1974

1999 USS Missouri Project (Coles et al. 1999)

2008 Legacy II Project (Coles et al., 2009)

Pearl Harbor - Species Report (Cont.)

Eunice australis Quatrefages, 1865

1973 Ref - Evans et al., 1974
1996 Legacy Project (Coles et al., 1997)

Eunice cariboea (Grube, 1856) Indigenous.

1996 Legacy Project (Coles et al., 1997)
1999 USS Missouri Project (Coles et al. 1999)
2008 Legacy II Project (Coles et al., 2009)

Eunice filamentosa Grube, 1856

1973 Ref - Evans et al., 1974
1996 Legacy Project (Coles et al., 1997)

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 Legacy Project (Coles et al., 1997)

Genus: *Marphysa*

Marphysa sp. Indigenous.

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.
2008 Legacy II Project (Coles et al., 2009)

Marphysa corallina Kinberg, 1865 Indigenous.

2008 Legacy II Project (Coles et al., 2009)

Marphysa sanguinea (Montagu, 1815)

1938 Spec - BPBM-R 1364 Identified by G. Tien.
1973 Ref - Evans et al., 1974
1996 Legacy Project (Coles et al., 1997)

Genus: *Nematonereis*

Nematonereis unicornis Schmarda, 1861 Indigenous.

1973 Ref - Evans et al., 1974
1973 Ref - McCain, 1974
1973 Ref - McCain, 1975
1996 Legacy Project (Coles et al., 1997)
2008 Legacy II Project (Coles et al., 2009)

Genus: *Palola*

Palola siciliensis Borradaile, 1898

1973 Ref - Evans et al., 1974 Recorded as *Eunice siciliensis*.
1996 Legacy Project (Coles et al., 1997)

Genus: *Paramarphysa*

Paramarphysa sp.

1973 Ref - Evans et al., 1974

Family: GLYCERIDAE

Genus: *Glycera*

Glycera tessellata Grube, 1863

1996 Legacy Project (Coles et al., 1997)

Family: HESIONIDAE

Unidentified Hesionidae

1978 Ref - Grovhoug, 1979

Genus: *Syllidia*

Syllidia armata Quatrefages, 1865

1996 Legacy Project (Coles et al., 1997)

Pearl Harbor - Species Report (Cont.)

Family: LUMBRINERIDAE

Unidentified Lumbrineridae

1973	Ref - Evans et al., 1974
1973	Ref - McCain, 1974
1973	Ref - McCain, 1975
2008	Legacy II Project (Coles et al., 2009)

Genus: *Lumbrineris*

Lumbrineris sp.

1996	Legacy Project (Coles et al., 1997)
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Lumbrineris dentata Hartmann-Schroder, 1965 Indigenous.

2008	Legacy II Project (Coles et al., 2009)
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Family: LYSARETIDAE

Genus: *Oenone*

Oenone fulgida (Savigny) Cryptogenic.

1999	USS Missouri Project (Coles et al. 1999)
1973	Ref - Evans et al., 1974

Family: NEREIDIDAE

Unidentified Nereididae

1931	Spec - BPBM-R 1488	
1978	Ref - Grovhoug, 1979	Recorded as Nereidae.
1996	Legacy Project (Coles et al., 1997)	
2007	Legacy II Project (Coles et al., 2009)	
2008	Legacy II Project (Coles et al., 2009)	

Genus: *Ceratonereis*

Ceratonereis sp.

1973	Ref - Evans et al., 1974
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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
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Genus: *Nereis*

Nereis sp.

1973	Ref - Evans et al., 1974
1987	Ref - Brewer & Assoc., 1987

Nereis sp. 1

1973	Ref - McCain, 1974	Recorded as <i>Nereis</i> sp. 1.
1973	Ref - McCain, 1975	Recorded as <i>Nereis</i> sp. 1.
1999	USS Missouri Project (Coles et al. 1999)	

Nereis sp. 2

1973	Ref - McCain, 1974	Recorded as <i>Nereis</i> sp. 2.
1973	Ref - McCain, 1975	Recorded as <i>Nereis</i> sp. 2.
1999	USS Missouri Project (Coles et al. 1999)	

Nereis areanacoedonta

Moore, 1903 Introduced.

1973	Ref - Evans et al., 1974	Recorded as <i>Nereis</i> (<i>Neanthes</i>) <i>caudata</i> (Delle Chiaje).
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Nereis corallina

Kinberg, 1866

1966	Ref - Hartman, 1966
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Pearl Harbor - Species Report (Cont.)

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 <i>Perinereis cultrifera</i> .
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Genus: *Platynereis*

Platynereis sp.

1973	Ref - Evans et al., 1974	
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Genus: *Pseudonereis*

Pseudonereis variegata (Grube, 1857)

1999	USS Missouri Project (Coles et al. 1999)	Recorded as <i>Nereis varigata</i>
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Family: ONUPHIDAE

Genus: *Diopatra*

Diopatra sp.

1973	Ref - Evans et al., 1974	
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Family: OPHELIIDAE

Unidentified Opheliidae

1978	Ref - Grovhoug, 1979	
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Genus: *Armandia*

Armandia sp.

1996	Legacy Project (Coles et al., 1997)	
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Family: ORBINIIDAE

Unidentified Orbiniidae

1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	

Family: PARAONIDAE

Unidentified Paraonidae

1978	Ref - Grovhoug, 1979	
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Family: PHYLLODOCIDAE

Unidentified Phyllodocidae

1978	Ref - Grovhoug, 1979	
2007	Legacy II Project (Coles et al., 2009)	
2008	Legacy II Project (Coles et al., 2009)	

Genus: *Eulalia*

Eulalia sp.

1996	Legacy Project (Coles et al., 1997)	
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Eulalia sanguinea Oersted, 1843

1966	Ref - Hartman, 1966	
1996	Legacy Project (Coles et al., 1997)	

Genus: *Eumida*

Eumida sanguinea (Oersted, 1843)

1966	Ref - Hartman, 1966	
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Unidentified *Eumida*

1996	Legacy Project (Coles et al., 1997)	
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Genus: *Phyllodoce*

Phyllodoce sp.

1996	Legacy Project (Coles et al., 1997)	
1999	USS Missouri Project (Coles et al. 1999)	

Family: POLYNOIDAE

Unidentified Polynoidae

1996	Legacy Project (Coles et al., 1997)	
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Pearl Harbor - Species Report (Cont.)

Genus: *Hololepidella*

Hololepidella nigropunctata

(Horst, 1915)

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 Legacy Project (Coles et al., 1997)

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.

1999 USS Missouri Project (Coles et al. 1999)

2007 Legacy II Project (Coles et al., 2009)

2008 Legacy II Project (Coles et al., 2009)

Genus: *Amphiglena*

Amphiglena sp.

Cryptogenic.

2008 Legacy II Project (Coles et al., 2009)

Amphiglena mediterranea

(Leydig, 1851)

Cryptogenic.

2008 Legacy II Project (Coles et al., 2009)

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. cingulata*.

1996 Legacy Project (Coles et al., 1997)

1999 USS Missouri Project (Coles et al. 1999)

2007 Ref - Brock, 2007

2007 Legacy II Project (Coles et al., 2009)

2008 Legacy II Project (Coles et al., 2009)

Genus: *Demonax*

Demonax sp.

Indigenous.

2008 Legacy II Project (Coles et al., 2009)

Demonax leucaspis

Kinberg, 1867

1975 Ref - Grovhoug, 1976

1976 Ref - Cooke et al., 1980

Genus: *Potamethus*

Potamethus sp.

Indigenous.

2008 Legacy II Project (Coles et al., 2009)

Genus: *Potamilla*

Potamilla sp.

Indigenous.

1996 Legacy Project (Coles et al., 1997)

2007 Legacy II Project (Coles et al., 2009)

2008 Legacy II Project (Coles et al., 2009)

Pearl Harbor - Species Report (Cont.)

Genus: *Sabella*

Sabella sp.

1973 Ref - Evans et al., 1974

Genus: *Sabellastarte*

Sabellastarte indica (Savigny, 1818) Indigenous.

2007 Legacy II Project (Coles et al., 2009)

2008 Legacy II Project (Coles et al., 2009)

Sabellastarte spectabilis (Grube, 1878) Introduced. Common name: Feather Duster Worm.

1976 Ref - Grovhoug & Rastetter, 1980 Recorded as *Sabellastarte sanctijosephi*.
 1979 Ref - AECOS, 1979 Off Pearl Harbor. Recorded as *Sabellastarte sanctijosephi*.
 1980 Ref - Grovhoug & Rastetter, 1980 Recorded as *Sabellastarte sanctijosephi*.
 1986 Ref - Lenihan, 1990 Recorded as *Sabellastarte sanctijosephi*.
 1987 Ref - AECOS, 1987 Recorded as *Sabellastarte sanctijosephi*.
 1993 Ref - Brock, 1994 Recorded as *Sabellastarte sanctijosephi*.
 1994 Ref - Brock, 1995 Recorded as *Sabellastarte sanctijosephi*.
 1996 Legacy Project (Coles et al., 1997) Recorded as *Sabellastarte sanctijosephi*.
 1999 USS Missouri Project (Coles et al. 1999) Recorded as *Sabellastarte sanctijosephi*.
 2006 Ref - Smith et al., 2006
 2007 Ref - Brock, 2007
 2007 Legacy II Project (Coles et al., 2009)
 2008 Legacy II Project (Coles et al., 2009)

Family: SERPULIDAE

Unidentified Serpulidae

1978 Ref - Grovhoug, 1979
 1979 Ref - AECOS, 1979 Off Pearl Harbor.
 1996 Legacy Project (Coles et al., 1997)
 2007 Legacy II Project (Coles et al., 2009)
 2008 Legacy II Project (Coles et al., 2009)

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. Indigenous.

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
 2007 Legacy II Project (Coles et al., 2009)
 2008 Legacy II Project (Coles et al., 2009)

Hydroides brachyacantha Rioja, 1941 Introduced.

2008 Legacy II Project (Coles et al., 2009)

Hydroides crucigera (Morch, 1863) Introduced.

1937 Ref - Straughan, 1969
 1938 Ref - Straughan, 1969
 1972 Ref - Long, 1974
 1973 Ref - Evans et al., 1974
 2008 Legacy II Project (Coles et al., 2009)

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).

Pearl Harbor - Species Report (Cont.)

1935	Ref - Ingram, 1937	Recorded as <i>H. lunulifera</i> .
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 <i>H. lunulifera</i> (Claparede, 1868).
1938	Spec - BPBM-R 1094	
1938	Spec - BPBM-R 1095	
1972	Ref - Long, 1974	
1973	Ref - Evans et al., 1974	Recorded as <i>H. lunulifera</i> (Claparede, 1868).
1973	Ref - McCain, 1974	Recorded as <i>H. lunulifera</i> .
1973	Ref - McCain, 1975	Recorded as <i>H. lunulifera</i> .
1975	Ref - Grovhoug, 1976	Recorded as <i>Hydroides norvegica</i> Gunnerus, 1768.
1976	Ref - Cooke et al., 1980	Recorded as <i>H. lunulifera</i> (Claparede, 1868).
1996	Legacy Project (Coles et al., 1997)	
2008	Legacy II Project (Coles et al., 2009)	
<i>Hydroides elegans</i> (Haswell, 1883) Introduced.		
1929	Spec - BPBM-R 1101	Identified by D. Straughan.
1929	Ref - Straughan, 1969	Recorded as <i>H. norvegica</i> Gunnerus, 1768.
1935	Ref - Edmondson, 1944	Recorded as <i>H. norvegica</i> Gunnerus, 1768.
1935	Ref - Ingram, 1937	Recorded as <i>H. norvegica</i> 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 <i>H. norvegica</i> Gunnerus, 1768.
1973	Ref - Evans et al., 1974	Recorded as <i>H. norvegica</i> Gunnerus, 1768.
1973	Ref - McCain, 1974	Recorded as <i>H. norvegica</i> .
1973	Ref - McCain, 1975	Recorded as <i>H. norvegica</i> .
1975	Ref - Grovhoug, 1976	Recorded as <i>Hydroides norvegica</i> Gunnerus, 1768.
1976	Ref - Cooke et al., 1980	
1978	Ref - Grovhoug, 1979	
1985	Ref - Hurlbut, 1990	
1987	Ref - Brewer & Assoc., 1987	
1996	Legacy Project (Coles et al., 1997)	
1999	USS Missouri Project (Coles et al. 1999)	
2007	Legacy II Project (Coles et al., 2009)	
2008	Legacy II Project (Coles et al., 2009)	
<i>Hydroides sanctaecrucis</i> Morch, 1863		
1972	Ref - Long, 1974	Off Pearl Harbor.
<i>Hydroides uncinata</i> Phillipe, 1844		
1972	Ref - Long, 1974	
Genus: <i>Neodexiospira</i>		
<i>Neodexiospira foraminosa</i> (Moore & Bush, 1904) Introduced.		
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	

Pearl Harbor - Species Report (Cont.)

Genus: *Pileolaria*

Pileolaria militaris Claparede, 1868 Introduced.
2008 Legacy II Project (Coles et al., 2009)

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 Legacy Project (Coles et al., 1997)
2007 Ref - Brock, 2007
2008 Legacy II Project (Coles et al., 2009)

Genus: *Salmacina*

Salmacina dysteri Huxley, 1855 Introduced. Common name: Sea Frost.
1972 Ref - Long, 1974
1986 Ref - Lenihan, 1990
1993 Ref - Brock, 1994
1994 Ref - Brock, 1995
1996 Legacy Project (Coles et al., 1997)
1999 USS Missouri Project (Coles et al. 1999)
2007 Ref - Brock, 2007
2007 Legacy II Project (Coles et al., 2009)
2008 Legacy II Project (Coles et al., 2009)

Genus: *Serpula*

Serpula sp. Indigenous.
2008 Legacy II Project (Coles et al., 2009)

Serpula vermicularis Linnaeus, 1767 Cryptogenic.
1938 Ref - Straughan, 1969
1940 Ref - Straughan, 1969
1948 Ref - Straughan, 1969
1996 Legacy Project (Coles et al., 1997)
1999 USS Missouri Project (Coles et al. 1999)
2007 Ref - Brock, 2007
2007 Legacy II Project (Coles et al., 2009)
2008 Legacy II Project (Coles et al., 2009)

Genus: *Simplicaria*

Simplicaria pseudomilitaris (Thirèot-Quièvreux, 1965) Cryptogenic.
1996 Legacy Project (Coles et al., 1997)
2008 Legacy II Project (Coles et al., 2009)

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

Pearl Harbor - Species Report (Cont.)

1987 Ref - Bailey-Brock & Hartman, 1987
 1996 Legacy Project (Coles et al., 1997)
 2008 Legacy II Project (Coles et al., 2009)

Family: SPIONIDAE

Unidentified Spionidae

1978 Ref - Grovhoug, 1979
 1996 Legacy Project (Coles et al., 1997)
 2008 Legacy II Project (Coles et al., 2009)

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 Legacy Project (Coles et al., 1997)
 2008 Legacy II Project (Coles et al., 2009)

Family: SYLLIDAE

Unidentified Syllidae

1978 Ref - Grovhoug, 1979
 1996 Legacy Project (Coles et al., 1997)
 2007 Legacy II Project (Coles et al., 2009)
 2008 Legacy II Project (Coles et al., 2009)

Genus: *Autolytus*

Autolytus sp.
 1996 Legacy Project (Coles et al., 1997)

Genus: *Branchiosyllis*

Branchiosyllis exilis (Gravier, 1900)
 1996 Legacy Project (Coles et al., 1997)
 1999 USS Missouri Project (Coles et al. 1999)

Genus: *Brania*

Brania rhopalophora (Ehlers, 1897)
 1996 Legacy Project (Coles et al., 1997)

Genus: *Exogone*

Exogone verugera (Claparède, 1869)
 1996 Legacy Project (Coles et al., 1997)

Genus: *Haplosyllis*

Haplosyllis spongicola (Grube, 1855)
 1973 Ref - Evans et al., 1974 Recorded as Syllis spongicola.
 1996 Legacy Project (Coles et al., 1997)
 1999 USS Missouri Project (Coles et al. 1999)

Genus: *Langerhansia*

Langerhansia cornuta (Rathke, 1843)
 1973 Ref - Evans et al., 1974 Recorded as Syllis cornuta.
 1996 Legacy Project (Coles et al., 1997)

Genus: *Myrianida*

Myrianida crassicirrata
 1996 Legacy Project (Coles et al., 1997)
 1999 USS Missouri Project (Coles et al. 1999)

Genus: *Opisthosyllis*

Opisthosyllis sp.
 1973 Ref - Evans et al., 1974

Pearl Harbor - Species Report (Cont.)

Genus: *Syllis*

Syllis sp.

1973 Ref - Evans et al., 1974

Syllis gracilis

1996 Legacy Project (Coles et al., 1997)

1999 USS Missouri Project (Coles et al. 1999)

Typosyllis variegata (Grube, 1860)

1973 Ref - Evans et al., 1974

Recorded as *Syllis variegata*.

Genus: *Trypanosyllis*

Trypanosyllis sp. Indigenous.

2008 Legacy II Project (Coles et al., 2009)

Trypanosyllis zebra (Grube, 1860)

1973 Ref - Evans et al., 1974

1996 Legacy Project (Coles et al., 1997)

1999 USS Missouri Project (Coles et al. 1999)

Genus: *Typosyllis*

Typosyllis sp.

1996 Legacy Project (Coles et al., 1997)

1999 USS Missouri Project (Coles et al. 1999)

Typosyllis hawaiiensis Hartmann-Schröder, 1965

1996 Legacy Project (Coles et al., 1997)

Typosyllis hyalina (Grube, 1863)

1996 Legacy Project (Coles et al., 1997)

Typosyllis prolifera

1996 Legacy Project (Coles et al., 1997)

1999 USS Missouri Project (Coles et al. 1999)

Family: TEREBELLIDAE

Unidentified Terebellidae

1978 Ref - Grovhoug, 1979

2007 Legacy II Project (Coles et al., 2009)

2008 Legacy II Project (Coles et al., 2009)

Genus: *Loimia*

Loimia medusa

(Savigny, 1818) Indigenous. Common name: Medusa Spaghettii Worm; Hawaiian name: kauna'oa.

2007 Legacy II Project (Coles et al., 2009)

2008 Legacy II Project (Coles et al., 2009)

Genus: *Thelepus*

Thelepus setosus (Quatrefages, 1865) Indigenous.

1973 Ref - Evans et al., 1974

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

1996 Legacy Project (Coles et al., 1997)

1999 USS Missouri Project (Coles et al. 1999)

2006 Ref - Smith et al., 2006

2007 Ref - Brock, 2007

2007 Legacy II Project (Coles et al., 2009)

Class: OLIGOCHAETA

Order: RHYNCHOBDELLIDA

Family: PISCICOLIDAE

Unidentified Piscicolidae

1973 Ref - Evans et al., 1974

Phylum: MOLLUSCA

Unidentified Mollusca

1914 Spec - BPBM-MO 65001

1917 Spec - BPBM-MO 18

1922 Spec - BPBM-MO 37

Ford Island. Catalogue V.
Off Pearl Harbor.

Pearl Harbor - Species Report (Cont.)

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: APLYSIIDAE

Unidentified Aplysiidae

2008 Legacy II Project (Coles et al., 2009)

Genus: *Tambja*

Tambja morosa (Bergh, 1877) Indigenous. Common name: Gloomy Nudibranch.

2008 Legacy II Project (Coles et al., 2009)

Family: CUSPIDARIIDAE

Genus: *Cuspidaria*

Cuspidaria sp. Indigenous.

2008 Legacy II Project (Coles et al., 2009)

Cuspidaria hawaiiensis Dall, Bartsch, and Rehder, 1938 Indigenous. Common name: Noble

Vermittid.

2007 Legacy II Project (Coles et al., 2009)

2008 Legacy II Project (Coles et al., 2009)

Family: MESODESMATIDAE

Genus: *Rocheffortina*

Rocheffortina sandwichensis Hayami & Kase, 1993 Indigenous.

2008 Legacy II Project (Coles et al., 2009)

Class: GASTROPODA

Family: CAECIDAE

Genus: *Caecum*

Caecum sepimentum de Folin, 1867

1996 Legacy Project (Coles et al., 1997)

Family: CEPHALASPIDAE

Unidentified Cephalaspidae

1996 Legacy Project (Coles et al., 1997)

Family: DIALIDAE

Genus: *Cerithidium*

Cerithidium perparvulum (Watson, 1886)

1973 Ref - Evans et al., 1974

Recorded as Obtortio perparvulum.

1996 Legacy Project (Coles et al., 1997)

Genus: *Diala*

Diala semistriata

1973 Ref - Evans et al., 1974

Recorded as Diala varia.

Diala varia A. Adams, 1861

1996 Legacy Project (Coles et al., 1997)

Pearl Harbor - Species Report (Cont.)

Family: EATONIELLIDAE

Genus: *Eatoniella*

Eatoniella sp.

1996 Legacy Project (Coles et al., 1997)

Order: ARCHAEOGASTROPODA

Family: FISSURELLIDAE

Unidentified Fissurellidae

2008 Legacy II Project (Coles et al., 2009)

Genus: *Diodora*

Diodora sp.

Indigenous.

2008 Legacy II Project (Coles et al., 2009)

Diodora granifera

(Pease, 1861)

Hawaiian name: `opihi.

Unknown Spec - BPBM-MO 225792
Catalogue XVI.

Opposite Ford Island on Railroad Wharf on Peninsula.

1973 Ref - Evans et al., 1974

1996 Legacy Project (Coles et al., 1997)

Diodora octagona

(Reeve, 1850)

Indigenous. Common name: Sea Frost.

2008 Legacy II Project (Coles et al., 2009)

Diodora octogona

Reeve, 1850

1996 Legacy Project (Coles et al., 1997)

Diodora ruppelli

(Sowerby, 1834)

Introduced.

1962 Ref - Kay, 1979

1996 Legacy Project (Coles et al., 1997)

2008 Legacy II Project (Coles et al., 2009)

Family: NERITIDAE

Genus: *Nerita*

Nerita sp.

1932 Spec - BPBM-MO 199261

Catalogue XIV.

Nerita picea

Recluz, 1841

Indigenous. Common name: Black Nerite; Hawaiian name: 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.

2008 Legacy II Project (Coles et al., 2009)

Genus: *Theodoxus*

Theodoxus cariosa

Gray Known only from Hawaii.

1912 Spec - BPBM-MO 64294

Catalogue V.

Theodoxus kanaka

Pilsbry

1912 Spec - BPBM-MO 64313

Catalogue V.

Theodoxus neglectus

Pease, 1861

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: ka`ala; ko`ele; `opihi kapua`i lio.

Cellana sp.

1934 Spec - BPBM-MO 205577

Dredge. Catalogue XIV.

Pearl Harbor - Species Report (Cont.)

1950	Spec - BPBM-MO 55	
1973	Ref - Evans et al., 1974	
Family: PHASIANELLIDAE		
Genus: <i>Tricolia</i>		
	<i>Tricolia variabilis</i>	(Pease, 1861)
1973	Ref - Evans et al., 1974	Hawaiian name: pupu kanaloa. Off Pearl Harbor.
Family: PHENACOLEPADIDAE		
Genus: <i>Phenacolepas</i>		
	<i>Phenacolepas</i> sp.	
1973	Ref - Evans et al., 1974	Off Pearl Harbor.
Family: SCISSURELLIDAE		
Genus: <i>Scissurella</i>		
	<i>Scissurella</i> sp.	
1973	Ref - Evans et al., 1974	
Family: SKENEIDAE		
Genus: <i>Lophocaclias</i>		
	<i>Lophocaclias minutissimus</i>	(Pilsbry, 1921)
1973	Ref - Evans et al., 1974	Off Pearl Harbor. Recorded as <i>Cyclostremiscus minutissimus</i> (Pilsbry, 1921).
Family: STOMATELLIDAE		
Genus: <i>Syncera</i>		
	<i>Syncera giffardi</i>	Dall
Unknown	Spec - BPBM-MO 65725	Pearl City. Catalogue V.
Family: TROCHIDAE		
Genus: <i>Danilia</i>		
	<i>Danilia eucheliformis</i>	(Nomura & Hatai, 1940)
1961	Spec - BPBM-MO 217634	Off Fort Kamehameha. Catalogue XV.
Genus: <i>Euchelus</i>		
	<i>Euchelus gemmatus</i>	Gould, 1845
1973	Ref - Evans et al., 1974	
Genus: <i>Tholotia</i>		
	<i>Tholotia subangulata</i>	(Pease, 1861)
1917	Ref - Pilsbry, 1917	Recorded as <i>Alcyna lineata</i> Pease, 1861. MCZ 31724.
Genus: <i>Trochus</i>		
	<i>Trochus</i> sp.	
1934	Spec - BPBM-MO 205576	Dredge. Catalogue XIV.
<i>Trochus histrio</i>		
1973	Ref - Evans et al., 1974	Reeve
<i>Trochus intextus</i>		
		Kiener, 1850
`oi; pupu o		Hawaiian name: pupu o Ha`upu; ha`upu; haupu; `okole `oi 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	Legacy Project (Coles et al., 1997)	

Pearl Harbor - Species Report (Cont.)

Family: TURBINIDAE

Genus: *Leptothyra*

Leptothyra candida (Pease, 1861)

1973 Ref - Evans et al., 1974 Off Pearl Harbor.
1996 Legacy Project (Coles et al., 1997)

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

1973 Ref - Evans et al., 1974
1996 Legacy Project (Coles et al., 1997)

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 (Linnaeus, 1758) Common name: Sundial shell; Hawaiian name: 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 cruentata Sowerby, 1841

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

Bursa granularis Röding, 1798

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

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.
2007 Ref - Brock, 2007 Recorded as *Crepidula* sp..

Crepidula aculeata (Gmelin, 1791) Introduced. Common name: Hoof Shell.

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

Pearl Harbor - Species Report (Cont.)

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	Legacy Project (Coles et al., 1997)
1999	USS Missouri Project (Coles et al. 1999)
2007	Legacy II Project (Coles et al., 2009)
2008	Legacy II Project (Coles et al., 2009)

Genus: *Crucibulum*

<i>Crucibulum spinosum</i>	(Sowerby, 1824)	Indigenous.
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	Legacy Project (Coles et al., 1997)	
2007	Legacy II Project (Coles et al., 2009)	

Family: CAPULIDAE

Genus: *Capulus*

<i>Capulus bicarinatus</i>	Pease	
Unknown	Spec - BPBM-MO 65647	Catalogue V.
1922	Spec - BPBM-MO 77	

Family: CASSIDIDAE

Genus: *Casmaria*

<i>Casmaria vibex</i>		
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*

<i>Cassis viber</i>		
1932	Spec - BPBM-MO 200430	Channel entrance, seaward. Catalogue XIV.

Genus: *Phalium*

<i>Phalium (Semicassis) umbilicatum</i>	(Pease, 1861)	
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.
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Genus: *Bittium*

<i>Bittium impendens</i>	(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	Legacy Project (Coles et al., 1997)	

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
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Pearl Harbor - Species Report (Cont.)

1996	Legacy Project (Coles et al., 1997)	
Genus: <i>Cerithiopsis</i>		
<i>Cerithiopsis</i> sp. A		
1973	Ref - Evans et al., 1974	Recorded as <i>Cerithiopsis</i> sp. A.
1996	Legacy Project (Coles et al., 1997)	
<i>Cerithiopsis</i> sp. B		
1973	Ref - Evans et al., 1974	Recorded as <i>Cerithiopsis</i> sp. B.
<i>Cerithiopsis acaria</i> sp.		
Unknown	Spec - BPBM-MO 65649	Catalogue V.
<i>Cerithiopsis acaria</i> sp.?		
1934	Spec - BPBM-MO 205561	Dredge. Catalogue XIV.
Genus: <i>Cerithium</i>		
<i>Cerithium articulatus</i>		
1961	Spec - BPBM-MO 217761	Off Fort Kamehameha?. Catalogue XV.
<i>Cerithium diminutirum</i> Phil.		
Unknown	Spec - BPBM-MO 63339	Ford Island. Catalogue V.
<i>Cerithium locticum</i> Pease		
Unknown	Spec - BPBM-MO 63176	Catalogue V.
Unknown	Spec - BPBM-MO 63229	Ford Island. Catalogue V.
<i>Cerithium matukense</i> Watson, 1886		
1961	Spec - BPBM-MO 217694	Off Pearl Harbor. Catalogue XV.
1982	Spec - BPBM-MO 207403	Catalogue XIV.
<i>Cerithium nesioticum</i> Pilsbry & Vanatta, 1905 Hawaiian name: pupu maka`aha; maka`aha.		
1973	Ref - Evans et al., 1974	
<i>Cerithium zebrum</i> Kiener, 1841 Indigenous.		
2008	Legacy II Project (Coles et al., 2009)	
Genus: <i>Finella</i>		
<i>Finella pupoides</i> A. Adams, 1860		
Unknown	Spec - BPBM-MO 229372	Catalogue XVI.
1996	Legacy Project (Coles et al., 1997)	
Genus: <i>Rhinoclavis</i>		
<i>Rhinoclavis fasciata</i> Bruguiere		
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: <i>Cymatium</i>		
<i>Cymatium</i> sp. Indigenous.		
1934	Spec - BPBM-MO 205568	Dredge. Catalogue XIV.
1934	Spec - BPBM-MO 205569	Dredge. Catalogue XIV.
1973	Ref - Evans et al., 1974	
2008	Legacy II Project (Coles et al., 2009)	
<i>Cymatium aquatile</i> 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.
<i>Cymatium gemmatum</i> Reeve, 1844		
Unknown	Spec - BPBM-MO 249233	Catalogue XVII.
1927	Spec - BPBM-MO 69	Naval Station.

Pearl Harbor - Species Report (Cont.)

1928	Spec - BPBM-MO 240865	Reef off Fort Kamehameha. Catalogue XVII.
1936	Spec - BPBM-MO 233927	Reef at Fort Kamehameha. Catalogue XVI.
1996	Legacy Project (Coles et al., 1997)	
<i>Cymatium intermedium</i> 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	Legacy Project (Coles et al., 1997)	
<i>Cymatium muricinum</i> Röding, 1798 Hawaiian name: 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.
<i>Cymatium nicobaricum</i> (Röding, 1798)		
1932	Spec - BPBM-MO 199158	Fort Kamehameha. Catalogue XIV.
1961	Spec - BPBM-MO 218320	Off Fort Kamehameha. Catalogue XV.
1996	Legacy Project (Coles et al., 1997)	
<i>Cymatium pileare</i> Linnaeus, 1758		
Catalogue XIV.		
1932	Spec - BPBM-MO 198718	Pearl Harbor entrance Channel, off Fort Kamehameha.
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, Pearl 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.
<i>Cymatium rubeculum</i> (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: <i>Distorsio</i>		
<i>Distorsio</i> sp.		
1934	Spec - BPBM-MO 205565	Dredge. Catalogue XIV.
Genus: <i>Gyrineum</i>		
<i>Gyrineum pusillum</i> 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: <i>Triton</i>		
<i>Triton tuberosus</i> Lamarck		
Unknown	Spec - BPBM-MO 62157	Catalogue V.

Pearl Harbor - Species Report (Cont.)

Family: CYPRAEIDAE

Genus: *Cypraea*

Hawaiian name: leho; leholeho; leho `oma`o.

Cypraea sp.

Indigenous.

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.
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Cypraea caputserpentis

Linnaeus, 1758

Hawaiian name: 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.

Cypraea carneola

Linnaeus, 1758

Indigenous. Hawaiian name: leho pauhu.

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

Cypraea childreni

Gray, 1825

1996	Legacy Project (Coles et al., 1997)	
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Cypraea chinensis

Gmelin, 1791

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

Linnaeus, 1767 Introduced.

1950	Ref - Burgess, 1959	Off Pearl Harbor.
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Cypraea cribraria

Linnaeus, 1758 Introduced.

1950	Ref - Burgess, 1959	Off Pearl Harbor.
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Cypraea cylindrica

Born Introduced.

1950	Ref - Burgess, 1959	Off Pearl Harbor.
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Cypraea depressa

Grey, 1825 Introduced.

1991	Ref - Burgess, 1995	Off Pearl Harbor.
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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

Reeve, 1846

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

Biraghi & Nicolay, 1993 Introduced.

1993	Ref - Burgess, 1995	Off Pearl Harbor.
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Pearl Harbor - Species Report (Cont.)

<i>Cypraea helvola</i>		Linnaeus, 1758	Indigenous. Hawaiian name: 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.
<i>Cypraea hirundo</i>		Linnaeus, 1758	Introduced.
1993	Ref - Burgess, 1995		Off Pearl Harbor.
<i>Cypraea isabella</i>		Linnaeus, 1758	Indigenous. Common name: Isabella Cowry; Hawaiian names: puleho; puleho holei; puleho kani`o; puleholeho; puleho palaoa; puleho `ula; puleholeho; leho kupe`e lima; momi ke`oke`o.
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.
<i>Cypraea labrolineata</i>		Gaskoin, 1849	Indigenous.
1993	Ref - Burgess, 1995		Off Pearl Harbor.
<i>Cypraea maculifera</i>		Shilder, 1932	Hawaiian name: kuoho; leho; leho kolea.
1957	Spec - BPBM-MO 246540		Fort Kaahamaha (Fort Kamehameha). Catalogue XVII.
<i>Cypraea moneta</i>		Linnaeus, 1758	Common Name: Money Cowry; Hawaiian name: 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.
<i>Cypraea poraria</i>		Linnaeus, 1758	Introduced.
1950	Ref - Burgess, 1959		Off Pearl Harbor.
<i>Cypraea reticulata</i>		Martyn	
1916	Spec - BPBM-MO 67		Reef Waikiki of entrance to Pearl Harbor.
1932	Spec - BPBM-MO 196358		Reef off Fort Kamehameha. Catalogue XIV.
<i>Cypraea scurra</i>		Gmelin, 1791	
1932	Spec - BPBM-MO 198044		Keahi Point. Catalogue XIV.
<i>Cypraea semiplota</i>		Mighels, 1845	Hawaiian name: 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.
<i>Cypraea shilderorum</i>			
1932	Spec - BPBM-MO 197146		Pearl Harbor Channel; Watertown. Catalogue XIV.
<i>Cypraea staphylaea</i>		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.
<i>Cypraea sulcidentata</i>		Gray, 1824	
1932	Spec - BPBM-MO 197173		Fort Kamehameha, reef off. Catalogue XIV.
<i>Cypraea talpa</i>		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.

Pearl Harbor - Species Report (Cont.)

<i>Cypraea teres</i>		Gmelin, 1791	
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.
1954	Spec - BPBM-MO 246850		Fort Kamehameha reef. Catalogue XVII.
1957	Spec - BPBM-MO 246865		Fort Kaahamaha (Fort Kamehameha). Catalogue XVII.
1961	Spec - BPBM-MO 218101		Off Fort Kamehameha. Catalogue XV.
<i>Cypraea tessellata</i>		Swainson, 1822	
1932	Spec - BPBM-MO 197197		Keahi Point. Catalogue XIV.
1932	Spec - BPBM-MO 198047		Pearl Harbor channel. Catalogue XIV.
Family: DIASTOMIDAE			
Genus: <i>Alaba</i>			
<i>Alaba goniochila</i>		(A. Adams, 1860)	
1973	Ref - Evans et al., 1974		Off Pearl Harbor.
Genus: <i>Alabina</i>			
<i>Alabina pearlensis</i>		Dall	
Unknown	Spec - BPBM-MO 65635		Catalogue V.
Genus: <i>Obtortio</i>			
<i>Obtortio fulva</i>		Watson	
1973	Ref - Evans et al., 1974		
Family: EULIMIDAE			
Genus: <i>Balcis</i>			
<i>Balcis</i> sp.		Indigenous.	
1976	Ref - Cooke et al., 1980		
1996	Legacy Project (Coles et al., 1997)		
2008	Legacy II Project (Coles et al., 2009)		
<i>Balcis thaanumi</i>		Pilsbry, 1917	
1936	Spec - BPBM-MO 230613		Reef at Fort Kamehameha. Catalogue XVI.
Genus: <i>Leiostraca</i>			
<i>Leiostraca</i> sp.			
1973	Ref - Evans et al., 1974		
Family: HIPPONICIDAE			
Genus: <i>Amalthea</i>			
<i>Amalthea</i> 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.
<i>Amalthea barbatus</i>			
1932	Spec - BPBM-MO 200171		Fort Kamehameha and Barber's Point, beach between. Catalogue XIV.
Genus: <i>Antisabia</i>			
<i>Antisabia foliacea</i>			
Unknown	Spec - BPBM-MO 209902		Fort Kamehameha Army Housing (S.C.) 910509AS. Catalogue XIV.
Genus: <i>Hipponix</i>			
<i>Hipponix</i> sp.			
1973	Ref - Evans et al., 1974		
1996	Legacy Project (Coles et al., 1997)		
<i>Hipponix (Cochlear) imbricatus</i>		Gould, 1846	Indigenous. Common name: Hoof Shell.
Unknown	Spec - BPBM-MO 64817		Catalogue V.
<i>Hipponix (Pilosabia) pilosus</i>		(Deshayes, 1832)	Indigenous.
2008	Legacy II Project (Coles et al., 2009)		
<i>Hipponix australis</i>			
1961	Spec - BPBM-MO 217888		Off Fort Kamehameha. Catalogue XV.

Pearl Harbor - Species Report (Cont.)

XVI.	<i>Hipponix foliaceus</i>	Quoy & Gaimard, 1835	
	1930	Spec - BPBM-MO 196836	Peninsula. Catalogue XIV.
	<i>Hipponix grayanus</i>		
	1961	Spec - BPBM-MO 217892	Off Fort Kamehameha. Catalogue XV.
	<i>Hipponix imbricatus</i>	Gould, 1846	
	Unknown	Spec - BPBM-MO 204603	Catalogue XIV.
	Unknown	Spec - BPBM-MO 63956	Ford Island. Catalogue V.
	1927	Spec - BPBM-MO 231294	Ford Island, on pearl oyster, along shore, on rocks. Catalogue
	1949	Spec - BPBM-MO 231301	Fort Kamehameha. Catalogue XVI.
	1996	Legacy Project (Coles et al., 1997)	
	<i>Hipponix pilosus</i>	(Deshayes, 1832)	
	1973	Ref - Evans et al., 1974	
	1979	Ref - AECOS, 1979	Off Pearl Harbor. Recorded as Hipponyx cf. barbatus.
	1996	Legacy Project (Coles et al., 1997)	
	Family: LITTORINIDAE		
	Genus: <i>Littoraria</i>		Common name: Periwinkle; Hawaiian name: pupu kolea.
XIV.	<i>Littoraria coccinea</i>	(Gmelin, 1791)	
	1930	Spec - BPBM-MO 196989	Peninsular, Pearl Lochs, N. of Dr. Whitney's place. Catalogue
	<i>Littoraria intermedia</i>		
	1930	Spec - BPBM-MO 196735	S.E. coast of peninsular Pearl Lochs. Catalogue XIV.
	1930	Spec - BPBM-MO 196745	Pearl Lochs. Catalogue XIV.
	<i>Littoraria pintado</i>	(Wood, 1828)	Indigenous.
	1996	Legacy Project (Coles et al., 1997)	
	1999	USS Missouri Project (Coles et al. 1999)	
	<i>Littoraria scabra</i>	(Linnaeus, 1758)	Indigenous. Common name: Feather Duster Worm;
			Hawaiian names: kukae kolea; pupu kolea;kolealea;
			pipipi kolea.
	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	Legacy Project (Coles et al., 1997)	
	2007	Ref - Brock, 2007	Recorded as Littorina scabra.
	2008	Legacy II Project (Coles et al., 2009)	
	Family: MODULIDAE		
	Genus: <i>Modulus</i>		
	<i>Modulus sp.</i>		
	1934	Spec - BPBM-MO 205575	Dredge. Catalogue XIV.
	<i>Modulus tectum</i>	Gmelin	Hawaiian name: pupu.
	1932	Spec - BPBM-MO 199280	Reef off Fort Kamehameha. Catalogue XIV.
	Family: NATICIDAE		
	Genus: <i>Natica</i>		
	<i>Natica sp.</i>		
	1961	Spec - BPBM-MO 218130	Off Fort Kamehameha. Catalogue XV.

Pearl Harbor - Species Report (Cont.)

1973	Ref - Evans et al., 1974		
<i>Natica gualteriana</i>		Recluz, 1844	Hawaiian name: 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		
<i>Natica tessellata</i>			
1961	Spec - BPBM-MO 218143		Off Fort Kamehameha. Catalogue XV.
Genus: <i>Polinices</i>			
<i>Polinices</i> sp.			
1934	Spec - BPBM-MO 205566		Dredge. Catalogue XIV.
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: <i>Rissoella</i>			
<i>Rissoella</i> sp.			
1973	Ref - Evans et al., 1974		
Family: RISSOIDAE			
Genus: <i>Cithna</i>			
<i>Cithna</i> sp.			
1973	Ref - Evans et al., 1974		Off Pearl Harbor.
Genus: <i>Merelina</i>			
<i>Merelina</i> sp.			
1973	Ref - Evans et al., 1974		
Genus: <i>Parashiela</i>			
<i>Parashiela beetsi</i>		Ladd, 1966	
1973	Ref - Evans et al., 1974		Off Pearl Harbor.
Genus: <i>Pusillina</i>			
<i>Pusillina marmorata</i>		Ponder, 1985	Indigenous.
2008	Legacy II Project (Coles et al., 2009)		
Genus: <i>Rissoina</i>			
<i>Rissoina ambigua</i>		(Gould, 1849)	
1973	Ref - Evans et al., 1974		
<i>Rissoina cerithiiformis</i>		Tryon, 1887	Indigenous.
2008	Legacy II Project (Coles et al., 2009)		
<i>Rissoina miltozona</i>		Tomlin, 1915	
1973	Ref - Evans et al., 1974		
1996	Legacy Project (Coles et al., 1997)		
<i>Rissoina rhyssa</i>		Dall	
Unknown	Spec - BPBM-MO 228923		Catalogue XVI.
Unknown	Spec - BPBM-MO 65714		Catalogue V.
<i>Rissoina turricula</i>		Pease, 1861	
1973	Ref - Evans et al., 1974		
1996	Legacy Project (Coles et al., 1997)		
Genus: <i>Schwartziella</i>			
<i>Schwartziella gracilis</i>		(Pease, 1861)	
1973	Ref - Evans et al., 1974		Recorded as <i>Rissoina gracilis</i> .
Genus: <i>Zebina</i>			
<i>Zebina tridentata</i>		(Michaud, 1830)	
Unknown	Spec - BPBM-MO 63855		Catalogue V.

Pearl Harbor - Species Report (Cont.)

1973	Ref - Evans et al., 1974	Off Pearl Harbor.
1996	Legacy Project (Coles et al., 1997)	
Family: STROMBIDAE		
Genus: <i>Strombus</i>		
<i>Strombus dentatus</i> (Linnaeus, 1758)		
1961	Spec - BPBM-MO 217932	Off Fort Kamehameha. Catalogue XV.
<i>Strombus helli</i> Kiener, 1843		
1961	Spec - BPBM-MO 217953	Off Fort Kamehameha. Catalogue XV.
1961	Spec - BPBM-MO 217954	Off Fort Kamehameha. Catalogue XV.
<i>Strombus maculatus</i> Sowerby, 1842 Hawaiian name: mamaiki; pupu mamaiki; pu leholeho.		
1932	Spec - BPBM-MO 199101	Reef off Fort Kamehameha. Catalogue XIV.
Family: TONNIDAE		
Genus: <i>Tonna</i> Hawaiian name: pu`oni`oni`o.		
<i>Tonna perdx</i> Linnaeus, 1758 Hawaiian name: puleho.		
1936	Spec - BPBM-MO 240897	Reef off Fort Kamehameha. Catalogue XVII.
Family: TRIPHORIDAE		
Genus: <i>Triforis</i>		
<i>Triforis flammulata</i> Pease		
Unknown	Spec - BPBM-MO 62886	Ford Island. Catalogue V.
Genus: <i>Triphora</i>		
<i>Triphora</i> {<i>Triphoridae</i>}		
1932	Spec - BPBM-MO 198048	Pearl Harbor entrance channel. Catalogue XIV.
1973	Ref - Evans et al., 1974	
1996	Legacy Project (Coles et al., 1997)	
Genus: <i>Viriola</i>		
<i>Viriola incisa</i> Pease, 1861		
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	
2008	Legacy II Project (Coles et al., 2009)	
Genus: <i>Dendropoma</i>		
<i>Dendropoma</i> sp.		
1972	Ref - Long, 1974	
1996	Legacy Project (Coles et al., 1997)	
<i>Dendropoma platypus</i> Morch, 1861		
1973	Ref - Evans et al., 1974	
1987	Ref - Brewer & Assoc., 1987	
<i>Dendropoma psarocephala</i> Hadfield & Kay, 1972		
1975	Ref - Grovhoug, 1976	
<i>Dendropoma psarocephala?</i> Hadfield & Kay, 1972		
1973	Ref - Evans et al., 1974	
Genus: <i>Eualetes</i>		
<i>Eualetes tulipa</i> (Chenu, 1843) Introduced. Common name: Noble Vermitid.		
1973	Ref - Evans et al., 1974	Recorded as Vermetus alii.
1975	Ref - Grovhoug, 1976	Recorded as Vermetus alii.
1986	Ref - Lenihan, 1990	Recorded as Vermetus alii.

Pearl Harbor - Species Report (Cont.)

1993	Ref - Brock, 1994	Recorded as <i>Vermetus alii</i> .
1994	Ref - Brock, 1995	Recorded as <i>Vermetus alii</i> .
1996	Legacy Project (Coles et al., 1997)	Recorded as <i>Vermetus alii</i>
1999	USS Missouri Project (Coles et al. 1999)	Recorded as <i>Vermetus alii</i>
2007	Ref - Brock, 2007	Recorded as <i>Vermetus alii</i> .
2007	Legacy II Project (Coles et al., 2009)	
2008	Legacy II Project (Coles et al., 2009)	

Genus: *Petalocochus*

<i>Petalocochus keenae</i>	Hadfield and Kay, 1972	Indigenous. Common name: Periwinkle.
2007	Legacy II Project (Coles et al., 2009)	
2008	Legacy II Project (Coles et al., 2009)	

Genus: *Serpulorbis*

<i>Serpulorbis variabilis</i>	Hadfield and Kay, 1972	Indigenous.
2007	Legacy II Project (Coles et al., 2009)	
2008	Legacy II Project (Coles et al., 2009)	

Genus: *Vermetus*

Hawaiian name: pohokupele; kauno`a.

<i>Vermetus</i> sp.	
Unknown	Spec - BPBM-MO 63578
1973	Ref - Evans et al., 1974

Catalogue V.

Family: VITRINELLIDAE

Genus: *Cyclostremiscus*

<i>Cyclostremiscus</i> sp. A		
1973	Ref - Evans et al., 1974	Off Pearl Harbor. Recorded as <i>Cyclostremiscus</i> sp. A.
<i>Cyclostremiscus</i> sp. B		
1973	Ref - Evans et al., 1974	Off Pearl Harbor. Recorded as <i>Cyclostremiscus</i> sp. B.
<i>Cyclostremiscus</i> sp. C		
1973	Ref - Evans et al., 1974	Off Pearl Harbor. Recorded as <i>Cyclostremiscus</i> sp. C.
<i>Cyclostremiscus</i> sp. D		
1973	Ref - Evans et al., 1974	Off Pearl Harbor. Recorded as <i>Cyclostremiscus</i> sp. D.
<i>Cyclostremiscus emeryi</i>	Ladd, 1966	
1973	Ref - Evans et al., 1974	Off Pearl Harbor.

Family: XENOPHORIDAE

Genus: *Xenophora*

<i>Xenophora pallida</i>		
1961	Spec - BPBM-MO 217922	Off Fort Kamehameha. Catalogue XV.

Order: NEOGASTROPODA

Family: BUCCINIDAE

Genus: *Cantharus*

<i>Cantharus farinosus</i>	(Gould, 1850)	
1973	Ref - Evans et al., 1974	

Genus: *Colubraria*

<i>Colubraria obscura</i>	Reeve, 1844	
Unknown	Spec - BPBM-MO 240920	Channel. Catalogue XVII.

Genus: *Engina*

<i>Engina</i> sp.	
1973	Ref - Evans et al., 1974

Genus: *Prodotia*

<i>Prodotia ignea</i>	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.

Pearl Harbor - Species Report (Cont.)

<i>Prodotia iostomus</i>	1932	Spec - BPBM-MO 199731	Fort Kamehameha, reef off. Catalogue XIV.
Family: COLUMBELLIDAE			
Genus: <i>Anachis</i>			
<i>Anachis miser</i>	1973	Ref - Evans et al., 1974	(Sowerby, 1844) Recorded as <i>A. zebra</i> .
Genus: <i>Columbella</i>			
<i>Columbella varians</i>	1932	Spec - BPBM-MO 199827	Sowerby Hawaiian name: pupu Ni`ihau. Fort Kamehameha, reef off. Catalogue XIV.
Genus: <i>Euplica</i>			
<i>Euplica varians</i>	1996	Legacy Project (Coles et al., 1997)	
Genus: <i>Mitrella</i>			
<i>Mitrella margarita</i>	1961	Spec - BPBM-MO 221163	Reeve, 1859 Off Fort Kamehameha?. Catalogue XV.
Genus: <i>Seminella</i>			
<i>Seminella sp.</i>	1996	Legacy Project (Coles et al., 1997)	
Family: CONIDAE			
Genus: <i>Conus</i>		Common name: Cone shell; Hawaiian name: pupu`ala; pupu poniuniu.	
<i>Conus sp.</i>	1961	Spec - BPBM-MO 220384	Off Fort Kamehameha. Catalogue XV.
<i>Conus abbreviatus</i>	1932	Spec - BPBM-MO 199015	Reeve, 1843 Fort Kamehameha. Catalogue XIV.
<i>Conus acutangulus</i>	1961	Spec - BPBM-MO 220118	Lamarck, 1810 Off Fort Kamehameha. Catalogue XV.
	1961	Spec - BPBM-MO 220119	Off Fort Kamehameha. Catalogue XV.
<i>Conus catus</i>	1932	Spec - BPBM-MO 198911	Hwass, 1792 Reef off Fort Kamehameha. Catalogue XIV.
	1936	Spec - BPBM-MO 238941	Fort Kamehameha. Catalogue XVI.
<i>Conus clavus</i>	1929	Spec - BPBM-MO 63	Linnaeus Brought up by dredger operations in entrance to Pearl Harbor.
<i>Conus dactylasus</i>	1929	Spec - BPBM-MO 64	Kiener Brought up by dredger operations in entrance to Pearl Harbor.
<i>Conus ebraeus</i>	1932	Spec - BPBM-MO 199614	Linnaeus, 1758 Hawaiian name: ohana o ka pupu`ala; ke`oke`o; `ele`ele. Fort Kamehameha. Catalogue XIV.
<i>Conus eugrammus</i>	2008	Legacy II Project (Coles et al., 2009)	Bartsch and Rehder, 1943 Indigenous.
<i>Conus flavidus</i>	1932	Spec - BPBM-MO 199052	Lamarck, 1810 Fort Kamehameha. Catalogue XIV.
<i>Conus lividus</i>	1932	Spec - BPBM-MO 198981	Hwass, 1792 Fort Kamehameha. Catalogue XIV.
<i>Conus marmoreus</i>	1932	Spec - BPBM-MO 200269	Linnaeus, 1758 Pearl Harbor channel; entrance, near seaward end. Catalogue XIV.
<i>Conus miles</i>	1932	Spec - BPBM-MO 199134	Linnaeus, 1758 Indigenous. Common name: Soldier Cone. Fort Kamehameha, near outer edge of the reef. Catalogue XIV.
	1932	Spec - BPBM-MO 199135	Reef off Fort Kamehameha. Catalogue XIV.
	1936	Spec - BPBM-MO 2	Off Fort Kamehameha, on the reef.
	1936	Spec - BPBM-MO 239251	Off Fort Kamehameha, on the reef. Catalogue XVI.

XIV.

Pearl Harbor - Species Report (Cont.)

XVII.	<i>Conus nussatella</i>		Linnaeus, 1758
	1927	Spec - BPBM-MO 241003	Off Fort Kamehameha, under loose, dead coral. Catalogue
	1936	Spec - BPBM-MO 239257	E shore of entrance; reef at Fort Kamehameha. Catalogue XVI.
	1936	Spec - BPBM-MO 62	Reef at Fort Kamehameha.
	<i>Conus pennaccus</i>		
	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.
	<i>Conus quercinus</i>		Lightfoot, 1786
	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.
	<i>Conus rattus</i>		Hwass, 1792
	1932	Spec - BPBM-MO 199084	Fort Kamehameha. Catalogue XIV.
	<i>Conus sponsalis</i>		Hass in Brugière, 1792
	1932	Spec - BPBM-MO 199201	Reef off Fort Kamehameha. Catalogue XIV.
	<i>Conus textile</i>		Linnaeus, 1758
feet of water.	1915	Spec - BPBM-MO 239129	Reef Waikiki of entrance to Pearl Harbor, under a rock in five
			Catalogue XVI.
	1936	Spec - BPBM-MO 65	Fort Kamehameha Reef.
	<i>Conus vexillum</i>		Gmelin, 1791
	1932	Spec - BPBM-MO 199346	Reef off Fort Kamehameha. Catalogue XIV.
	1932	Spec - BPBM-MO 199347	Fort Kamehameha. Catalogue XIV.
	<i>Conus vitulinus</i>		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: CORALLIOPHILIDAE		
	Genus: <i>Quoyula</i>		
	<i>Quoyula madreporarum</i>		Sowerby, 1834
	1932	Spec - BPBM-MO 198765	Reef off Fort Kamehameha. Catalogue XIV.
	Family: FASCIOLARIIDAE		
	Genus: <i>Fusinus</i>		
	<i>Fusinus</i> sp.		
	1934	Spec - BPBM-MO 205567	Dredge. Catalogue XIV.
	1961	Spec - BPBM-MO 218747	Off Fort Kamehameha, Station 2. Catalogue XV.
	<i>Fusinus sandvicensis</i>		Saverly
	1934	Spec - BPBM-MO 215733	West Lock, Dredging. Catalogue XV.
	1940	Spec - BPBM-MO 249147	Dredging. Catalogue XVII.
	Genus: <i>Fusolaturus</i>		
	<i>Fusolaturus kuroseanus?</i>		
	1961	Spec - BPBM-MO 222218	Off Fort Kamehameha. Catalogue XV.
	Genus: <i>Peristernia</i>		
	<i>Peristernia chlorostoma</i>		(Sowerby, 1825) Hawaiian name: 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.

Pearl Harbor - Species Report (Cont.)

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	
1996	Legacy Project (Coles et al., 1997)	

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*

(Röding, 1798)

1932	Spec - BPBM-MO 198732	Reef off Fort Kamehameha. Catalogue XIV.
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Family: MARGINELLIDAE

Genus: *Cystiscus*

Cystiscus sp.

1973	Ref - Evans et al., 1974	
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Genus: *Granula*

Granula sandwicensis

(Pease, 1860)

Hawaiian name: pupu `aha`aha.

1973	Ref - Evans et al., 1974	Recorded as Kogomea sandwicensis (Pease).
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Genus: *Marginella*

Marginella sp. a-1

Unknown	Spec - BPBM-MO 61271	Catalogue V.
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Family: MITRIDAE

Genus: *Cancilla*

Cancilla granatina

Lamarck, 1811

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, 1821

1961	Spec - BPBM-MO 219471	Off Fort Kamehameha. Catalogue XV.
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Genus: *Mitra*

Mitra sp.

Indigenous.

1973	Ref - Evans et al., 1974	
2008	Legacy II Project (Coles et al., 2009)	

Mitra assimilis

Reeve, 1868

1932	Spec - BPBM-MO 199442	Fort Kamehameha. Catalogue XIV.
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Mitra brunnea

Pease, 1861

1915	Spec - BPBM-MO 6	Fort Kamehameha.
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Mitra litterata

Lamarck, 1811

1936	Spec - BPBM-MO 238093	E shore of entrance; reef at Fort Kamehameha. Catalogue XVI.
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Mitra mitra

Linnaeus, 1758

1961	Spec - BPBM-MO 219381	Off Fort Kamehameha. Catalogue XV.
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Mitra pellisserpentis

Reeve, 1844

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

Reeve, 1844

1932	Spec - BPBM-MO 199503	Fort Kamehameha, reef off. Catalogue XIV.
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Pearl Harbor - Species Report (Cont.)

Genus: <i>Neocancilla</i>		
<i>Neocancilla waikikiensis</i>	Pilsbry, 1921	
1961 Spec - BPBM-MO 219594		Off Fort Kamehameha. Catalogue XV.
Genus: <i>Scabricola</i>		
<i>Scabricola newcombii</i>	Pease, 1869	
1961 Spec - BPBM-MO 219413		Off Fort Kamehameha. Catalogue XV.
Genus: <i>Subcancilla</i>		
<i>Subcancilla flammea</i>	(Quoy & Gaimard, 1833)	
1982 Spec - BPBM-MO 242714		Entrance to west. Catalogue XVII.
Genus: <i>Vexillum</i>		
<i>Vexillum (Pusia) lautum</i>	(Reeve, 1845)	
1932 Spec - BPBM-MO 199456		Fort Kamehameha, reef off. Catalogue XIV.
<i>Vexillum alveolus</i>	Reeve, 1845	
1938 Spec - BPBM-MO 12		Fossil near Yacht Club.
<i>Vexillum bellum</i>	Pease, 1860	
1962 Spec - BPBM-MO 219200		Off Fort Kamehameha. Catalogue XV.
<i>Vexillum filistriatum</i>	(Sowerby, 1874)	
1982 Spec - BPBM-MO 243097		Entrance to west. Catalogue XVII.
<i>Vexillum pacificum</i>	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: <i>Aspella</i>		
<i>Aspella producta</i>	(Pease, 1861)	
1932 Spec - BPBM-MO 200760		Fort Kamehameha, reef off. Catalogue XIV.
1973 Ref - Evans et al., 1974		
Genus: <i>Chicoreus</i>		
<i>Chicoreus insularum</i>	(Pilsbry, 1921)	
1961 Spec - BPBM-MO 218423		Off Fort Kamehameha. Catalogue XV.
Genus: <i>Drupella</i>		
<i>Drupella elata</i>	Blainville, 1832	
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: <i>Morula</i>		
<i>Morula sp.</i>		
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.
<i>Morula dermosa</i>		
1932 Spec - BPBM-MO 198253		Fort Kamehameha. Catalogue XIV.
1932 Spec - BPBM-MO 198254		Fort Kamehameha. Catalogue XIV.
1996 Legacy Project (Coles et al., 1997)		
<i>Morula foliacea</i>	Conrad	
1932 Spec - BPBM-MO 198180		Reef off Fort Kamehameha. Catalogue XIV.
1936 Spec - BPBM-MO 234727		Reefs at Fort Kamehameha. Catalogue XVI.
<i>Morula granulata</i>	Duclos, 1832	Hawaiian name: pupu maka`awa; maka`awa.
Unknown Spec - BPBM-MO 204188		Fort Kamehameha. Catalogue XIV. May be M. uva.

Pearl Harbor - Species Report (Cont.)

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 <i>M. uva</i> .
1932	Spec - BPBM-MO 198243	Fort Kamehameha. Catalogue XIV. May be <i>M. uva</i> .
1932	Spec - BPBM-MO 198300	End of Waipio Peninsula. Catalogue XIV.
1932	Spec - BPBM-MO 198301	End of Waipio Peninsula. Catalogue XIV.
<i>Morula mitosa?</i>		
	Dall	
1927	Spec - BPBM-MO 73	Naval Station.
<i>Morula spinosa</i>		
	H. and A. Adams, 1853	
1932	Spec - BPBM-MO 198280	Fort Kamehameha. Catalogue XIV.
<i>Morula uva</i>		
	Röding, 1798	
1949	Spec - BPBM-MO 234787	E shore of entrance; reef at Fort Kamehameha. Catalogue XVI.
<i>Morula vexilla</i>		
	(Kuroda, 1953)	
1961	Spec - BPBM-MO 222217	Off Fort Kamehameha. Catalogue XV.
Genus: <i>Murex</i>		
<i>Murex sandwichensis</i>		
	Pease	
1932	Spec - BPBM-MO 198399	Fort Kamehameha, reef off. Catalogue XIV.
Genus: <i>Vitularia</i>		
<i>Vitularia miliaris</i>		
	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 <i>Vitularia milaris</i> .
Family: NASSARIIDAE		
Genus: <i>Nassarius</i>		
<i>Nassarius crematus</i>		
	(Hinds, 1844)	
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: <i>Caducifer</i>		
<i>Caducifer decapitata</i>		
	Reeve	
1936	Spec - BPBM-MO 235879	E shore of entrance; reef at Fort Kamehameha. Catalogue XVI.
Genus: <i>Clathurella</i>		
<i>Clathurella fuscomaculata</i>		
	Pease, 1860	
1932	Spec - BPBM-MO 200762	Fort Kamehameha, reef off. Catalogue XIV.
Family: PYRAMIDELLIDAE		
Genus: <i>Evalea</i>		
<i>Evalea peasei</i>		
	Dautzenberg & Bouge, 1933	Hawaiian name: pupu po`ai.
1973	Ref - Evans et al., 1974	Recorded as <i>Odostomia eclecta</i> Pilsbry.
Genus: <i>Herviera</i>		
<i>Herviera patricia</i>		
	Pilsbry, 1918	
1973	Ref - Evans et al., 1974	Recorded as <i>Odostomia patricia</i> Pilsbry.
Genus: <i>Hinemoa</i>		
<i>Hinemoa indica</i>		
	(Melvill, 1896)	Introduced.
1973	Ref - Evans et al., 1974	Recorded as <i>Odostomia indica</i> Melvill.
1996	Legacy Project (Coles et al., 1997)	
2008	Legacy II Project (Coles et al., 2009)	
Genus: <i>Miralda</i>		
<i>Miralda paulbartschi</i>		
	Pilsbry, 1918	
1973	Ref - Evans et al., 1974	Recorded as <i>Odostomia paulbartschi</i> Pilsbry.

Pearl Harbor - Species Report (Cont.)

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
1996 Legacy Project (Coles et al., 1997)

Genus: *Pyramidella*

Pyramidella sp.
1996 Legacy Project (Coles et al., 1997)

Pyramidella dolabrata Linnaeus, 1758
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 Pilsbry
1932 Spec - BPBM-MO 200126 Fort Kamehameha, reef. Catalogue XIV.

Pyramidella sulcata A. Adams, 1859 Hawaiian name: 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 Legacy Project (Coles et al., 1997)

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 Deshayes, 1859
1961 Spec - BPBM-MO 219838 Off Fort Kamehameha. Catalogue XV.

Hastula nitida Hinds, 1844
1961 Spec - BPBM-MO 220973 Off Fort Kamehameha. Catalogue XV.
1961 Spec - BPBM-MO 221008 Off Fort Kamehameha. Catalogue XV.

Hastula penicillata Hinds, 1844
1961 Spec - BPBM-MO 220950 Off Fort Kamehameha. Catalogue XV.

Genus: *Terebra*

Duplicaria gouldi Deshayes Hawaiian name: loloa; `oi `oi.
1915 Spec - BPBM-MO 54 Off entrance, M. 5, I. 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.

Pearl Harbor - Species Report (Cont.)

<i>Terebra</i> sp.	1932	Spec - BPBM-MO 199570	Fort Kamehameha, reef off. Catalogue XIV.
<i>Terebra achates</i>	1932	Spec - BPBM-MO 199574	Catalogue XIV.
<i>Terebra amoena</i>	1961	Spec - BPBM-MO 222344	Off Fort Kamehameha. Catalogue XV.
<i>Terebra cerithina</i>	1961	Spec - BPBM-MO 220041	Off Fort Kamehameha. Catalogue XV.
<i>Terebra cerithina?</i>	1991	Spec - BPBM-MO 246085	Fort Kamehameha south end housing area. Catalogue XVII.
<i>Terebra columellaris</i>	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.
<i>Terebra funiculata</i>	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.
<i>Terebra lanta</i>	1915	Spec - BPBM-MO 9	Dredged off entrance to Pearl Harbor, Map 34, loc. 1.
<i>Terebra maculata</i>	1961	Spec - BPBM-MO 219863	Off Fort Kamehameha. Catalogue XV.
	1961	Spec - BPBM-MO 219864	Off Fort Kamehameha. Catalogue XV.
<i>Terebra pertusa</i>	1917	Spec - BPBM-MO 29	Off Pearl Harbor.
<i>Terebra plumbea</i>	1915	Spec - BPBM-MO 7	Dredged off entrance to Pearl Harbor, Map 35, loc. 1.
Family: THAIDIDAE			
Genus: <i>Muricodrupa</i>			
<i>Muricodrupa funiculus</i>	Unknown	Spec - BPBM-MO 234516	Catalogue XVI.
Genus: <i>Nassa</i>			
<i>Nassa</i> sp.	1934	Spec - BPBM-MO 205582	Dredge. Catalogue XIV.
<i>Nassa sarta</i>	1932	Spec - BPBM-MO 198407	Fort Kamehameha, reef off. Catalogue XIV.
Genus: <i>Pinaxia</i>			
<i>Pinaxia versicolor</i>	1936	Spec - BPBM-MO 234832	E shore of entrance; reef at Fort Kamehameha. Catalogue XVI.
Genus: <i>Vexilla</i>			
<i>Vexilla</i> sp.	1932	Spec - BPBM-MO 198326	Fort Kamehameha, reef off. Catalogue XIV.
Family: TURRIDAE			
Unidentified Turridae			
	1973	Ref - Evans et al., 1974	
Genus: <i>Anacithara</i>			
<i>Anacithara perfecta</i>	Unknown	Spec - BPBM-MO 9817	Honouliuli, West Loch. Catalogue I.
Genus: <i>Carinapex</i>			
<i>Carinapex</i> sp.	1973	Ref - Evans et al., 1974	

Pearl Harbor - Species Report (Cont.)

Genus: <i>Cymatosyrinx</i>			
<i>Cymatosyrinx mighelsi</i>	Dall		
Unknown	Spec - BPBM-MO 65654		Catalogue V.
Genus: <i>Etrema</i>			
<i>Etrema sp.?</i>			
1961	Spec - BPBM-MO 220816		Off Fort Kamehameha. Catalogue XV.
Genus: <i>Gemmula</i>			
<i>Gemmula interpolata</i>	Powell, 1967		
1961	Spec - BPBM-MO 220825		Off Fort Kamehameha. Catalogue XV.
<i>Gemmula monilifera</i>	Pease, 1861		
1961	Spec - BPBM-MO 220764		Off Fort Kamehameha. Catalogue XV.
Genus: <i>Kermia</i>			
<i>Kermia sp.</i>			
1996	Legacy Project (Coles et al., 1997)		
Genus: <i>Lora</i>			
<i>Lora sp. a-7</i>			
Unknown	Spec - BPBM-MO 61097		Catalogue V.
Genus: <i>Philbertia</i>			
<i>Philbertia katharia</i>	Dall		
Unknown	Spec - BPBM-MO 65696		Catalogue V.
<i>Philbertia lutea</i>	Pease		
Unknown	Spec - BPBM-MO 65697		Catalogue V.
Genus: <i>Turris</i>			
<i>Turris crispa intricata</i>			
1961	Spec - BPBM-MO 220826		Off Fort Kamehameha. Catalogue XV.
Order: CEPHALASPIDEA			
Family: ACTEONIDAE			
Genus: <i>Pupa</i>			
<i>Pupa tessellata</i>			
1961	Spec - BPBM-MO 220460		Off Fort Kamehameha. Catalogue XV.
Family: ATYIDAE			
Genus: <i>Haminea</i>			
<i>Haminoea galba</i>	Pease, 1861		
1936	Spec - BPBM-MO 13		Fossil near Yacht Club.
Family: BULLIDAE			
Genus: <i>Bulla</i>			
<i>Bulla vernicosa</i>	Gould, 1855	Hawaiian name: pupu waha loa.	
1961	Spec - BPBM-MO 220487		Off Fort Kamehameha. Catalogue XV.
1961	Spec - BPBM-MO 220488		Off Fort Kamehameha. Catalogue XV.
1996	Legacy Project (Coles et al., 1997)		
Family: HAMINOEIDAE			
Genus: <i>Atys</i>			
<i>Atys debilis</i>	Pease, 1860	Indigenous.	
2008	Legacy II Project (Coles et al., 2009)		
<i>Atys kuhnsi</i>	Pilsbry, 1917		
1996	Legacy Project (Coles et al., 1997)		
<i>Atys kuhnsi?</i>	Pilsbry, 1917		
1961	Spec - BPBM-MO 220543		Off Fort Kamehameha. Catalogue XV.
<i>Atys semistriata</i>	Pease, 1860		
1921	Ref - Pilsbry, 1921		Recorded as <i>Atys semistriata fordinsulae</i> .

Pearl Harbor - Species Report (Cont.)

Family: HYDATINIDAE

Genus: *Hydatina*

Hydatina amplustre

1961 Spec - BPBM-MO 220478

(Linnaeus, 1758)

Hawaiian name: pupu leholeho oni`oni`o; pupu lei hala.
Off Fort Kamehameha. Catalogue XV.

Order: BASOMMATOPHORA

Family: ELLOBIIDAE

Genus: *Melampus*

Melampus castaneus

1923 Spec - BPBM-MO 1

Montfort

Hawaiian name: `aoa.

Near Railroad Wharf.

Family: SIPHONARIIDAE

Genus: *Siphonaria*

Siphonaria normalis

Gould, 1846

Indigenous.

Common name: False `opihi; Hawaiian
name: `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 Legacy Project (Coles et al., 1997)

1999 USS Missouri Project (Coles et al. 1999)

2007 Ref - Brock, 2007

2007 Legacy II Project (Coles et al., 2009)

2008 Legacy II Project (Coles et al., 2009)

Genus: *Williamia*

Williamia cf. radiata sp.

(Pease, 1861)

1996 Legacy Project (Coles et al., 1997)

Order: SACOGLOSSA

Family: CALIPHYLLIDAE

Genus: *Cyerce*

Cyerce elegans

1996 Legacy Project (Coles et al., 1997)

Family: JULIIDAE

Genus: *Julia*

Julia exquisita

1973 Ref - Evans et al., 1974

Gould, 1862

Off Pearl Harbor.

Order: NOTASPIDEA

Family: UMBRACULIDAE

Genus: *Umbraculum*

Umbraculum sp.

1996 Legacy Project (Coles et al., 1997)

Umbraculum sinicum

(Gmelin, 1791)

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 Legacy Project (Coles et al., 1997)

Family: DENDRODORIDIDAE

Genus: *Dendrodoris*

Dendrodoris nigra

(Stimpson, 1856)

1975 Ref - Grovhoug, 1976

Pearl Harbor - Species Report (Cont.)

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

(Ruppell & Leuckart, 1828) Indigenous. Common name: Painted

Nudibrach.

1996 Legacy Project (Coles et al., 1997)
2007 Legacy II Project (Coles et al., 2009)
2008 Legacy II Project (Coles et al., 2009)

Family: HEXABRANCHIDAE

Genus: *Hexabranchnus*

Hexabranchnus sanguineus

(Ruppell & Leuckart, 1831)

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 bronnii

Unknown Spec - BPBM-MO 10998
Unknown Spec - BPBM-MO 64832

Catalogue II.
Hoiiai. Catalogue V.

Genus: *Laemodonta*

Laemodonta octanfracta

Unknown Spec - BPBM-MO 64874
Unknown Spec - BPBM-MO 64875
1915 Spec - BPBM-MO 14
1915 Spec - BPBM-MO 16
1923 Spec - BPBM-MO 15
1923 Spec - BPBM-MO 17
1923 Spec - BPBM-MO 67478
1932 Spec - BPBM-MO 199237
1932 Spec - BPBM-MO 199238
1932 Spec - BPBM-MO 199241

Hoiiai. Catalogue V.
Hoiiai. Catalogue V.
Ford Island.
Ford Island.
Under rocks near Railroad Wharf, opposite Ford Island.
Near Railroad Wharf, opposite Ford Island.
Pearl City Peninsula. Catalogue V.
Fort Kamehameha, shore at. Catalogue XIV.
Peninsula; along shore at Cobb's place. Catalogue XIV.
Pearl City Peninsula, near Railroad Wharf, along shore at

Cobb's place.

1932 Spec - BPBM-MO 199242

Catalogue XIV.
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: pupu mo`o.

Unknown Spec - BPBM-MO 64604
1931 Spec - BPBM-MO 78
1932 Spec - BPBM-MO 199796

Ford Island. Catalogue V.
Peninsula, Railroad Wharf. Catalogue XIV.

Pearl Harbor - Species Report (Cont.)

Family: MOPALIIDAE

Genus: *Plaxiphora*

Plaxiphora kamehamehae

1977 Spec - BPBM-MO 207066

Ferreira & Bertsch, 1979

Fort Kamehameha Beach. Catalogue XIV.

Order: ACANTHOCHITONIDA

Family: ACANTHOCHITONIDAE

Genus: *Acanthochiton*

Acanthochiton viridis

Unknown Spec - BPBM-MO 64598

Unknown Spec - BPBM-MO 64600

Unknown Spec - BPBM-MO 64601

Unknown Spec - BPBM-MO 64783

Pease, 1872

Hawaiian name: kuakulu; kuapa`a; pe`elua; pupu pe`elua.

Ford Island. Catalogue V.

Ford Island. Catalogue V.

Ford Island. Catalogue V.

Ford Island. Catalogue V.

Class: BIVALVIA

Unidentified Bivalvia

1996 Legacy Project (Coles et al., 1997)

Family: EURYCYNIDAE

Unidentified Eurycynidae

1996 Legacy Project (Coles et al., 1997)

Order: ARCOIDA

Family: ANOMIIDAE

Genus: *Anomia*

Anomia nobilis

Unknown Spec - BPBM-MO 60317

1912 Spec - BPBM-MO 68170

1915 Spec - BPBM-MO 20

1915 Ref - Bryan, 1915

1919 Spec - BPBM-MO 60319

1923 Spec - BPBM-MO 30

1923 Spec - BPBM-MO 67480

1932 Spec - BPBM-MO 200174

1932 Spec - BPBM-MO 200175

1932 Spec - BPBM-MO 201515

1935 Ref - Edmondson, 1944

1936 Ref - Edmondson & Ingram, 1939

1938 Ref - Dall et al., 1938

1938 Ref - Dall et al., 1938

1938 Ref - Dall et al., 1938

1947 Spec - BPBM-MO 46

1948 Spec - BPBM-MO 40

1948 Spec - BPBM-MO 48

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 Legacy Project (Coles et al., 1997)

1999 USS Missouri Project (Coles et al. 1999)

2007 Ref - Brock, 2007

2007 Legacy II Project (Coles et al., 2009)

2008 Legacy II Project (Coles et al., 2009)

Reeve, 1856

Introduced. Hawaiian name: pa; papaua.

Ford Island. Catalogue V.

(Pliocene). Catalogue V.

Map 35, I.2.

Drydock. Catalogue V.

At Railroad Wharf opposite Ford Island, Peninsula.

Railroad Wharf, Pearl City Peninsula. Catalogue V.

Pearl City Peninsula, end. Catalogue XIV.

Pearl Harbor Channel; Watertown. Catalogue XIV.

Pearl City Peninsula, Railroad Wharf. Catalogue XIV.

USNM 337554.

USNM 337552.

USNM 321285.

Bottom of barge in dry dock..

Motile dry dock in Dry Dock #2..

Bottom of steel barge..

Pearl Harbor - Species Report (Cont.)

Family: ARCIDAE

Genus: *Anadara*

Anadara antiquata

(Linnaeus, 1758) Fossil.

1923 Spec - BPBM-MO 21
1938 Ref - Dall et al., 1938

Near Ford Island Wharf in short bluffs.
Recorded as *Arca vetula*. USNM 36158.

Genus: *Arca*

Hawaiian name: kupukele.

Arca sp.

1973 Ref - Evans et al., 1974

Arca sp. a-3

Unknown Spec - BPBM-MO 60151

Catalogue V.

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

Forsskål, 1775 Fossil.

1938 Ref - Dall et al., 1938
1950 Spec - BPBM-MO 250728

Recorded as *Barbatia hendersoni*. BPBM 351286.
Ship bottom (with Mytilidae). Catalogue XVII.

Barbatia nuttingi

(Dall, Bartsch & Rehder, 1938) Indigenous.

1973 Ref - Evans et al., 1974

Barbatia tenella

Reeve, 1844

1938 Ref - Dall et al., 1938

Off Pearl Harbor. Recorded as *Calloarca hua*. USNM 427760.

Genus: *Bentharca*

Bentharca asperula

Dall, 1881

1959 Spec - BPBM-MO 221099

Off Pearl Harbor. Catalogue XV.

Family: GLYCYMERIDIDAE

Genus: *Glycymeris*

Glycymeris molokaia

Dall, Bartsch & Rehder

1961 Spec - BPBM-MO 218786

Off Fort Kamehameha. Catalogue XV.

Family: GRYPHAEIDAE

Genus: *Hytissa*

Hytissa hyotis

Linnaeus, 1758 Introduced.

1950 Ref - Paulay, 1996
1950 Ref - Paulay, 1996

USNM 700474.
USNM 699996.

Genus: *Parahytissa*

Parahytissa numisma

(Lamarck, 1819) Indigenous.

Unknown Spec - BPBM-MO 60242
1902 Ref - Dall et al., 1938
1932 Spec - BPBM-MO 200507
1935 Ref - Ingram, 1937
1973 Ref - Evans et al., 1974
1999 USS Missouri Project (Coles et al. 1999)

Catalogue V.
Recorded as *O. thaunami* Dall et al., 1938. USNM 335600.
Fort Kamehameha, reef off. Catalogue XIV.
Recorded as *O. thaunami*.
Recorded as *Ostrea hanleyana*.
Recorded as *Ostrea hanleyana*.

Family: ISOGNOMONIDAE

Genus: *Isognomon*

Isognomon sp.

Indigenous.

1934 Spec - BPBM-MO 205583
1973 Ref - Evans et al., 1974
1979 Ref - AECOS, 1979
1986 Ref - Lenihan, 1990
2008 Legacy II Project (Coles et al., 2009)

Dredge. Catalogue XIV.
Off Pearl Harbor.

Isognomon sp. m-2

Unknown Spec - BPBM-MO 60199

Catalogue V.

Pearl Harbor - Species Report (Cont.)

<i>Isognomon anomioides</i>		Reeve	
1932	Spec - BPBM-MO 200513		Fort Kamehameha. Catalogue XIV.
<i>Isognomon californicum</i>		(Conrad, 1837)	Indigenous.
2008	Legacy II Project (Coles et al., 2009)		
<i>Isognomon incisum</i>		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.
<i>Isognomon legumen</i>		(Gmelin, 1791)	Indigenous.
1996	Legacy Project (Coles et al., 1997)		
2008	Legacy II Project (Coles et al., 2009)		
<i>Isognomon perna</i>		(Linnaeus, 1767)	Indigenous. Hawaiian name: nahawe.
Unknown	Spec - BPBM-MO 60176		Catalogue V.
1920	Ref - Dall et al., 1938		Recorded as <i>Isognomon costellatum</i> . USNM 337484.
1920	Ref - Dall et al., 1938		Recorded as <i>Isognomon costellatum</i> . USNM 428275.
1973	Ref - Evans et al., 1974		
2008	Legacy II Project (Coles et al., 2009)		
Family: LIMIDAE			
Genus: <i>Lima</i>			
<i>Lima aperta</i>		Sowerby	
1932	Spec - BPBM-MO 200194		Fort Kamehameha; along edge of channel. Catalogue XIV.
Questionable ID.			
Family: MALLEIDAE			
Genus: <i>Malleus</i>			
<i>Malleus daemonicus?</i>		Reeve, 1858	
1950	Spec - BPBM-MO 250727		Ship bottom. Catalogue XVII.
<i>Malleus regula</i>		(Forsskål, 1775)	
1943	Ref - Hutchins, 1949		Recorded as <i>Malleus nuttalli</i> .
Family: MYTILIDAE			
Unidentified Mytilidae			
1950	Spec - BPBM-MO 250729		Ship bottom (with BPBM 250728). Catalogue XVII.
Genus: <i>Brachidontes</i>			
<i>Brachidontes crebristriatus</i>		(Conrad, 1837)	Indigenous. Hawaiian name: `owa`owaka;
nahawelepahikaua;		nahawele li`ili`i; kio nahawe.	
Unknown	Spec - BPBM-MO 60320		Catalogue V.
1902	Ref - Dall et al., 1938		USNM 335839.
1920	Ref - Dall et al., 1938		USNM 428391.
1920	Ref - Dall et al., 1938		Recorded as <i>Brachidontes crebristriatus maritimus</i> . USNM
428270.			
1921	Ref - Pilsbry, 1921		Recorded as <i>Mytilus crebristriatus</i> .
1923	Spec - BPBM-MO 196317		Peninsula; Railroad Wharf. Catalogue XIV.
1938	Ref - Dall et al., 1938		USNM 337445.
1938	Ref - Dall et al., 1938		BPBM 159.
1973	Ref - Evans et al., 1974		Recorded as <i>Hormomya crebristriatus</i> (Conrad).
1996	Legacy Project (Coles et al., 1997)		
Genus: <i>Lithophaga</i>			
<i>Lithophaga fasciola</i>		Dall, Bartsch & Rehder, 1938	
1996	Legacy Project (Coles et al., 1997)		
Genus: <i>Musculus</i>			
<i>Musculus oahuensis</i>		Dall, Bartsch & Rehder, 1938	
1920	Ref - Dall et al., 1938		USNM 484181.

Pearl Harbor - Species Report (Cont.)

Genus: *Septifer*

Septifer bryanai

Pilsbry, 1921

1972 Ref - Long, 1974

Off Pearl Harbor.

Family: OSTREIDAE

Unidentified Ostreidae

1996 Legacy Project (Coles et al., 1997)
2007 Legacy II Project (Coles et al., 2009)
2008 Legacy II Project (Coles et al., 2009)

Genus: *Crassostrea*

Crassostrea sp.

Introduced.

1996 Legacy Project (Coles et al., 1997)
2008 Legacy II Project (Coles et al., 2009)

Crassostrea gigas

(Thunberg, 1793) Introduced.

1938 Ref - Brock, 1960
1993 Ref - Brock, 1994
1994 Ref - Brock, 1995
2007 Ref - Brock, 2007

Crassostrea retusa

Sowerby, 1871 Fossil.

1899 Spec - BPBM-MO 67990
30ft. above Tide..

1/4 mile E. of Waipio Station in Railway cut near Pearl Harbor

1912 Spec - BPBM-MO 68168
1923 Spec - BPBM-MO 67483
1932 Spec - BPBM-MO 200301

Catalogue V.
(Pliocene). Catalogue V.
Shore. Eastside of Waipio Peninsula. Catalogue V.
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 Legacy Project (Coles et al., 1997)
2006 Ref - Smith et al., 2006
2008 Legacy II Project (Coles et al., 2009)

Genus: *Dendostrea*

Dendostrea sandvicensis

Sowerby, 1871 Indigenous. Common name: Noble Vermitid.

Unknown Spec - BPBM-MO 60225
Unknown Spec - BPBM-MO 60226
Unknown Spec - BPBM-MO 60228
Unknown Spec - BPBM-MO 60231
1902 Ref - Dall et al., 1938
1902 Ref - Dall et al., 1938
1912 Spec - BPBM-MO 68169
1915 Spec - BPBM-MO 31
1915 Ref - Bryan, 1915
1920 Ref - Dall et al., 1938
1920 Ref - Dall et al., 1938
1920 Ref - Dall et al., 1938
1921 Ref - Pilsbry, 1921
1921 Ref - Pilsbry, 1921
1923 Spec - BPBM-MO 32

Catalogue V.
Catalogue V.
Catalogue V.
Catalogue V.
Recorded as *Ostrea sandvichensis*. USNM 335584.
Recorded as *O. kupua* Dall et al., 1938. USNM 335586.
(Pliocene). Catalogue V.
Ford Island.
Recorded as *O. rosacea*.
Recorded as *O. kupua* Dall et al., 1938. USNM 321289.
Recorded as *O. kupua* Dall et al., 1938. USNM 484156.
Recorded as *O. kupua* Dall et al., 1938. USNM 321284.
Recorded as *Ostrea sandvichensis*.
Recorded as *Ostrea sandvichensis*. MCZ 31714.
At Railroad Wharf opposite Ford Island, Peninsula.

Pearl Harbor - Species Report (Cont.)

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 <i>Ostrea sandvichensis</i> .
1936	Ref - Edmondson & Ingram, 1939	Recorded as <i>Ostrea sandvichensis</i> .
1938	Ref - Dall et al., 1938	Recorded as <i>Ostrea sandvichensis</i> . USNM 337472.
1938	Ref - Dall et al., 1938	Recorded as <i>O. kupua</i> Dall et al., 1938. BPBM 60225.
1972	Ref - Long, 1974	Recorded as <i>O. sandvichensis</i> var. <i>thaanumi</i> .
1973	Ref - Evans et al., 1974	Recorded as <i>Ostrea sandvichensis</i> .
1987	Ref - Brewer & Assoc., 1987	Recorded as <i>Ostrea sandvichensis</i> .
1993	Ref - Brock, 1994	Recorded as <i>Ostrea sandvichensis</i> .
1994	Ref - Brock, 1995	Recorded as <i>Ostrea sandvichensis</i> .
1996	Legacy Project (Coles et al., 1997)	
1999	USS Missouri Project (Coles et al. 1999)	
2007	Ref - Brock, 2007	Recorded as <i>Ostrea sandvichensis</i> .
2008	Legacy II Project (Coles et al., 2009)	
Genus: <i>Lopha</i>		
<i>Lopha cristigalli</i> (Linnaeus, 1758) Introduced.		
1951	Ref - Paulay, 1996	USNM 699998.
Genus: <i>Nanostrea</i>		
<i>Nanostrea exigua</i> Harry, 1985		
1985	Ref - Harry, 1985	
1996	Ref - Paulay, 1996	USNM 337556.
Genus: <i>Ostrea</i>		
<i>Ostrea</i> 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 <i>Ostrea frons</i> .
1973	Ref - Evans et al., 1974	
1986	Ref - Lenihan, 1990	
1996	Legacy Project (Coles et al., 1997)	
<i>Ostrea cf. hanleyana</i> Sowerby, 1871 Indigenous.		
2008	Legacy II Project (Coles et al., 2009)	
<i>Ostrea lima</i> Sowerby, 1871 Indigenous.		
1972	Ref - Long, 1974	Recorded as <i>O. kavaia</i> Dall et al., 1938.
<i>Ostrea margaritae</i> Pisbry, 1918		
Unknown	Spec - BPBM-MO 65691	Catalogue V.
Genus: <i>Saccostrea</i>		
<i>Saccostrea cucullata</i> (Born, 1778)		
1996	Legacy Project (Coles et al., 1997)	
Family: PECTINIDAE		
Genus: <i>Anguipecten</i>		
<i>Anguipecten lamberti</i> Sowerby, 1874		
1961	Spec - BPBM-MO 218856	Off Fort Kamehameha. Catalogue XV. Questionable ID.
Genus: <i>Chlamys</i>		
<i>Chlamys</i> sp.		
1934	Spec - BPBM-MO 205571	Dredge. Catalogue XIV.
1934	Spec - BPBM-MO 205572	Dredge. Catalogue XIV.
<i>Chlamys irregularis</i> (Sowerby, 1842) Indigenous.		
Unknown	Spec - BPBM-MO 60247	Catalogue V.
1923	Spec - BPBM-MO 39	Ford Island Wharf on Penisula.

Pearl Harbor - Species Report (Cont.)

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: <i>Pecten</i>		
<i>Pecten n. sp. p-4</i>		
Unknown	Spec - BPBM-MO 60291	Ford Island. Catalogue V. Questionable ID.
<i>Pecten n. sp. p-5</i>		
Unknown	Spec - BPBM-MO 60292	Catalogue V. Questionable ID.
Family: PINNIDAE		
Genus: <i>Pinna</i>		
<i>Pinna sp.</i>		
1973	Ref - Evans et al., 1974	
<i>Pinna muricata</i> Linnaeus, 1758		
1972	Ref - Long, 1974	Off Pearl Harbor.
Family: PTERIIDAE		
Genus: <i>Pinctada</i>		
<i>Pinctada sp.</i> Indigenous.		
Unknown	Spec - BPBM-MO 45	
2007	Legacy II Project (Coles et al., 2009)	
<i>Pinctada cumingi</i> 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.
<i>Pinctada margaritifera</i> (Linnaeus, 1758) Indigenous. Common name: mother-of-pearl shell;		
Hawaiian name: pa; pa hau.		
1915	Ref - Bryan, 1915	Recorded as <i>Avicula margaritifera</i> .
1926	Spec - BPBM-MO 208454	Shore, rocks east of Mokapu. Catalogue XIV.
1936	Spec - BPBM-MO 24	Reef at Fort Kamehameha.
1972	Ref - Long, 1974	Off Pearl Harbor.
1973	Ref - Evans et al., 1974	
1996	Legacy Project (Coles et al., 1997)	
2006	Ref - Smith et al., 2006	
<i>Pinctada radiata</i> (Leach, 1814) Indigenous. Hawaiian name: 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 <i>Margaritifera fimbriata</i> .
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 <i>P. nebulosa</i> .
1938	Ref - Dall et al., 1938	Recorded as <i>P. nebulosa</i> (Conrad, 1837). BPBM 9.
1938	Ref - Dall et al., 1938	Recorded as <i>P. nebulosa</i> (Conrad, 1837). USNM 337475.
1939	Ref - Dall et al., 1938	Recorded as <i>P. nebulosa</i> (Conrad, 1837). USNM 382878.
1996	Legacy Project (Coles et al., 1997)	
Genus: <i>Pteria</i>		
<i>Pteria loveni</i> (Dunker, 1872)		
1972	Ref - Long, 1974	Off Pearl Harbor. Questionable ID.

Pearl Harbor - Species Report (Cont.)

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	
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Spondylus linguaefelis

Sowerby, 1847

1972	Ref - Long, 1974	Off Pearl Harbor. Recorded as <i>Spondylus gloriosus</i> .
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Spondylus linguaefelis?

Sowerby, 1847

1961	Spec - BPBM-MO 221073	Off Fort Kamehameha. Catalogue XV.
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Spondylus sparsispinosus

1918	Spec - BPBM-MO 28	
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Spondylus tenebrosus

Reeve, 1856

2007	Ref - Brock, 2007	
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Spondylus violacescens

Reeve, 1856

Hawaiian name: `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 <i>Spondylus hawaiiensis</i> Dall et al., 1938.
1993	Ref - Brock, 1994	Recorded as <i>Spondylus tenebrosus</i> .
1994	Ref - Brock, 1995	Recorded as <i>Spondylus tenebrosus</i> .

Order: VENEROIDA

Family: CARDIIDAE

Genus: *Trachycardium*

Trachycardium orbita

Sowerby, 1833

Hawaiian name: `olepe kupa; pupu kupa.

1920	Ref - Dall et al., 1938	Recorded as <i>T. hawaiiensis</i> . USNM 346229.
1932	Spec - BPBM-MO 200248	Pearl Harbor Channel; Watertown. Catalogue XIV.

Family: CHAMIDAE

Genus: *Chama*

Chama sp.

Indigenous.

1973	Ref - Evans et al., 1974	
1996	Legacy Project (Coles et al., 1997)	
1999	USS Missouri Project (Coles et al. 1999)	
2008	Legacy II Project (Coles et al., 2009)	

Chama brassica

Reeve, 1847

Introduced.

1951	Ref - Paulay, 1996	USNM 700006.
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Chama cf. fibula

Reeve, 1846

Cryptogenic.

1999	USS Missouri Project (Coles et al. 1999)	
2008	Legacy II Project (Coles et al., 2009)	

Chama elatensis

Delsaerd, 1986

Introduced.

1996	Legacy Project (Coles et al., 1997)	
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Chama fibula

Reeve, 1846

Cryptogenic.

1920	Ref - Dall et al., 1938	Recorded as <i>C. hendersoni</i> . USNM 341296.
1920	Ref - Dall et al., 1938	Recorded as <i>C. hendersoni</i> . USNM 484174.
1935	Spec - BPBM-MO 35	Near Yacht Club.
1979	Ref - Kay, 1979	
1996	Legacy Project (Coles et al., 1997)	
2008	Legacy II Project (Coles et al., 2009)	

Chama iostoma

Conrad, 1837

Indigenous.

Unknown	Spec - BPBM-MO 60395	Catalogue V.
1920	Ref - Dall et al., 1938	USNM 484173.
1923	Spec - BPBM-MO 36	Near entrance.
2007	Legacy II Project (Coles et al., 2009)	

Pearl Harbor - Species Report (Cont.)

2008	Legacy II Project (Coles et al., 2009)		
<i>Chama lazarus</i>		Linnaeus, 1758	Introduced.
1950	Ref - Paulay, 1996		USNM 699558.
1996	Legacy Project (Coles et al., 1997)		
<i>Chama macerophylla</i>		Gmelin, 1791	
2006	Ref - Smith et al., 2006		Recorded as <i>Chama elatensis</i> .
<i>Chama pacifica</i>		Brodrup, 1835	Introduced.
1950	Ref - Paulay, 1996		USNM 699558.
1950	Ref - Paulay, 1996		USNM 699565.
1950	Ref - Paulay, 1996		USNM 699561.
1951	Ref - Paulay, 1996		USNM 699563.
1996	Legacy Project (Coles et al., 1997)		
Family: GLOSSIDAE			
Genus: <i>Meiocardia</i>			
<i>Meiocardia hawaiana</i>		Dall, Bartsch & Rehder	
1961	Spec - BPBM-MO 218932		Off Fort Kamehameha. Catalogue XV.
Family: KELLIIDAE			
Genus: <i>Lasaea</i>			
<i>Lasaea hawaiiensis</i>		Dall, Bartsch & Rehder, 1938	
1923	Spec - BPBM-MO 240097		Crevices in shore rocks, Peninsula. Catalogue XVI.
1923	Ref - Dall et al., 1938		Recorded as <i>Lasaea hawaiiensis</i> . BPBM 3.
Family: LUCINIDAE			
Genus: <i>Ctena</i>			
<i>Ctena sp.</i>		Hawaiian name: `olepe kupe.	
1934	Spec - BPBM-MO 205589		Dredge. Catalogue XIV.
<i>Ctena bella</i>		(Conrad, 1837)	Indigenous. Hawaiian name: `olepe kupe `opiopio.
1920	Ref - Dall et al., 1938		USNM 341291.
1920	Ref - Dall et al., 1938		USNM 428228.
1920	Ref - Dall et al., 1938		USNM 428390.
1923	Spec - BPBM-MO 196300		Peninsula; Railroad Wharf. Catalogue XIV.
1923	Spec - BPBM-MO 33		At Railroad 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	Legacy Project (Coles et al., 1997)		
2008	Legacy II Project (Coles et al., 2009)		
Genus: <i>Lucina</i>			
<i>Lucina edentula</i>		(Linnaeus, 1758)	
1961	Spec - BPBM-MO 218798		Off Fort Kamehameha. Catalogue XV.
Genus: <i>Pillucina</i>			
<i>Pillucina spaldingi</i>		(Pilsbry, 1921)	
1973	Ref - Evans et al., 1974		
1996	Legacy Project (Coles et al., 1997)		
Family: MACTRIDAE			
Genus: <i>Mactra</i>			
<i>Mactra thaanumi</i>		Dall, Bartsch & Rehder	
1963	Spec - BPBM-MO 221087		Off Pearl Harbor. Catalogue XV.
Family: SEMELIDAE			
Genus: <i>Abra</i>			
<i>Abra sp. A sp.</i>		Introduced.	
1996	Legacy Project (Coles et al., 1997)		

Pearl Harbor - Species Report (Cont.)

Genus: *Semele*

Semele australis

Sowerby, 1832

Unknown Spec - BPBM-MO 209617

Catalogue XIV.

Family: TELLINIDAE

Unidentified Tellinidae

1996 Legacy Project (Coles et al., 1997)

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 337353.

1938 Ref - Dall et al., 1938

Recorded as *Scissulina dispar*. USNM 33754.

Macoma obliquilineata

(Conrad, 1837)

1920 Ref - Dall et al., 1938

Recorded as *Jactellina obliquilineata*. USNM 331294.

Genus: *Pharoanella*

Pharoanella variabilis

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 Legacy Project (Coles et al., 1997)

Tellina sp. A

1996 Legacy Project (Coles et al., 1997)

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 fasigata

Sowerby, 1851

New record for Hawaii. Cryptogenic. Common name: Hawaiian Oyster.

2008 Legacy II Project (Coles et al., 2009)

Pearl Harbor - Species Report (Cont.)

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	Legacy Project (Coles et al., 1997)	

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 <i>P. edmonsoni</i> . USNM 428286.
1938	Ref - Dall et al., 1938	Recorded as <i>P. edmonsoni</i> . BPBM 2016c.

Genus: *Venerupis*

Venerupis (Ruditapes) philippinarum (A. Adams & Reeve) Introduced.

Unknown	Spec - BPBM-MO 209621	Catalogue XIV.
1918	Ref - Dall et al., 1938	Recorded as <i>Venerupis philippinarum</i> . USNM 337389.
1919	Ref - Bryan, 1919	Recorded as <i>Tapes philippinarum okupi</i> .
1920	Ref - Edmondson & Wilson, 1940	Recorded as <i>Tapes philippinarum</i> .
1920	Ref - Thanaum, 1921	Recorded as <i>Tapes philippinarum</i> .
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 <i>Tapes philippinarum</i> .
1996	Legacy Project (Coles et al., 1997)	

Genus: *Venus*

Venus sp.

1934	Spec - BPBM-MO 205578	Dredge. Catalogue XIV.
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Order: MYOIDA

Family: GASTROCHAENIDAE

Genus: *Gastrochaena*

Gastrochaena gigantea

Spengler, 1783 Hawaiian name: `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 <i>Rocellaria hawaiiensis</i> . USNM 341293.
1938	Ref - Dall et al., 1938	Recorded as <i>Rocellaria hawaiiensis</i> . BPBM 60549.
1938	Ref - Dall et al., 1938	Recorded as <i>Rocellaria hawaiiensis</i> . BPBM 94.
1938	Ref - Dall et al., 1938	Recorded as <i>Rocellaria hawaiiensis</i> . USNM 337310.
1938	Ref - Dall et al., 1938	Recorded as <i>Rocellaria hawaiiensis</i> . USNM 361952.

Genus: *Rocellaria*

Rocellaria sp.

1973	Ref - Evans et al., 1974	
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Rocellaria gigantea

Deshayes Hawaiian names: `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.

Pearl Harbor - Species Report (Cont.)

Family: HIATELLIDAE

Genus: *Hiatella*

Hiatella arctica

(Linnaeus, 1767) Introduced.

1973	Ref - Evans et al., 1974	Recorded as <i>Hiatella hawaiiensis</i> Dall et al., 1938.
1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	
1975	Ref - Grovhoug, 1976	Recorded as <i>Hiatella hawaiiensis</i> Dall et al., 1938.
1978	Ref - Grovhoug, 1979	<i>Hiatella hawaiiensis</i> Dall, Bartsch & Rehder, 1938.
1987	Ref - Brewer & Assoc., 1987	Recorded as <i>Hiatella hawaiiensis</i> Dall et al., 1938.
1996	Legacy Project (Coles et al., 1997)	
1999	USS Missouri Project (Coles et al. 1999)	
2008	Legacy II Project (Coles et al., 2009)	

Sphenia luticola

(H. & A. Adams, 1854) Introduced.

1972	Ref - Long, 1974	Recorded as <i>S. cf. fragilis</i> (H. & A. Adams, 1846).
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Family: MYIDAE

Genus: *Sphenia*

Sphenia sp. A sp.

Introduced.

1996	Legacy Project (Coles et al., 1997)	
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Family: PHOLADIDAE

Genus: *Martesia*

Martesia sp.

1939	Spec - BPBM-MO 205356	Catalogue XIV.
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Martesia striata

(Linnaeus, 1758) Introduced. Hawaiian name: `olepe makaloa.

Unknown	Spec - BPBM-MO 60554	Catalogue V.
1920	Ref - Dall et al., 1938	Recorded as <i>M. hawaiiensis</i> . USNM 484213.
1920	Ref - Dall et al., 1938	Recorded as <i>M. hawaiiensis</i> . USNM 218042.
1920	Ref - Dall et al., 1938	Recorded as <i>M. hawaiiensis</i> . BPBM 30.
1920	Ref - Dall et al., 1938	Recorded as <i>M. hawaiiensis</i> . USNM 484214.
1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	
1986	Ref - Lenihan, 1990	
1996	Legacy Project (Coles et al., 1997)	

Genus: *Pholas*

Pholas sp.

Unknown	Spec - BPBM-MO 67987	Said by Dr. C.M. Cooke to have come from Pearl Harbor.
Catalogue V.		Questionable ID.

Family: TEREDINIDAE

Unidentified Teredinidae

1996	Legacy Project (Coles et al., 1997)	
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Genus: *Bankia*

Bankia bipalmulata

(Lamarck, 1801) Introduced.

1936	Ref - Edmondson, 1942	Recorded as <i>Bankia hawaiiensis</i> .
1976	Ref - Cooke et al., 1980	

Genus: *Lyrodus*

Lyrodus affinis

Deschayes, 1863 Introduced.

1973	Ref - McCain, 1974	Recorded as <i>Teredo ?milleri</i> .
1973	Ref - McCain, 1975	Recorded as <i>Teredo ?milleri</i> .
1976	Ref - Cooke et al., 1980	

Lyrodus pedicellatus

(Quatrefages, 1849) Introduced.

1935	Ref - Edmondson, 1940	Recorded as <i>Bankia hawaiiensis</i> .
1938	Ref - Dall et al., 1938	Recorded as <i>Teredo kauaiensis</i> .
1976	Ref - Cooke et al., 1980	

Pearl Harbor - Species Report (Cont.)

Genus: <i>Teredo</i>		Hawaiian name: wawahi wa`a.
<i>Teredo</i> sp.		Indigenous.
Catalogue V.	Unknown Spec - BPBM-MO 67988	Said by Dr. C.M. Cooke to have come from Pearl Harbor.
	1973 Ref - Evans et al., 1974	
	1986 Ref - Lenihan, 1990	
	2008 Legacy II Project (Coles et al., 2009)	
<i>Teredo bartschi</i>		Clapp, 1923 Introduced.
	1935 Ref - Edmondson, 1940	
	1935 Ref - Edmondson, 1942	
	1976 Ref - Cooke et al., 1980	
	1996 Legacy Project (Coles et al., 1997)	
<i>Teredo clappi</i>		Bartsch, 1923 Introduced.
	1923 Ref - Dall et al., 1938	Recorded as <i>T. trulliformis</i> Miller, 1924. USNM 361888.
	1924 Ref - Miller, 1924	Recorded as <i>T. trulliformis</i> Miller, 1924.
	1976 Ref - Cooke et al., 1980	
<i>Teredo diegensis</i>		Bartsch, 1916
	1924 Ref - Edmondson, 1940	
	1924 Ref - Edmondson, 1942	
	1973 Ref - McCain, 1974	
	1973 Ref - McCain, 1975	
<i>Teredo furcifera</i>		van Martens, 1894 Introduced.
	1921 Ref - Bartsch, 1921	Recorded as <i>T. parksi</i> Bartsch, 1921.
	1921 Ref - Dall et al., 1938	Recorded as <i>T. parksi</i> Bartsch, 1921. USNM 345311.
	1921 Ref - Dall et al., 1938	Recorded as <i>T. parksi</i> Bartsch, 1921. USNM 489211.
	1921 Ref - Dall et al., 1938	Recorded as <i>T. parksi</i> Bartsch, 1921. USNM 341132.
	1935 Ref - Edmondson, 1942	Recorded as <i>T. parksi</i> Bartsch, 1921.
	1976 Ref - Cooke et al., 1980	
<i>Teredo oahuensis</i>		Edmondson, 1942
	1973 Ref - McCain, 1974	
	1973 Ref - McCain, 1975	
Class: SCAPHOPODA		
Order: DENTALIDA		
Family: DENTALIIDAE		
Genus: <i>Dentalium</i>		
<i>Dentalium</i> sp.		
	1961 Spec - BPBM-MO 220733	Off Fort Kamehameha. Catalogue XV.
Class: CEPHALOPODA		
Order: OCTOPODA		
Family: OCTOPODIDAE		
Genus: <i>Polypus</i>		
<i>Polypus</i> 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 Legacy Project (Coles et al., 1997)	

Pearl Harbor - Species Report (Cont.)

2008 Legacy II Project (Coles et al., 2009)

Order: PANTOPODA

Family: AMMOTHEIDAE

Genus: *Achelia*

Achelia plicata

1973 Ref - Evans et al., 1974

Dillwyn

Off Pearl Harbor.

Family: ENDEIDAE

Genus: *Endeis*

Endeis nodosa

1973 Ref - Evans et al., 1974

Hilton, 1942

Endeis procera

1996 Legacy Project (Coles et al., 1997)

(Loman)

Family: PYCNOGONIDAE

Genus: *Anoplodactylus*

Anoplodactylus sp.

1948 Spec - BPBM-S 8605

Identified by C.A. Child, 1969.

Anoplodactylus californicus

1996 Legacy Project (Coles et al., 1997)

Hall

Anoplodactylus portus

1937 Spec - BPBM-S 4963

1945 Spec - BPBM-S 7219

1947 Spec - BPBM-S 7227

1948 Spec - BPBM-S 7243

1948 Spec - BPBM-S 8786

1973 Ref - Evans et al., 1974

Calman

Identified by J.H. Stock, 1967 (Loan #1616).

Drydock.

Anoplodactylus projectus

1938 Spec - BPBM-S 4702

Hilton

Identified by Dr. Hilton.

Anoplodactylus pyncnosoma

1996 Legacy Project (Coles et al., 1997)

(Helfer)

Genus: *Pigrogromitus*

Pigrogromitus robustus

1948 Spec - BPBM-S 8606

Identified by C.A. Child, 1969.

Pigrogromitus timsanus

1996 Legacy Project (Coles et al., 1997)

Calman

Introduced.

Class: CRUSTACEA

Unidentified Cirripedia

1931 Spec - BPBM-B 277

1976 Spec - BPBM-B 587

1982 Spec - BPBM-B 499

1982 Spec - BPBM-B 513

Merry Point.

Off Pearl Harbor; from dredge spoil dumping site.

Off Pearl Harbor; from dredge spoil dumping site.

Unidentified Copepoda

1996 Legacy Project (Coles et al., 1997)

Unidentified Ostracoda

1973 Ref - Evans et al., 1974

1996 Legacy Project (Coles et al., 1997)

Family: CYLINDROLEBERIDIDAE

Genus: *Parasterope*

Parasterope sp.

2008 Legacy II Project (Coles et al., 2009)

Indigenous.

Pearl Harbor - Species Report (Cont.)

Family: CYPRIDIDAE

Genus: *Paravargula*

Paravargula sp.

Indigenous.

2007 Legacy II Project (Coles et al., 2009)

2008 Legacy II Project (Coles et al., 2009)

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.

Introduced. Common name: Acorn Barnacle.

1973 Ref - Evans et al., 1974

1975 Spec - BPBM-B 565

1976 Ref - Cooke et al., 1980

1986 Ref - Lenihan, 1990

1996 Legacy Project (Coles et al., 1997)

2008 Legacy II Project (Coles et al., 2009)

Balanus amphitrite

Darwin Introduced. Common name: Acorn Barnacle.

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

1935 Ref - Edmondson & Ingram, 1939

1935 Ref - Edmondson, 1944

Recorded as *B. amphitrite hawaiiensis* Broch.

1935 Ref - Ingram, 1937

1943 Ref - Hutchins, 1949

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:

Recorded as *B. amphitrite amphitrite*

1972 Ref - Long, 1974

Recorded as *B. amphitrite amphitrite*

1973 Ref - Evans et al., 1974

Recorded as *B. amphitrite hawaiiensis* Broch.

1973 Ref - McCain, 1974

Recorded as *B. amphitrite amphitrite*

1973 Ref - McCain, 1975

Recorded as *B. amphitrite amphitrite*

1975 Ref - Grovhoug, 1976

Recorded as *B. amphitrite hawaiiensis* Broch.

1987 Ref - Brewer & Assoc., 1987

Recorded as *B. amphitrite amphitrite*

1994 Ref - Brock, 1995

Recorded as *B. amphitrite amphitrite*

1996 Legacy Project (Coles et al., 1997)

Recorded as *B. amphitrite amphitrite*

1999 USS Missouri Project (Coles et al. 1999)

2008 Legacy II Project (Coles et al., 2009)

Pearl Harbor - Species Report (Cont.)

<i>Balanus amphitrite?</i>		Darwin	Introduced. Common name: Acorn Barnacle.
1975	Spec - BPBM-B 568		Identified by T.L. Smalley.
1977	Spec - BPBM-B 615		Pearl Harbor?. Identified by T.L. Smalley.
<i>Balanus crenatus</i>		Bruguere, 1789	
1972	Ref - Long, 1974		Off Pearl Harbor.
<i>Balanus eburneus</i>		Gould, 1841	Introduced. Common name: Reticulated Barnacle.
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	Legacy Project (Coles et al., 1997)		
2008	Legacy II Project (Coles et al., 2009)		
<i>Balanus reticulatus</i>		Utinomi, 1960	Introduced. Common name: Reticulated Barnacle.
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	Legacy Project (Coles et al., 1997)		
1999	USS Missouri Project (Coles et al. 1999)		
2008	Legacy II Project (Coles et al., 2009)		
<i>Balanus tintinnabulum</i>		(Linnaeus, 1758)	
1943	Ref - Hutchins, 1949		Off Pearl Harbor.
1972	Ref - Long, 1974		Off Pearl Harbor.
<i>Balanus trigonus</i>		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: <i>Chelonibia</i>			
<i>Chelonibia</i> sp.			
1973	Ref - Evans et al., 1974		
Family: CHTHAMALIDAE			
Genus: <i>Chthamalus</i>			
<i>Chthamalus</i> sp.		Introduced.	
1993	Ref - Brock, 1994		Recorded as <i>Chthamalus hembeli</i> .
1994	Ref - Brock, 1995		Recorded as <i>Chthamalus hembeli</i> .
<i>Chthamalus proteus</i>		Darbo & Southward, 1980	Introduced. Common name: Proteus Rock
			Barnacle.
1996	Legacy Project (Coles et al., 1997)		
1999	USS Missouri Project (Coles et al. 1999)		
2006	Ref - Smith et al., 2006		
2007	Ref - Brock, 2007		
2008	Legacy II Project (Coles et al., 2009)		

Pearl Harbor - Species Report (Cont.)

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 Legacy Project (Coles et al., 1997)

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

1978 Ref - Grovhoug, 1979

Recorded as *Apseudes* sp. 1.

Recorded as *Apseudes* sp. 1.

Apseudes sp. 2

1973 Ref - Evans et al., 1974

1978 Ref - Grovhoug, 1979

Recorded as *Apseudes* sp. 2.

Recorded as *Apseudes* sp. 2.

Apseudes sp. A

1996 Legacy Project (Coles et al., 1997)

Apseudes sp. 1

Indigenous.

2007 Legacy II Project (Coles et al., 2009)

Apseudes tropicalis

1996 Legacy Project (Coles et al., 1997)

Genus: *Parapseudes*

Parapseudes neglectus

Indigenous.

1996 Legacy Project (Coles et al., 1997)

Parapseudes pedispinis

Cryptogenic.

1996 Legacy Project (Coles et al., 1997)

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 Legacy Project (Coles et al., 1997)

1999 USS Missouri Project (Coles et al. 1999)

2007 Legacy II Project (Coles et al., 2009)

2008 Legacy II Project (Coles et al., 2009)

Family: TANAIDAE

Genus: *Anatanais*

Anatanais insularis

Miller, 1940 Indigenous.

1973 Ref - Evans et al., 1974

Pearl Harbor - Species Report (Cont.)

1978 Ref - Grovhoug, 1979
1996 Legacy Project (Coles et al., 1997)

Order: ISOPODA

Family: ANTHURIDAE

Genus: *Mesanthura*

Mesanthura n. sp.

Mesanthura sp. A Cryptogenic.

1996 Legacy Project (Coles et al., 1997)

1999 USS Missouri Project (Coles et al. 1999)

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?

Hansen

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: JAEROPSIDAE

Genus: *Jaeropsis*

Jaeropsis hawaiiensis

Miller, 1941

1927 Ref - Miller, 1941

Family: JANIRIDAE

Genus: *Carpias*

Carpias sp.

1996 Legacy Project (Coles et al., 1997)

Genus: *Cerpias*

Cerpias algicola

1996 Legacy Project (Coles et al., 1997)

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 Legacy Project (Coles et al., 1997)

Limnoria lignorum

1996 Legacy Project (Coles et al., 1997)

Limnoria tripunctata

Menzies, 1957 Introduced.

1973 Ref - Evans et al., 1974

1996 Legacy Project (Coles et al., 1997)

Pearl Harbor - Species Report (Cont.)

Family: MUNNIDAE

Genus: *Munna*

Munna acarina

1996 Legacy Project (Coles et al., 1997)

Family: SCYPHACIDAE

Genus: *Armadilloniscus*

Armadilloniscus litoralis

1996 Legacy Project (Coles et al., 1997)

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. Cryptogenic.

1996 Legacy Project (Coles et al., 1997)

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 Legacy Project (Coles et al., 1997)

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.

2007 Legacy II Project (Coles et al., 2009)

2008 Legacy II Project (Coles et al., 2009)

Family: AMPHILOCHIDAE

Genus: *Amphilocheus*

Amphilocheus kailua Barnard, 1970

1996 Legacy Project (Coles et al., 1997)

Amphilocheus likelike Barnard, 1970

1996 Legacy Project (Coles et al., 1997)

Pearl Harbor - Species Report (Cont.)

Genus: *Gitanopsis*
Gitanopsis pele Barnard, 1970
 1996 Legacy Project (Coles et al., 1997)

Family: AMPITHOIDAE

Genus: *Ampithoe*
Ampithoe sp.
Ampithoe waialua Barnard, 1970 Indigenous.
 1996 Legacy Project (Coles et al., 1997)
 1999 USS Missouri Project (Coles et al. 1999)

Genus: *Paragrubia*
Paragrubia vorax Chevreaux, 1901
 1996 Legacy Project (Coles et al., 1997)

Family: AORIDAE

Genus: *Bemlos*
Bemlos sp. Indigenous.
 1973 Ref - Evans et al., 1974 Recorded as Lembos.
Bemlos macromanus Shoemaker, 1925 Indigenous.
 1973 Ref - Evans et al., 1974 Recorded as Lembos macromanus.
 1978 Ref - Grovhoug, 1979 Recorded as Lembos macromanus.
 1996 Legacy Project (Coles et al., 1997)
Bemlos pualani (Barnard, 1970)
 1996 Legacy Project (Coles et al., 1997)
Bemlos waipio (Barnard, 1970)
 1996 Legacy Project (Coles et al., 1997)

Genus: *Grandidierella*
Grandidierella sp.
 2008 Legacy II Project (Coles et al., 2009)
Grandidierella bispinosa Cryptogenic.
 1996 Legacy Project (Coles et al., 1997)
Grandidierella japonica Introduced.
 1996 Legacy Project (Coles et al., 1997)

Family: CAPRELLIDAE

Unidentified Caprellidae
 2008 Legacy II Project (Coles et al., 2009)
 Genus: *Caprella* Hawaiian name: `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

Genus: *Paracaprella*
Paracaprella pusilla Mayer, 1890
 1978 Ref - Grovhoug, 1979

Family: COLOMASTIGIDAE

Genus: *Colomastix*
Colomastix kapiolani Barnard, 1970 Indigenous.
 1999 USS Missouri Project (Coles et al. 1999)
 2008 Legacy II Project (Coles et al., 2009)
Colomastix lunailo Barnard, 1970 Indigenous.
 1996 Legacy Project (Coles et al., 1997)
 1999 USS Missouri Project (Coles et al. 1999)
 2007 Legacy II Project (Coles et al., 2009)
 2008 Legacy II Project (Coles et al., 2009)
Colomastix pusilla Grube, 1855 Indigenous.
 1996 Legacy Project (Coles et al., 1997)

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2008 Legacy II Project (Coles et al., 2009)

Family: COROPHIIDAE

Genus: *Corophium*

Corophium sp. Introduced.

2007 Legacy II Project (Coles et al., 2009)

Corophium baconi Shoemaker, 1934 Introduced.

1973 Ref - Evans et al., 1974

1978 Ref - Grovhoug, 1979

1996 Legacy Project (Coles et al., 1997)

2008 Legacy II Project (Coles et al., 2009)

Corophium insidiosum Crawford, 1937 Introduced.

1978 Ref - Grovhoug, 1979

1996 Legacy Project (Coles et al., 1997)

Genus: *Ericthonius*

Ericthonius sp.

2008 Legacy II Project (Coles et al., 2009)

Ericthonius brasiliensis (Dana, 1853) Introduced.

1938 Ref - Barnard, 1955

1938 Spec - BPBM-S 5947

1973 Ref - Evans et al., 1974

1978 Ref - Grovhoug, 1979

1996 Legacy Project (Coles et al., 1997)

1999 USS Missouri Project (Coles et al. 1999)

2008 Legacy II Project (Coles et al., 2009)

Recorded as *Ericthonius brasiliensis*.

Identified by J.L. Barnard.

Recorded as *Ericthonius brasiliensis*.

Recorded as *Ericthonius brasiliensis*.

Genus: *Monocorophium*

Monocorophium ascherusicum (Costa, 1857) Introduced.

1973 Ref - Evans et al., 1974

1996 Legacy Project (Coles et al., 1997)

2008 Legacy II Project (Coles et al., 2009)

Recorded as *Corophium ascherusicum*.

Family: GAMMARIDAE

Genus: *Elasmopus*

Elasmopus sp. Indigenous.

2008 Legacy II Project (Coles et al., 2009)

Elasmopus diplonyx Schellenberg, 1938

1996 Legacy Project (Coles et al., 1997)

Elasmopus ecuadorensis hawaiiensis Schellenberg, 1938

1973 Ref - Evans et al., 1974

Elasmopus molokai Barnard, 1970

1996 Legacy Project (Coles et al., 1997)

Elasmopus pectenicrus (Bate, 1862)

1937 Ref - Barnard, 1955

1937 Spec - BPBM-S 5993

1944 Ref - Barnard, 1970

1948 Ref - Barnard, 1970

1948 Spec - BPBM-S 5994

1948 Spec - BPBM-S 8717

1948 Spec - BPBM-S 8718

1948 Spec - BPBM-S 8719

1950 Spec - BPBM-S 5995

1950 Spec - BPBM-S 6010

Off Pearl Harbor. Recorded as *Elasmopus pectenicrus*.

Identified by J.L. Barnard.

Off Pearl Harbor. Recorded as *Elasmopus pectenicrus*.

Recorded as *Elasmopus pectenicrus*.

Identified by J.L. Barnard.

Drydock. Identified by J.L. Barnard.

Drydock. Identified by J.L. Barnard.

Drydock. Identified by J.L. Barnard.

Identified by J.L. Barnard.

Identified by J.L. Barnard.

Elasmopus piikoi Barnard, 1970

1978 Ref - Grovhoug, 1979

Pearl Harbor - Species Report (Cont.)

<i>Elasmopus rapax</i>	(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	Legacy Project (Coles et al., 1997)	

Genus: *Eriopisa*

<i>Eriopisa hamakua</i>	Barnard, 1970	
1967	Spec - BPBM-S 7273	Off W end of Pearl Harbor.
1996	Legacy Project (Coles et al., 1997)	

Genus: *Eriopisella*

<i>Eriopisella sechellensis upolu</i>	
1996	Legacy Project (Coles et al., 1997)

Genus: *Maera*

<i>Maera sp.</i>	Indigenous.	
2007	Legacy II Project (Coles et al., 2009)	
<i>Maera kaiulani</i>	Barnard, 1970	
1967	Spec - BPBM-S 7276	Off W end of Pearl Harbor.
<i>Maera pacifica</i>	Indigenous.	
1996	Legacy Project (Coles et al., 1997)	
1999	USS Missouri Project (Coles et al. 1999)	
2008	Legacy II Project (Coles et al., 2009)	

Family: HYALIDAE

Genus: *Hyale*

<i>Hyale grandicornis bishopae</i>	Barnard, 1970	
1996	Legacy Project (Coles et al., 1997)	

Family: ISAEIDAE

Genus: *Gammaropsis*

<i>Gammaropsis sp.</i>		
<i>Gammaropsis alamoana</i>	Barnard, 1970	
1996	Legacy Project (Coles et al., 1997)	
1999	USS Missouri Project (Coles et al. 1999)	

Genus: *Photis*

<i>Photis hawaiiensis</i>	Barnard, 1955	Cryptogenic.
2008	Legacy II Project (Coles et al., 2009)	
<i>Photis hawaiiensis</i>	Barnard, 1955	
1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	
1996	Legacy Project (Coles et al., 1997)	

Family: LEUCOTHOIDAE

Genus: *Leucothoe*

<i>Leucothoe sp.</i>		
1973	Ref - Evans et al., 1974	
<i>Leucothoe hyhelia</i>	Barnard, 1965	Indigenous.
1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	
1996	Legacy Project (Coles et al., 1997)	
1999	USS Missouri Project (Coles et al. 1999)	
2007	Legacy II Project (Coles et al., 2009)	
2008	Legacy II Project (Coles et al., 2009)	
<i>Leucothoe tridens</i>	Stebbing, 1888	
1996	Legacy Project (Coles et al., 1997)	

Pearl Harbor - Species Report (Cont.)

Paraleucothoe flindersi Stebbing, 1888 Cryptogenic.
 1996 Legacy Project (Coles et al., 1997)
 1999 USS Missouri Project (Coles et al. 1999)

Family: LILJEBORGIIDAE

Genus: *Liljeborgia*
Liljeborgia heeia Baranard, 1970
 1996 Legacy Project (Coles et al., 1997)

Family: LYSIANASSIDAE

Genus: *Lysianassa*
Lysianassa ewa Barnard, 1970 Indigenous.
 1999 USS Missouri Project (Coles et al. 1999)
 2008 Legacy II Project (Coles et al., 2009)

Family: PACHYNIDAE

Unidentified Pachynidae
 2007 Legacy II Project (Coles et al., 2009)

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 Legacy Project (Coles et al., 1997)
 2008 Legacy II Project (Coles et al., 2009)

Podocerus talaus lawai
 1996 Legacy Project (Coles et al., 1997)

Family: STENOTHOIDAE

Unidentified Stenothoidae
 2008 Legacy II Project (Coles et al., 2009)

Genus: *Stenothoe*

Stenothoe catta
 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 Legacy Project (Coles et al., 1997)

Stenothoe valida Dana, 1853 Cryptogenic.
 1978 Ref - Grovhoug, 1979
 1996 Legacy Project (Coles et al., 1997)

Stenothoe sp.
 1999 USS Missouri Project (Coles et al. 1999)

Order: DECAPODA

Unidentified Caridea
 1996 Legacy Project (Coles et al., 1997)

Family: ALPHEIDAE

Unidentified Alpheidae
 1979 Ref - AECOS, 1979 Off Pearl Harbor.
 1996 Legacy Project (Coles et al., 1997)

Pearl Harbor - Species Report (Cont.)

Genus: <i>Alpheopsis</i>		
<i>Alpheopsis equalis</i>	Coutiere, 1896	
1973	Ref - Evans et al., 1974	
Genus: <i>Alpheus</i>		
<i>Alpheus sp.</i>		
1973	Ref - Evans et al., 1974	
1986	Ref - Lenihan, 1990	
1996	Legacy Project (Coles et al., 1997)	
1999	USS Missouri Project (Coles et al. 1999))	
<i>Alpheus sp. 1</i>		
1987	Ref - Brewer & Assoc., 1987	Recorded as <i>Alpheus sp. 1</i> .
<i>Alpheus brevipes</i>	De Haan, 1849	
1996	Legacy Project (Coles et al., 1997)	
<i>Alpheus collumianus</i>	Stimpson, 1860	
1996	Legacy Project (Coles et al., 1997)	
<i>Alpheus crassimanus</i>	Heller, 1865	
1929	Spec - BPBM-S 8928	Identified by Banner.
1938	Spec - BPBM-S 6442	Identified by A.H. Banner.
<i>Alpheus diadema</i>	Dana, 1852	
1973	Ref - Evans et al., 1974	
<i>Alpheus gracilipes</i>	Stimpson, 1860	
1973	Ref - Evans et al., 1974	
1996	Legacy Project (Coles et al., 1997)	
<i>Alpheus gracilis simplex</i>	(Banner, 1953)	
1973	Ref - Evans et al., 1974	
<i>Alpheus heeia</i>	Banner & Banner, 1974	
1973	Ref - Evans et al., 1974	
<i>Alpheus lanceoloti</i>	Coutiere, 1905	
1973	Ref - Evans et al., 1974	
<i>Alpheus lobidens</i>		
1996	Legacy Project (Coles et al., 1997)	
<i>Alpheus lobidens polynesica</i>	Banner & Banner, 1974	
1973	Ref - Evans et al., 1974	
<i>Alpheus lottini</i>	Guérin, 1829	
1996	Legacy Project (Coles et al., 1997)	
<i>Alpheus mackayi</i>	Banner & Banner, 1974	
1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
1996	Legacy Project (Coles et al., 1997)	
2007	Ref - Brock, 2007	
<i>Alpheus pacificus</i>	Dana, 1852	
1947	Spec - BPBM-S 5302	
1947	Spec - BPBM-S 5317	
1948	Spec - BPBM-S 5337	
<i>Alpheus paracrinitus</i>	Miers, 1881	
1973	Ref - Evans et al., 1974	
1996	Legacy Project (Coles et al., 1997)	
<i>Alpheus paralcycone</i>	Coutiere, 1905	
1973	Ref - Evans et al., 1974	

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<i>Alpheus platyunguiculatus</i>	(Banner, 1953)
1973 Ref - Evans et al., 1974	
<i>Alpheus rapacida</i>	deMan, 1911
1973 Ref - Evans et al., 1974	
1978 Ref - Grovhoug, 1979	
<i>Alpheus rapax</i>	Fabricius, 1798
1973 Ref - Evans et al., 1974	
Genus: <i>Leptalpheus</i>	
<i>Leptalpheus pacificus</i>	Banner & Banner, 1974
1972 Spec - BPBM-S 8550	
1973 Ref - Evans et al., 1974	
Genus: <i>Metalpheus</i>	
<i>Metalpheus paragracilis</i>	(Coutière, 1897)
1996 Legacy Project (Coles et al., 1997)	
Genus: <i>Synalpheus</i>	
<i>Synalpheus bituberculatus</i>	deMan, 1911
1973 Ref - Evans et al., 1974	
1996 Legacy Project (Coles et al., 1997)	
<i>Synalpheus pachymeris</i>	Coutiere, 1905
1973 Ref - Evans et al., 1974	
<i>Synalpheus paraneomeris</i>	Coutière, 1905
1996 Legacy Project (Coles et al., 1997)	
<i>Synalpheus streptodactylus</i>	Coutiere Indigenous. Common name: Snapping Shrimp.
1973 Ref - Evans et al., 1974	
1996 Legacy Project (Coles et al., 1997)	
2007 Legacy II Project (Coles et al., 2009)	
<i>Synalpheus thai</i>	Banner & Banner, 1966 Indigenous. Common name: Snapping Shrimp.
1973 Ref - Evans et al., 1974	
1996 Legacy Project (Coles et al., 1997)	
2007 Legacy II Project (Coles et al., 2009)	
Unidentified <i>Synalpheus</i>	
1996 Legacy Project (Coles et al., 1997)	
1999 USS Missouri Project (Coles et al. 1999)	
Family: AXIIDAE	
Genus: <i>Enoplometopus</i>	
<i>Enoplometopus occidentalis</i>	(Randall) Common name: Western Lobster; Hawaiian name: `opae; ula.
1973 Ref - Evans et al., 1974	
Family: CALAPPIDAE	
Genus: <i>Calappa</i>	Hawaiian name: pokipoki; papai pokipoki.
<i>Calappa gallus</i>	(Herbst, 1803)
1979 Ref - AECOS, 1979	Off Pearl Harbor.
<i>Calappa hepatica</i>	(Linnaeus, 1767) Common name: Hepatic Box Crab; Hawaiian names:
	pokipoki; pokipoki `au moana; pokipoki kuapa`a; popoki.
1973 Ref - Evans et al., 1974	
Genus: <i>Cryptosoma</i>	
<i>Cryptosoma granulosum</i>	Alcock
Unknown Spec - BPBM-S 1500	
Family: CALLIANASSIDAE	
Genus: <i>Callianassa</i>	
<i>Callianassa sp.</i>	
1996 Legacy Project (Coles et al., 1997)	

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Callianassa variabilis

1996 Legacy Project (Coles et al., 1997)

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*.

Family: GRAPSIDAE

Unidentified Grapsidae

1996 Legacy Project (Coles et al., 1997)

Genus: *Metapograpsus*

Metapograpsus thukuhar (Owen, 1839)

1906 Ref - Rathbun, 1906
 1929 Spec - BPBM-S 3157
 1931 Spec - BPBM-S 3368 Middle Loch.
 1939 Spec - BPBM-S 4427
 1948 Spec - BPBM-S 5331
 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 Legacy Project (Coles et al., 1997)

Genus: *Metopograpsus*

Metopograpsus messor (Forsk., 1775) Indigenous. Common name: Shore Crab.

2007 Legacy II Project (Coles et al., 2009)
 2008 Legacy II Project (Coles et al., 2009)

Metopograpsus thukuhar (Owen, 1893) Indigenous. Common name: Shore Crab.

2007 Ref - Brock, 2007 Recorded as *M. messor*.
 2008 Legacy II Project (Coles et al., 2009)

Genus: *Nanosesarma*

Nanosesarma minutum (De Man, 1887) Introduced.

1996 Legacy Project (Coles et al., 1997)

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Genus: <i>Pachygrapsus</i>		
<i>Pachygrapsus</i> sp.	Indigenous.	
2008	Legacy II Project (Coles et al., 2009)	
Genus: <i>Plagusia</i>		
<i>Plagusia depressa tuberculata</i>	Lamarck, 1818	
1947	Spec - BPBM-S 5306	
1973	Ref - Evans et al., 1974	Off Pearl Harbor. Recorded as <i>Plagusia depressa tuberculata</i>
(Lameroux).		
Family: HAPALOCARCINIDAE		
Genus: <i>Hapalocarcinus</i>		
<i>Hapalocarcinus marsupialis</i>	Stimpson, 1859	
1996	Legacy Project (Coles et al., 1997)	
Family: HIPPOLYTIDAE		
Genus: <i>Hippolysmata</i>		
<i>Hippolysmata</i> sp.		
1948	Spec - BPBM-S 6079	
<i>Hippolysmata vittata</i>		
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: <i>Leptodius</i>		
<i>Leptodius exaratus</i>	Milne Edwards	
1906	Ref - Rathbun , 1906	
<i>Leptodius sanguineus</i>	(H. Milne Edwards, 1834)	
1973	Ref - Evans et al., 1974	
Genus: <i>Lysmata</i>		
<i>Lysmata acicula</i>	(Rathbun)	
1948	Spec - BPBM-S 5329	
1973	Ref - Evans et al., 1974	
Genus: <i>Saron</i>		
<i>Saron marmoratus</i>	(Olivier, 1811)	Hawaiian name: `opae.
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
Genus: <i>Spirontocaris</i>		
<i>Spirontocaris marmoratus</i>		
1950	Spec - BPBM-S 5634	
Family: HOMOLIDAE		
Genus: <i>Homola</i>		
<i>Homola ikedai</i>	Sakai, 1879	
1976	Spec - BPBM-S 10637	Entrance to Pearl Harbor; 2.5 miles off Buoy 1.
Genus: <i>Paromola</i>		
<i>Paromola japonica</i>	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: <i>Randallia</i>		
<i>Randallia distincta</i>	Rathbun	
1983	Spec - BPBM-S 11187	Mamala Bay; Pearl Harbor disposal site. Identified by E.H.
Chave.		

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Family: MAJIDAE

Genus: *Hyastensus*

Hyastensus spinosus

1996 Legacy Project (Coles et al., 1997)

Genus: *Schizophroidea*

Schizophroidea hilensis

Rathbun, 1906

1996 Legacy Project (Coles et al., 1997)

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: Telescope-Eyed Ghost Crab; Hawaiian names: maka`aloe; `aloe; `ohiki makaloe.

1930 Spec - BPBM-S 3476

1973 Ref - Evans et al., 1974

1996 Legacy Project (Coles et al., 1997)

Middle Loch.

Genus: *Ocypode*

Ocypode ceratophthalma

(Pallas, 1872)

Common name: sand crab; Hawaiian name: `ohiki. Off Pearl Harbor.

1979 Ref - AECOS, 1979

Ocypode laevis

Dana

1996 Legacy Project (Coles et al., 1997)

Family: PALAEMONIDAE

Unidentified Palaemonidae

1996 Legacy Project (Coles et al., 1997)

Genus: *Brachycarpus*

Brachycarpus biunguiculatus

(Lucas, 1846)

1996 Legacy Project (Coles et al., 1997)

Genus: *Conchodytes*

Conchodytes tridacnae

Peters, 1852

1973 Ref - Evans et al., 1974

Off Pearl Harbor.

Genus: *Harpiliopsis*

Harpiliopsis depressa

(Stimpson, 1860)

1996 Legacy Project (Coles et al., 1997)

Genus: *Leander*

Leander sp.

1973 Ref - Evans et al., 1974

Genus: *Macrobrachium*

Macrobrachium grandimanus

(Randall)

Hawaiian name: `opae `oea`a.

1922 Spec - BPBM-S 717

Genus: *Palaemon*

Palaemon debelis

Dana, 1852

1934 Spec - BPBM-S 3833

Palaemon dibilis

Dana, 1852

1906 Ref - Rathbun, 1906

Palaemon pacificus

(Simpson)

1996 Legacy Project (Coles et al., 1997)

Palaemon pacificus?

(Simpson)

1978 Ref - Grovhoug, 1979

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Genus: <i>Palaemonella</i>			
<i>Palaemonella</i> sp.			
1973	Ref - Evans et al., 1974		
1996	Legacy Project (Coles et al., 1997)		
<i>Palaemonella rotumana</i>			
1996	Legacy Project (Coles et al., 1997)		
<i>Palaemonella tenuipes</i>		Dana, 1852	
1948	Spec - BPBM-S 5339		
1987	Ref - AECOS, 1987		Recorded as <i>Palaemonella tenuides</i> .
1996	Legacy Project (Coles et al., 1997)		
<i>Palaemonella tenuipes?</i>		Dana, 1852	
1973	Ref - McCain, 1974		Recorded as <i>Palaemonella tenuides</i> .
1973	Ref - McCain, 1975		Recorded as <i>Palaemonella tenuides</i> .
Family: PALINURIDAE			
Genus: <i>Panulirus</i>			
<i>Panulirus marginatus</i>		(Quoy & Gaimard, 1825)	
1973	Ref - Evans et al., 1974		Off Pearl Harbor.
<i>Panulirus penicillatus</i>		(Olivier, 1791)	
1973	Ref - Evans et al., 1974		
Family: PANDALIDAE			
Genus: <i>Heterocarpus</i>			
<i>Heterocarpus</i> sp.			
1982	Spec - BPBM-S 10095		Off Pearl Harbor dredge spoil site. Identified by D.M. Devaney.
<i>Heterocarpus ensifer</i>		Milne-Edwards	
1983	Spec - BPBM-S 11149		Mamala Bay; Pearl Harbor disposal site. Identified by R.M. Moffitt.
Genus: <i>Plesionika</i>			
<i>Plesionika</i> sp.			
1982	Spec - BPBM-S 10096		Off Pearl Harbor dredge spoil site; in vicinity of hard outcrop. Identified by D.M. Devaney.
<i>Plesionika alcocki</i>		(Anderson)	
1983	Spec - BPBM-S 11150		Mamala Bay; Pearl Harbor disposal site.
Family: PARTHENOPIIDAE			
Genus: <i>Parthenope</i>			
<i>Parthenope</i> sp.		Indigenous.	
2008	Legacy II Project (Coles et al., 2009)		
<i>Parthenope stellata</i>		Rathbun, 1906	
1982	Spec - BPBM-S 10097		Off Pearl Harbor dredge spoil site; in vicinity of hard outcrop. Identified by D.M. Devaney.
<i>Parthenope whitei</i>		(Adams & White)	
1973	Ref - Evans et al., 1974		
Family: PORTUNIDAE			
Unidentified Portunidae			
1996	Legacy Project (Coles et al., 1997)		
Genus: <i>Charybdis</i>			
<i>Charybdis erythrodactyla</i>		(Lamarck)	Common name: Red-Legged Swimming Crab; Hawaiian name: papa'i ako'ako'a.
1902	Spec - BPBM-S 4991		
<i>Charybdis hellerii</i>		(A. Milne Edwards)	Introduced.
1950	Spec - BPBM-S 5622		
1950	Ref - Edmondson, 1954		
<i>Charybdis orientalis</i>		Dana, 1852	
1902	Spec - BPBM-S 4992		

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Genus: <i>Libystes</i>		
<i>Libystes nitidus</i>	A. Milne Edwards, 1868	
1973	Ref - Evans et al., 1974	
Genus: <i>Podophthalmus</i>		
<i>Podophthalmus vigil</i>	(Weber, 1795)	Common name: Long-Eyed Swimming Crab; Hawaiian name: mo`ala.
1906	Ref - Rathbun, 1906	
1973	Ref - Evans et al., 1974	Recorded as <i>Podophthalmus vigil</i> (Fabricus).
2006	Ref - Smith et al., 2006	
Genus: <i>Portunus</i>		Hawaiian name: `ala`eke.
<i>Portunus longispinosus</i>	(Dana, 1852)	
1973	Ref - Evans et al., 1974	Recorded as <i>Portunus longispinosus</i> Rathbun.
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
<i>Portunus sanguinolentus</i>	(Herbst, 1899)	Common name: Blood-Spotted Swimming Crab; Hawaiian name: kuhonu; papa`i kuahonu; kuohonu.
1973	Ref - Evans et al., 1974	
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
2006	Ref - Smith et al., 2006	
2007	Ref - Brock, 2007	
Genus: <i>Scylla</i>		
<i>Scylla serrata</i>	(Forsskål, 1775)	Introduced. Common names: Serrate Swimming Crab; Samoan Crab; Mangrove Crab; Red Crab.
1973	Ref - Evans et al., 1974	Recorded as <i>Scylla serrata</i> de Man.
1987	Ref - Brewer & Assoc., 1987	
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
1996	Legacy Project (Coles et al., 1997)	
Genus: <i>Thalamita</i>		
<i>Thalamita admete</i>	(Herbst, 1803)	
1973	Ref - Evans et al., 1974	
<i>Thalamita crenata</i>	Latreille, 1900	
1973	Ref - Evans et al., 1974	
1987	Ref - AECOS, 1987	
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
1996	Legacy Project (Coles et al., 1997)	
2006	Ref - Smith et al., 2006	
<i>Thalamita crenata?</i>	Latreille, 1900	
1950	Spec - BPBM-S 5621	
<i>Thalamita dakini</i>	Montgomery, 1931	Indigenous.
2008	Legacy II Project (Coles et al., 2009)	
<i>Thalamita edwardsi</i>		
1950	Spec - BPBM-S 5619	
2007	Ref - Brock, 2007	
<i>Thalamita edwardsi?</i>		
1948	Spec - BPBM-S 5335	
<i>Thalamita integra</i>	Dana, 1852	Indigenous.
1915	Spec - BPBM-S 1590	
1916	Spec - BPBM-S 741	
1922	Spec - BPBM-S 1597	
1922	Spec - BPBM-S 718	

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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	Legacy Project (Coles et al., 1997)		
1999	USS Missouri Project (Coles et al. 1999)		
2007	Ref - Brock, 2007		
2008	Legacy II Project (Coles et al., 2009)		
<i>Thalamita medipacifica</i> Edmondson, 1954			
1923	Spec - BPBM-S 3210		
<i>Thalamita quadridens</i>			
1950	Spec - BPBM-S 5623		
Unidentified <i>Thalamita</i>			
1996	Legacy Project (Coles et al., 1997)		
2008	Legacy II Project (Coles et al., 2009)		
Family: RANINIDAE			
Genus: <i>Ranina</i>			
<i>Ranina ranina</i> Linnaeus, 1758			
1902	Spec - BPBM-S 4993		
Family: SCYLLARIDAE			
Genus: <i>Parribacus</i>			
<i>Parribacus antarcticus</i> (Lund, 1793) Common name: Antarctic Slipper Lobster; Hawaiian name: ula papapa.			
1973	Ref - Evans et al., 1974	Off Pearl Harbor.	
Genus: <i>Scyllarides</i>			
<i>Scyllarides squamosus</i> (Milne Edwards, 1837)			
1973	Ref - Evans et al., 1974		
1993	Ref - Brock, 1994		
1994	Ref - Brock, 1995		
Family: SERGESTIDAE			
Genus: <i>Lucifer</i>			
<i>Lucifer sp.</i>			
1973	Ref - Evans et al., 1974		
<i>Lucifer chacei</i> Bowman, 1966			
1978	Ref - Grovhoug, 1979		
Family: STENOPODIDAE			
Genus: <i>Stenopus</i>			
<i>Stenopus hispidus</i> (Olivier, 1811) Indigenous. Common name: Banded Shrimp; Hawaiian name: `opae huna.			
1973	Ref - Evans et al., 1974		
1996	Legacy Project (Coles et al., 1997)		

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2008 Legacy II Project (Coles et al., 2009)

Family: XANTHIDAE

Unidentified Xanthidae

1979 Ref - AECOS, 1979 Off Pearl Harbor.
1996 Legacy Project (Coles et al., 1997)
2007 Legacy II Project (Coles et al., 2009)

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 laevis (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 Legacy Project (Coles et al., 1997)

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

1996 Legacy Project (Coles et al., 1997)

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

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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 herbstii*.

Panopeus lacustris

Desbonne, 1867 Introduced.

2008 Legacy II Project (Coles et al., 2009)

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 Legacy Project (Coles et al., 1997)

2008 Legacy II Project (Coles et al., 2009)

Genus: *Paramedeus*

Paramedeus simplex

(Milne Edwards, 1873)

1996 Legacy Project (Coles et al., 1997)

Genus: *Phymodius*

Phymodius sp.

Indigenous.

2008 Legacy II Project (Coles et al., 2009)

Phymodius nitidus

(Dana, 1852) Indigenous.

1929 Spec - BPBM-S 3161

1973 Ref - Evans et al., 1974

1996 Legacy Project (Coles et al., 1997)

2007 Legacy II Project (Coles et al., 2009)

2008 Legacy II Project (Coles et al., 2009)

Phymodius unguatus

Milne Edwards, 1834

1996 Legacy Project (Coles et al., 1997)

Genus: *Pilumnus*

Pilumnus longicornis

Hilgendorf, 1878

1950 Spec - BPBM-S 5624

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<i>Pilumnus minutus</i>		De Haan, 1833	
1996	Legacy Project (Coles et al., 1997)		
<i>Pilumnus oahuensis</i>		Edmondson, 1931	Introduced. Common name: Pilumnid Crab.
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	Legacy Project (Coles et al., 1997)		
1999	USS Missouri Project (Coles et al. 1999)		
2007	Legacy II Project (Coles et al., 2009)		
2008	Legacy II Project (Coles et al., 2009)		
<i>Pilumnus taeniola</i>		Rathbun, 1906	Indigenous.
2008	Legacy II Project (Coles et al., 2009)		
Genus: <i>Platypodia</i>			
<i>Platypodia eydouxii</i>		(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 <i>Platypodia eydouxii</i> .
1996	Legacy Project (Coles et al., 1997)		
<i>Platypodia semigranosa</i>			
1950	Spec - BPBM-S 5638		
Unidentified <i>Platypodia</i>			
1996	Legacy Project (Coles et al., 1997)		
Genus: <i>Trapezia</i>			
<i>Trapezia guttata</i>		Rüppell, 1830	
1973	Ref - Evans et al., 1974		Off Pearl Harbor.
<i>Trapezia intermedia</i>		(Miers)	
1996	Legacy Project (Coles et al., 1997)		
<i>Trapezia wardi</i>		Serène, 1970	
1996	Legacy Project (Coles et al., 1997)		
Genus: <i>Xanthias</i>			
<i>Xanthias</i> sp.			
1973	Ref - Evans et al., 1974		
Order: STOMATOPODA			
Family: GONODACTYLIDAE			
Genus: <i>Gonodactylaceus</i>			
<i>Gonodactylaceus falcatus</i>		(Forsskål, 1775)	Introduced. Common name: Snapping Shrimp.
1973	Ref - Evans et al., 1974		Recorded as <i>Gonodactylus falcatus</i> .
1987	Ref - AECOS, 1987		Recorded as <i>Gonodactylus falcatus</i> .
1993	Ref - Brock, 1995		Recorded as <i>Gonodactylus alohoa</i> .
1996	Legacy Project (Coles et al., 1997)		Recorded as <i>Gonodactylus alohoa</i> .
1999	USS Missouri Project (Coles et al. 1999)		Recorded as <i>Gonodactylus falcatus</i> .
2006	Ref - Smith et al., 2006		Recorded as <i>Gonodactylaceus mutates</i> .
2007	Ref - Brock, 2007		Recorded as <i>Gonodactylus falcatus</i> .

Pearl Harbor - Species Report (Cont.)

2007 Legacy II Project (Coles et al., 2009)

Genus: *Pseudosquilla*

Pseudosquilla ciliata (Fabricius, 1787) Hawaiian name: aloalo.

1938 Spec - BPBM-S 4567

1973 Ref - Evans et al., 1974

Recorded as *Pseudosquilla ciliata* Miers.

1996 Legacy Project (Coles et al., 1997)

Family: LYSIOSQUILLIDAE

Genus: *Lysiosquilla*

Lysiosquilla maculatus (Fabricius.)

1923 Spec - BPBM-S 2522

Genus: *Lysiosquillina*

Lysiosquillina maculata (Fabricius, 1793)

2006 Ref - Smith et al., 2006

2007 Ref - Brock, 2007

Family: SQUILLIDAE

Genus: *Squilla*

Squilla sp.

1986 Ref - Lenihan, 1990

Class: INSECTA

Order: COLLEMBOLA

Unidentified Collembola

1996 Legacy Project (Coles et al., 1997)

Phylum: SIPUNCULA

Class: SIPUNCULIDA

Unidentified Sipunculida

1996 Legacy Project (Coles et al., 1997)

Family: PHASCOLOSOMATIDAE

Genus: *Phascolosoma*

Phascolosoma perlucens Baird, 1868

1973 Ref - Evans et al., 1974

Recorded as *Phascolosoma dentigerum* (Selenka, deMan &

Bulo.

Phascolosoma stephensoni (Stephen, 1942) Indigenous.

2007 Legacy II Project (Coles et al., 2009)

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

2007 Legacy II Project (Coles et al., 2009)

Family: CLEIDOCHASMATIDAE

Genus: *Diaperoforma*

Diaperoforma sp. Indigenous.

1999 USS Missouri Project (Coles et al. 1999)

2008 Legacy II Project (Coles et al., 2009)

Class: GYMNOLEMMATA

Order: CTENOSTOMATA

Family: VESICULARIIDAE

Genus: *Amathia*

Amathia sp.

1950 Spec - BPBM-K 214

1972 Ref - Long, 1974

Off Pearl Harbor.

Pearl Harbor - Species Report (Cont.)

Amathia sp.?

1947 Spec - BPBM-K 234

Amathia distans

Busk, 1886 Introduced. Common name: Bushy Bryozoan.

1948 Spec - BPBM-K 207
1948 Spec - BPBM-K 210
1973 Ref - Evans et al., 1974
1978 Ref - Grovhoug, 1979
1996 Legacy Project (Coles et al., 1997)
1999 USS Missouri Project (Coles et al. 1999)
2007 Legacy II Project (Coles et al., 2009)
2008 Legacy II Project (Coles et al., 2009)

Amathia distans?

Busk, 1886 Introduced. Common name: Bushy Bryozoan.

Unknown Spec - BPBM-K 455

Genus: *Bowerbankia*

Bowerbankia sp.

1972 Ref - Long, 1974 Off Pearl Harbor.

Genus: *Zoobotryon*

Zoobotryon sp.

1996 Legacy Project (Coles et al., 1997)

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.
1999 USS Missouri Project (Coles et al. 1999)
2008 Legacy II Project (Coles et al., 2009)

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 Legacy Project (Coles et al., 1997)

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

Pearl Harbor - Species Report (Cont.)

1996	Legacy Project (Coles et al., 1997)	
<i>Bugula dentata</i>		(Lamauroux, 1816) Introduced. Common name: Blue Fan Bryozoan.
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 <i>Bugula californica</i> .
1973	Ref - Evans et al., 1974	Recorded as <i>Bugula californica</i> .
1975	Ref - Grovhoug, 1976	Recorded as <i>Bugula californica</i> .
1993	Ref - Brock, 1994	Recorded as <i>Bugula californica</i> .
1994	Ref - Brock, 1995	Recorded as <i>Bugula californica</i> .
1996	Legacy Project (Coles et al., 1997)	
2008	Legacy II Project (Coles et al., 2009)	

<i>Bugula neritina</i>		(Linnaeus, 1758) Introduced. Common name: Red Fan Bryozoan.
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	Legacy Project (Coles et al., 1997)	
1999	USS Missouri Project (Coles et al. 1999)	
2008	Legacy II Project (Coles et al., 2009)	

<i>Bugula stolonifera</i>		(Robertson) Introduced
1999	USS Missouri Project (Coles et al. 1999)	

Family: CELLEPORARIIDAE

Genus: <i>Celleporaria</i>		
<i>Celleporaria</i> sp.		Indigenous.
2007	Legacy II Project (Coles et al., 2009)	
2008	Legacy II Project (Coles et al., 2009)	

<i>Celleporaria costazii</i>		(Audouin, 1826)
1972	Ref - Long, 1974	Off Pearl Harbor.

Pearl Harbor - Species Report (Cont.)

Celleporaria pilaefera

1999 USS Missouri Project (Coles et al. 1999)

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 Legacy Project (Coles et al., 1997)

Parasmittina spathulata

(Smitt, 1873)

1972 Ref - Long, 1974

Off Pearl Harbor.

Family: RETEPORIDAE

Genus: *Reteporellina*

Reteporellina denticulata

(Busk, 1884)

1972 Ref - Long, 1974

Off Pearl Harbor.

1996 Legacy Project (Coles et al., 1997)

Genus: *Rhynchozoon*

Rhynchozoon sp.

1972 Ref - Long, 1974

Off Pearl Harbor.

Family: SAVIGNYELLIDAE

Genus: *Savignyella*

Savignyella lafontii

(Audouin, 1826)

1972 Ref - Long, 1974

1996 Legacy Project (Coles et al., 1997)

Family: SCHIZOPORELLIDAE

Genus: *Schizoporella*

Schizoporella cf. *errata*

(Waters, 1878) Introduced. Common name: Erratic Bryozoan.

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

Recorded as *Schizoporella errata*.

1996 Legacy Project (Coles et al., 1997)

Recorded as *Schizoporella errata*

1999 USS Missouri Project (Coles et al. 1999)

Recorded as *Schizoporella errata*

2007 Legacy II Project (Coles et al., 2009)

2008 Legacy II Project (Coles et al., 2009)

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).

Pearl Harbor - Species Report (Cont.)

1994 Ref - Brock, 1995 Recorded as *S. unicornis* (Johnston, 1847).
 1996 Legacy Project (Coles et al., 1997)
 2007 Ref - Brock, 2007

Unidentified Schizoporella

1996 Legacy Project (Coles et al., 1997)

Family: SCRUPOCELLARIIDAE

Genus: *Scrupocellaria*

Scrupocellaria sinuosa

1972 Ref - Long, 1974

Canu & Bassler, 1927

Off Pearl Harbor.

Family: STEGANOPORELLIDAE

Genus: *Steganoporella*

Steganoporella sp.

1972 Ref - Long, 1974

Off Pearl Harbor.

Family: THALAMOPORELLIDAE

Genus: *Thalamoporella*

Thalamoporella hawaiiiana

1972 Ref - Long, 1974

Soule & Soule, 1970

Off Pearl Harbor.

Family: VITTATICELLIDAE

Genus: *Vittaticella*

Vittaticella elegans

1972 Ref - Long, 1974

(Busk, 1852)

Off Pearl Harbor.

Family: WATERISPORIDAE

Genus: *Waterispora*

Waterispora edmondsoni

1972 Ref - Long, 1974

Soule & Soule, 1968 Introduced.

1975 Ref - Grovhoug, 1976

1978 Ref - Grovhoug, 1979

1996 Legacy Project (Coles et al., 1997)

Genus: *Watersipora*

Watersipora sp.

1999 USS Missouri Project (Coles et al. 1999)

Watersipora edmondsoni

2008

Soule and Soule, 1968 Introduced.

Legacy II Project (Coles et al., 2009)

Phylum: ECHINODERMATA

Class: STELLEROIDEA

Order: PLATYASTERIDA

Family: LUIDIIDAE

Genus: *Luidia*

Luidia hystrix

1902 Spec - BPBM-W 1023

1902 Spec - BPBM-W 654

Fisher, 1906 Hawaiian name: la kai; pe`a.

Order: VALVATIDA

Family: GONIASTERIDAE

Genus: *Plinthaster*

Plinthaster ceramoidea

1978 Spec - BPBM-W 3014

(Fisher, 1906)

Off Pearl Harbor; dredge spoil site. Identified by D.M. Devaney.

Family: OPHIODIASTERIDAE

Genus: *Linckia*

Linckia multifora

1972 Spec - BPBM-W 2010

(Lamarck, 1816)

150 yds NW from Buoy "1" at harbor entrance. Identified by

D.M. Devaney.

Family: OREASTERIDAE

Genus: *Culcita*

Culcita novaeguineae f. arenosa

Unknown Spec - BPBM-W 627

Hawaiian name: pe`a.

Pearl Harbor - Species Report (Cont.)

1902	Spec - BPBM-W 1026		
<i>Culcita novaeguineae f. nesiotis</i>		Fisher, 1925	
Unknown	Spec - BPBM-W 626		
Order: FORCIPULATIDA			
Family: ASTERIIDAE			
Genus: <i>Distolasterias</i>			
<i>Distolasterias euplecta</i>		Fisher, 1906	
1982	Spec - BPBM-W 3028		Off Pearl Harbor; dredge spoil site. Identified by D.M. Devaney,
1982.			
Order: OPHIURIDA			
Family: AMPHIURIDAE			
Genus: <i>Amphipholis</i>			
<i>Amphipholis squamata</i>		(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: <i>Ophionereis</i>			
<i>Ophionereis porrecta</i>		Lyman	
1967	Spec - BPBM-W 2579		Ewa End.
Family: OPHIACTIDAE			
Genus: <i>Histampica</i>			
<i>Histampica cythera</i>		(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: <i>Ophiactis</i>			
<i>Ophiactis sp.</i>			
1982	Spec - BPBM-W 3012		Off Pearl Harbor; dredge spoil site. Identified by D.M. Devaney.
May 1982.			
<i>Ophiactis dyscrita</i>		Clark, 1911	
1949	Ref - Clark, 1949		USNM 6927.
<i>Ophiactis modesta</i>		Brock, 1888	
1938	Spec - BPBM-W 1031		
1942	Ref - Ely, 1942		
<i>Ophiactis savignyi</i>		(Müller & Troschel, 1842)	Cryptogenic. Common name: Sponge Brittle Star.
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	Legacy Project (Coles et al., 1997)		
1999	USS Missouri Project (Coles et al. 1999)		
2007	Legacy II Project (Coles et al., 2009)		
2008	Legacy II Project (Coles et al., 2009)		

Pearl Harbor - Species Report (Cont.)

Family: OPHIOMIDAE

Genus: *Ophiocoma*

Ophiocoma erinaceus (Duncan, 1887) Indigenous. Common name: Spiny Brittle Star.
2008 Legacy II Project (Coles et al., 2009)

Ophiocoma sexradia (Duncan, 1887)
1973 Ref - Evans et al., 1974

Family: OPHIOTHURICIDAE

Genus: *Macrophiothrix*

Macrophiothrix demessa (Lyman)
1967 Spec - BPBM-W 2580 Ewa End.

Class: ECHINOIDEA

Order: CIDAROIDA

Family: CIDARIDAE

Genus: *Eucidaris*

Eucidaris metularia (Lamarck, 1816) Indigenous. Common name: Ten-lined Urchin; Hawaiian name: ha`ue`ue; peni.
1973 Ref - Evans et al., 1974
2008 Legacy II Project (Coles et al., 2009)

Order: DIADEMATOIDA

Family: DIADEMATIDAE

Genus: *Diadema*

Diadema paucispinum Agassiz, 1863 Indigenous. Common name: Long-spined Urchin; Hawaiian name: wana hālula.
1973 Ref - Evans et al., 1974
1996 Legacy Project (Coles et al., 1997)

Genus: *Echinothrix*

Echinothrix calamaris (Pallas, 1774) Indigenous. Common name: Banded Urchin.
2006 Ref - Smith et al., 2006
2008 Legacy II Project (Coles et al., 2009)

Echinothrix diadema (Linnaeus, 1758) Indigenous. Common name: Blue-Black Sea Urchin.
2006 Ref - Smith et al., 2006
2008 Legacy II Project (Coles et al., 2009)

Order: TEMNOPLEUROIDA

Family: TEMNOPLEURIDAE

Genus: *Mespilia*

Mespilia globulus (Linnaeus, 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) Indigenous. Common name: Collector Urchin; Hawaiian names: hawa`e; hawa`e maoli; hawa`e po`ohina.
1973 Ref - Evans et al., 1974
1996 Legacy Project (Coles et al., 1997)
2006 Ref - Smith et al., 2006
2008 Legacy II Project (Coles et al., 2009)

Order: ECHINOIDA

Family: ECHINOMETRIDAE

Genus: *Echinometra*

Echinometra mathaei (de Blainville, 1825) Indigenous. Common name: Rock-boring Urchin.
1979 Ref - AECOS, 1979 Off Pearl Harbor.
1996 Legacy Project (Coles et al., 1997)

Pearl Harbor - Species Report (Cont.)

2008 Legacy II Project (Coles et al., 2009)

Genus: *Heterocentrotus*

Heterocentrotus mammillatus

(Linnaeus, 1758) Indigenous. Common name: Red Pencil Urchin;
Hawaiian name: ha'uke'uke iwi loloa; ha'ue'ue; `ina `ula; ha'uke'uke.

1973 Ref - Evans et al., 1974

Class: HOLOTHUROIDEA

Order: ASPIDOCHIROTIDA

Family: HOLOTHURIIDAE

Genus: *Actinopyga*

Actinopyga mauritiana

(Quoy & Gaimard, 1833)

1996 Legacy Project (Coles et al., 1997)

2006 Ref - Smith et al., 2006

Genus: *Holothuria*

Holothuria sp.

Indigenous.

2008 Legacy II Project (Coles et al., 2009)

Holothuria (Lessonothuria) pardalis Selenka, 1867

Indigenous. Common name: Leopard Sea Cucumber.

2008 Legacy II Project (Coles et al., 2009)

Holothuria atra

Jager, 1833

1996 Legacy Project (Coles et al., 1997)

Holothuria impatiens

Forsskål, 1775

1979 Ref - AECOS, 1979

Off Pearl Harbor.

Holothuria pervicax

(Selenka, 1867)

1973 Ref - Evans et al., 1974

Genus: *Labidodemas*

Labidodemas semperianum

Selenka, 1867

Indigenous. Common name: White Sea Cucumber.

2008 Legacy II Project (Coles et al., 2009)

Order: APODIDA

Family: SYNAPTIDAE

Genus: *Ophiodesoma*

Ophiodesoma spectabilis

Fisher, 1907

Indigenous. Common name: Conspicuous Sea Cucumber.

1907 Ref - Fisher, 1907

Recorded as Ophiodesoma spectabilis. USNM 21226.

1955 Spec - BPBM-W 1234

On beach.

1973 Ref - Evans et al., 1974

Recorded as Ophiodesoma spectabilis.

1987 Ref - AECOS, 1987

Recorded as Ophiodesoma spectabilis.

1993 Ref - Brock, 1994

Recorded as Ophiodesoma spectabilis.

1994 Ref - Brock, 1995

Recorded as Ophiodesoma spectabilis.

1996 Legacy Project (Coles et al., 1997)

2006 Ref - Smith et al., 2006

2007 Ref - Brock, 2007

2007 Legacy II Project (Coles et al., 2009)

2008 Legacy II Project (Coles et al., 2009)

Genus: *Polyplectana*

Polyplectana kefersteinii

(Selenka, 1867)

Indigenous. Common name: Keferstan's Sea Cucumber.

2008 Legacy II Project (Coles et al., 2009)

Phylum: CHAETOGNATHA

Class: SAGITTOIDEA

Order: APHRAGMOPHORA

Family: PTEROSAGITTIDAE

Genus: *Pterosagitta*

Pterosagitta sp.

1973 Ref - Evans et al., 1974

Pearl Harbor - Species Report (Cont.)

Family: SAGITTIDAE

Genus: *Sagitta*

Sagitta sp.

1973 Ref - Evans et al., 1974

Sagitta enflata

1978 Ref - Grovhoug, 1979

Grassi, 1883

Sagitta regularis

1978 Ref - Grovhoug, 1979

Aida, 1897

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 Legacy Project (Coles et al., 1997)

Class: ASCIDIACEA

Unidentified Ascidiacea

1979 Ref - AECOS, 1979

Off Pearl Harbor.

1996 Legacy Project (Coles et al., 1997)

Order: APLOUSOBRANCHIA

Family: CLAVELINIDAE

Genus: *Clavelina*

Clavelina sp.

1973 Ref - Evans et al., 1974

Family: DIDEMNIDAE

Unidentified Didemnidae

1986 Ref - Lenihan, 1990

1996 Legacy Project (Coles et al., 1997)

Genus: *Didemnum*

Didemnum sp.

1972 Ref - Long, 1974

1985 Ref - Hurlbut, 1990

Didemnum candidum

2007 Ref - Brock, 2007

Savigny, 1816

Didemnum cf. *candidum*

1985 Ref - Hurlbut, 1990

1993 Ref - Brock, 1994

1994 Ref - Brock, 1995

1999 USS Missouri Project (Coles et al. 1999)

2007 Legacy II Project (Coles et al., 2009)

2008 Legacy II Project (Coles et al., 2009)

Savigny, 1816 Introduced. Common name: White Didemnid.

Recorded as *Didemnum candidum*.

Recorded as *Didemnum candidum*.

Recorded as *Didemnum candidum*.

Didemnum edmondsoni

1993 Ref - Brock, 1994

Eldredge, 1966 Indigenous.

Pearl Harbor - Species Report (Cont.)

1994	Ref - Brock, 1995	
2008	Legacy II Project (Coles et al., 2009)	
<i>Didemnum perlucidum</i> Monniot, 1983 Introduced.		
2007	Legacy II Project (Coles et al., 2009)	
Genus: <i>Diplosoma</i>		
<i>Diplosoma cf. spongiforme</i> (Giard, 1872) New record for Hawaii. Introduced.		
2008	Legacy II Project (Coles et al., 2009)	
<i>Diplosoma listerianum</i> (Milne-Edwards, 1841) Introduced.		
1975	Ref - Grovhoug, 1976	Recorded as <i>Diplosoma macdonaldi</i> .
1978	Ref - Grovhoug, 1979	Recorded as <i>Diplosoma macdonaldi</i> .
1985	Ref - Hurlbut, 1990	
1987	Ref - Brewer & Assoc., 1987	Recorded as <i>Diplosoma macdonaldi</i> .
1999	USS Missouri Project (Coles et al. 1999)	
2008	Legacy II Project (Coles et al., 2009)	
Genus: <i>Trididemnum</i>		
<i>Trididemnum savignyi</i> (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: <i>Polyclinum</i>		
<i>Polyclinum sp.</i> Indigenous.		
1975	Ref - Grovhoug, 1976	
<i>Polyclinum constellatum</i> Savigny, 1816		
1973	Ref - McCain, 1974	
1973	Ref - McCain, 1975	
1993	Ref - Brock, 1994	
1994	Ref - Brock, 1995	
1996	Legacy Project (Coles et al., 1997)]	
1999	USS Missouri Project (Coles et al. 1999)	
2007	Ref - Brock, 2007	
<i>Polyclinum vasculosum</i> Pizon, 1908		
1920	Ref - Tokioka, 1967	USNM 11755.
1972	Ref - Long, 1974	
Order: PHLEBOBRANCHIA		
Family: ASCIDIIDAE		
Genus: <i>Ascidia</i>		
<i>Ascidia n. sp.</i> Known only from Hawaii.		
1996	Legacy Project (Coles et al., 1997)	
<i>Ascidia sp.</i> Indigenous.		
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	Legacy Project (Coles et al., 1997)	
1999	USS Missouri Project (Coles et al. 1999)	
2008	Legacy II Project (Coles et al., 2009)	
<i>Ascidia sp. B</i> Introduced.		
1996	Legacy Project (Coles et al., 1997)	
2008	Legacy II Project (Coles et al., 2009)	
<i>Ascidia archaia</i>		
1999	USS Missouri Project (Coles et al. 1999)	
<i>Ascidia interrupta</i>		
1993	Ref - Brock, 1994	Recorded as <i>Ascidia interrupta</i> ..

Pearl Harbor - Species Report (Cont.)

1994	Ref - Brock, 1995	Recorded as <i>Ascidia interrupta</i> ..
<i>Ascidia melanostoma</i> (Sluiter, 1885)		
1972	Ref - Long, 1974	
1996	Legacy Project (Coles et al., 1997)	
<i>Ascidia sp. A</i> Introduced.		
1999	USS Missouri Project (Coles et al. 1999)	
2007	Legacy II Project (Coles et al., 2009)	
<i>Ascidia sydneyensis</i> (Stimpson, 1855) Introduced. Common name: Yellow-green Sea Squirt.		
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	Legacy Project (Coles et al., 1997)	
1999	USS Missouri Project (Coles et al. 1999)	
2007	Legacy II Project (Coles et al., 2009)	
2008	Legacy II Project (Coles et al., 2009)	
Genus: <i>Phallusia</i>		
<i>Phallusia nigra</i> Savigny, 1816 Introduced. Common name: Black Sea Squirt.		
1985	Ref - Hurlbut, 1990	
1993	Ref - Brock, 1994	Recorded as <i>Ascidia nigra</i> .
1994	Ref - Brock, 1995	Recorded as <i>Ascidia nigra</i> .
1996	Legacy Project (Coles et al., 1997)	
1999	USS Missouri Project (Coles et al. 1999))	
2007	Ref - Brock, 2007	Recorded as <i>Ascidia nigra</i> .
2007	Legacy II Project (Coles et al., 2009)	
2008	Legacy II Project (Coles et al., 2009)	
Family: CIONIDAE		
Genus: <i>Ciona</i>		
<i>Ciona intestinalis</i> (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: <i>Perophora</i>		
<i>Perophora sp.</i>		
1975	Ref - Grovhoug, 1976	
<i>Perophora annectens</i>		
1996	Legacy Project (Coles et al., 1997)	
1999	USS Missouri Project (Coles et al. 1999)	
Order: STOLIDOBRANCHIA		
Family: PYURIDAE		
Genus: <i>Herdmania</i>		
<i>Herdmania sp.</i> Indigenous.		
2008	Legacy II Project (Coles et al., 2009)	
<i>Herdmania mauritiana</i> (Drasche, 1884) Introduced.		
2008	Legacy II Project (Coles et al., 2009)	
<i>Herdmania pallida</i> (Savigny, 1816) Introduced.		
1972	Ref - Long, 1974	Recorded as <i>Herdmania momus</i> .
1973	Ref - Evans et al., 1974	Recorded as <i>Herdmania momus</i> .
1993	Ref - Brock, 1994	Recorded as <i>Herdmania momus</i> .
1994	Ref - Brock, 1995	Recorded as <i>Herdmania momus</i> .
1996	Legacy Project (Coles et al., 1997)	Recorded as <i>Herdmania momus</i> .
1999	USS Missouri Project (Coles et al. 1999)	Recorded as <i>Herdmania momus</i> .
2007	Legacy II Project (Coles et al., 2009)	
2008	Legacy II Project (Coles et al., 2009)	
Genus: <i>Microsomus</i>		
<i>Microcosmus exasperatus</i> Introduced.		
1996	Legacy Project (Coles et al., 1997)	
1999	USS Missouri Project (Coles et al. 1999)	
2008	Legacy II Project (Coles et al., 2009)	

Pearl Harbor - Species Report (Cont.)

Family: STYELIDAE

Genus: *Botrylloides*

Botrylloides sp.

Indigenous.

- 1996 Legacy Project (Coles et al., 1997)
- 1999 USS Missouri Project (Coles et al. 1999)
- 2008 Legacy II Project (Coles et al., 2009)

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
- 2007 Ref - Brock, 2007

Genus: *Botryllus*

Botryllus sp.

Indigenous.

- 1975 Ref - Grovhoug, 1976 Recorded as *Botrylloides*.
- 1978 Ref - Grovhoug, 1979 Recorded as *Botrylloides*.
- 1996 Legacy Project (Coles et al., 1997)

Genus: *Cnemidocarpa*

Cnemidocarpa areolata (Heller, 1978)

- 1999 USS Missouri Project (Coles et al. 1999)

Cnemidocarpa irene (Hartmeyer, 1906) Introduced.

- 2008 Legacy II Project (Coles et al., 2009)

Genus: *Eusynstyela aliena*

Eusynstyela aliena

Monniot 1991

- 1999 USS Missouri Project (Coles et al. 1999)

Genus: *Polyandrocarpa*

Polyandrocarpa sp. A

- 1996 Legacy Project (Coles et al., 1997)

Polyandrocarpa sp. B sp.

- 1996 Legacy Project (Coles et al., 1997)

Polyandrocarpa sagamiensis Tokioka, 1953 Introduced.

- 1999 USS Missouri Project (Coles et al. 1999)
- 2008 Legacy II Project (Coles et al., 2009)

Polyandrocarpa zooritensis Van Name, 1931 Introduced.

- 2008 Legacy II Project (Coles et al., 2009)

Genus: *Polycarpa*

Polycarpa sp.

Indigenous.

- 2008 Legacy II Project (Coles et al., 2009)

Polycarpa aurita (Sluiter, 1890) Indigenous.

- 2008 Legacy II Project (Coles et al., 2009)

Polycarpa cryptocarpa (Sluiter, 1885) New record for Hawaii. Cryptogenic.

- 2008 Legacy II Project (Coles et al., 2009)

Genus: *Styela*

Styela sp.

- 1973 Ref - Evans et al., 1974

Styela areoleata

Heller, 1878

- 1975 Ref - Grovhoug, 1976

Styela canopus

Savigny, 1816 Introduced.

- 1999 USS Missouri Project (Coles et al. 1999)
- 2007 Legacy II Project (Coles et al., 2009)
- 2008 Legacy II Project (Coles et al., 2009)

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.

Pearl Harbor - Species Report (Cont.)

Styela partita? (Stimson, 1852)

1929 Spec - BPBM-Y 102

Genus: *Symplegma*

***Symplegma* sp.** Tokioka, 1949 Indigenous.

1929 Spec - BPBM-Y 110

1996 Legacy Project (Coles et al., 1997)

1999 USS Missouri Project (Coles et al. 1999)

2008 Legacy II Project (Coles et al., 2009)

Symplegma oceania Tokioka, 1961 Introduced.

1975 Ref - Grovhoug, 1976

1978 Ref - Grovhoug, 1979

1996 Legacy Project (Coles et al., 1997)

Recorded as *Symplegma connectans*.

Recorded as *Symplegma connectans*.

Symplegma reptans Introduced.

1996 Legacy Project (Coles et al., 1997)

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

1948 Spec - BPBM-S 8788

Identified by Koichiro Nakamura, 1985.

Drydock.

Aetobatus narinari (Euphrasen, 1790)

1973 Ref - Evans et al., 1974

1978 Ref - Grovhoug, 1979

1987 Ref - Brewer & Assoc., 1987

Pearl Harbor - Species Report (Cont.)

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

2006 Ref - Smith et al., 2006 Recorded as *Elops hawaiiensis*.

Order: ANGUILLIFORMES

Family: CONGRIDAE

Genus: *Conger*

Conger cinereus marginatus Valenciennes, 1841

1973 Ref - Evans et al., 1974 Recorded as *C. marginatus*.

1978 Ref - Grovhoug, 1979 Recorded as *C. cinereus*.

Family: MURAENIDAE

Genus: *Gymnothorax*

Gymnothorax sp.

1979 Ref - AECOS, 1979 Off Pearl Harbor.

1986 Ref - Lenihan, 1990

1996 Legacy Project (Coles et al., 1997)

Gymnothorax flavimarginatus (Rüppell, 1828)

1973 Ref - Evans et al., 1974

Gymnothorax petelli (Bleeker, 1856)

1973 Ref - Evans et al., 1974

Gymnothorax undulatus (Lacépède, 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: Clupeidae

Genus: *Herklotsichthys*

Herklotsichthys quadrimaculatus (Rüppell, 1837)

2006 Ref - Smith et al., 2006

Family: ENGRAULIDAE

Genus: *Encrasicholina*

Encrasicholina purpurea Fowler, 1900

1961 Ref - Au, 1965 Recorded as *Stolephorus 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*.

Pearl Harbor - Species Report (Cont.)

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
 2006 Ref - Smith et al., 2006

Saurida nebulosa Valenciennes, 1849

1992 Spec - BPBM-I 35396

Genus: *Synodus*

Synodus sp.

1996 Legacy Project (Coles et al., 1997)

Synodus variegatus (Lacépède, 1803)

1973 Ref - Evans et al., 1974

Order: GONORYNCHIFORMES

Family: CHANIDAE

Genus: *Chanos*

Chanos chanos (Forsskål, 1775)

1973 Ref - Evans et al., 1974 Recorded as Chanos.
 1978 Ref - Grovhoug, 1979 Recorded as Chanos.
 1987 Ref - Brewer & Assoc., 1987 Recorded as Chanos.
 1993 Ref - Brock, 1994 Recorded as Chanos.
 1994 Ref - Brock, 1995 Recorded as Chanos.
 2006 Ref - Smith et al., 2006

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: ATHERINIDAE

Genus: *Atherinomorus*

Atherinomorus insularum (Jordan and Evermann, 1903)

2006 Ref - Smith et al., 2006 Recorded as Pranesus insularum.

Family: BELONIDAE

Genus: *Tylosurus*

Tylosurus crocodilus (Peron & LeSueur, 1821)

1973 Ref - Evans et al., 1974
 1978 Ref - Grovhoug, 1979

Pearl Harbor - Species Report (Cont.)

Family: CYPRINODONTIDAE

Genus: *Fundulus*

<i>Fundulus grandis</i>		Baird & Girard, 1853	Introduced.
1905	Ref - Brock, 1960		
1905	Ref - Maciolek, 1984		
1907	Ref - Van Dine, 1907		
1987	Ref - Randall, 1987		

Family: HEMIRAMPHIDAE

Genus: *Hemiramphus*

<i>Hemiramphus depauperatus</i>		Lay & Bennett, 1839	
1973	Ref - Evans et al., 1974		
1978	Ref - Grovhoug, 1979		
1987	Ref - Brewer & Assoc., 1987		

Family: POECILIIDAE

Unidentified Poeciliidae

1996	Legacy Project (Coles et al., 1997)		
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Genus: *Gambusia*

<i>Gambusia affinis</i>		(Baird & Girard, 1853)	Introduced.
1905	Ref - Brock, 1960		
1905	Ref - Maciolek, 1984		
1907	Ref - Van Dine, 1907		
1987	Ref - Randall, 1987		

Genus: *Poecilia*

<i>Poecilia latipinna</i>		(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.

Order: POLYMIXIIFORMES

Family: HOLOCENTRIDAE

Genus: *Myripristis*

<i>Myripristis amaena</i>		(Castelnau, 1873)	
2006	Ref - Smith et al., 2006		Recorded as Myripristis amaenus.
<i>Myripristis berndti</i>		Jordan & Evermann, 1903	
1973	Ref - Evans et al., 1974		Recorded as murdjan (Forsskal).
1978	Ref - Grovhoug, 1979		Recorded as murdjan (Forsskal).
1996	Legacy Project (Coles et al., 1997)		

Genus: *Neoniphon*

<i>Neoniphon sammara</i>		(Forsskål, 1775)	
1973	Ref - Evans et al., 1974		Recorded as Flammeo sammara (Forsskal).
1978	Ref - Grovhoug, 1979		Recorded as Flammeo sammara (Forsskal).

Genus: *Sargocentron*

<i>Sargocentron diadema</i>		(Lacepede, 1802)	Hawaiian name: 'ala 'ihi kalalao.
1996	Spec - BPBM-I 37326		NE side of West Loch channel.
<i>Sargocentron punctatissimum</i>		(Cuvier in Cuvier and Valenciennes, 1829)	
2006	Ref - Smith et al., 2006		Recorded as Adioryx lacteoguttatus.
2006	Ref - Smith et al., 2006		

Order: GASTEROSTEIFORMES

Family: AULOSTOMIDAE

Genus: *Aulostomus*

<i>Aulostomus chinensis</i>		(Linnaeus, 1766)	
1973	Ref - Evans et al., 1974		

Pearl Harbor - Species Report (Cont.)

1996 Legacy Project (Coles et al., 1997)

Family: SYNGNATHIDAE

Genus: *Doryrhamphus*

Doryrhamphus exisis Kaup, 1856

1996 Legacy Project (Coles et al., 1997)

Genus: *Hippocampus*

Hippocampus kuda Bleeker, 1852

1924 Spec - BPBM-I 3787

2007 Ref - Brock, 2007

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 coniota (Jenkins, 1903)

1973 Ref - Evans et al., 1974

Recorded as *Scorpaena coniota* (Jenkins).

Order: PERCIFORMES

Family: ACANTHURIDAE

Genus: *Acanthurus*

Acanthurus blochi (Cuvier, 1829) Indigenous. Common name: Ringtail Surgeonfish;
Hawaiian name: Pualu.

1996 Legacy Project (Coles et al., 1997)

2006 Ref - Smith et al., 2006

Recorded as *Acanthurus blochii*.

2008 Legacy II Project (Coles et al., 2009)

Acanthurus dussumieri

Cuvier & Valenciennes, 1835 Indigenous. Common name: Eyestripe Surgeonfish; Hawaiian name: palani.

1973 Ref - Evans et al., 1974

1973 Ref - McCain, 1974

1973 Ref - McCain, 1975

1978 Ref - Grovhoug, 1979

1986 Ref - Lenihan, 1990

2006 Ref - Smith et al., 2006

2008 Legacy II Project (Coles et al., 2009)

Acanthurus guttatus

Bloch & Schneider, 1801

1996 Legacy Project (Coles et al., 1997)

Acanthurus leucopareius

(Jenkins, 1903) Indigenous. Common name: Whitebar Surgeonfish;
Hawaiian name: māikoko.

2008 Legacy II Project (Coles et al., 2009)

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

Pearl Harbor - Species Report (Cont.)

<i>Acanthurus nigrofuscus</i>		(Forsskål, 1775)	
1996	Legacy Project (Coles et al., 1997)		
<i>Acanthurus olivaceus</i>		(Bloch & Schneider, 1801)	
1973	Ref - Evans et al., 1974		
<i>Acanthurus triostegus</i>		(Linnaeus, 1758)	Indigenous. Common name: Convict Tang; Hawaiian name: palani.
1973	Ref - Evans et al., 1974		
1973	Ref - McCain, 1974		
1973	Ref - McCain, 1975		
1979	Ref - AECOS, 1979		Off Pearl Harbor. Recorded as <i>A. triostegus sandvicensis</i> .
1996	Legacy Project (Coles et al., 1997)		
2006	Ref - Smith et al., 2006		
2007	Legacy II Project (Coles et al., 2009)		
2008	Legacy II Project (Coles et al., 2009)		
<i>Acanthurus xanthopterus</i>		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	Legacy Project (Coles et al., 1997)		
2006	Ref - Smith et al., 2006		
Genus: <i>Ctenochaetus</i>			
<i>Ctenochaetus strigosus</i>		(Bennett, 1828)	
1973	Ref - Evans et al., 1974		
1996	Legacy Project (Coles et al., 1997)		
2006	Ref - Smith et al., 2006		
Genus: <i>Naso</i>			
<i>Naso brevirostris</i>		(Valenciennes, 1835)	
1978	Ref - Grovhoug, 1979		
1986	Ref - Lenihan, 1990		
1996	Legacy Project (Coles et al., 1997)		
<i>Naso lituratus</i>		(Forster and Schneider, 1801)	
2006	Ref - Smith et al., 2006		
<i>Naso unicornis</i>		(Forsskål, 1775)	Indigenous. Common name: Bluespine Unicornfish; Hawaiian name: kala.
1973	Ref - Evans et al., 1974		
1986	Ref - Lenihan, 1990		
1994	Ref - Brock, 1995		
1996	Legacy Project (Coles et al., 1997)		
2007	Legacy II Project (Coles et al., 2009)		
Genus: <i>Zanclus</i>			
<i>Zanclus cornutus</i>		(Linnaeus, 1758)	Indigenous. Common name: Moorish Idol; Hawaiian name: kīhikihi.
1973	Ref - Evans et al., 1974		Recorded as <i>canescens</i> (Linnaeus).
1978	Ref - Grovhoug, 1979		
1993	Ref - Brock, 1994		
1994	Ref - Brock, 1995		
1996	Legacy Project (Coles et al., 1997)		
2006	Ref - Smith et al., 2006		

Pearl Harbor - Species Report (Cont.)

Genus: *Zebrasoma*

Zebrasoma flavescens

(Bennett, 1828) Indigenous. Common name: Yellow Tang; Hawaiian name: lau-T-pala.

1973 Ref - Evans et al., 1974
1978 Ref - Grovhoug, 1979
1996 Legacy Project (Coles et al., 1997)
2006 Ref - Smith et al., 2006
2007 Legacy II Project (Coles et al., 2009)

Zebrasoma veliferum

(Bloch, 1797)

1973 Ref - Evans et al., 1974
1986 Ref - Lenihan, 1990
2006 Ref - Smith et al., 2006

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 Legacy Project (Coles et al., 1997)
2006 Ref - Smith et al., 2006

Apogon snyderi

Jordan & Evermann, 1903

1978 Ref - Grovhoug, 1979

Genus: *Foa*

Foa brachygramma

(Jenkins, 1903) Hawaiian name: '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.
2006 Ref - Smith et al., 2006

Family: BLENNIIDAE

Unidentified Blenniidae

1987 Ref - Brewer & Assoc., 1987
2008 Legacy II Project (Coles et al., 2009)

Genus: *Cirripectus*

Cirripectus vanderbilti

(Fowler, 1938)

1996 Legacy Project (Coles et al., 1997)

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.

Pearl Harbor - Species Report (Cont.)

Family: CARANGIDAE

Genus: *Carangoides*

Carangoides gymnostethoides Bleeker, 1852
1973 Ref - Evans et al., 1974

Genus: *Caranx*

Caranx sp.

1996 Legacy Project (Coles et al., 1997)

Caranx ignobilis (Forsskål, 1775)

1973 Ref - Evans et al., 1974
1973 Ref - McCain, 1974
1973 Ref - McCain, 1975
1993 Ref - Brock, 1994
1994 Ref - Brock, 1995
2006 Ref - Smith et al., 2006

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 Legacy Project (Coles et al., 1997)

Caranx sexfasciatus Quoy & Gaimard, 1825

1973 Ref - Evans et al., 1974
1973 Ref - McCain, 1974
1973 Ref - McCain, 1975
1978 Ref - Grovhoug, 1979

Genus: *Decapterus*

Decapterus macarellus (Cuvier, 1833)

2006 Ref - Smith et al., 2006

Genus: *Gnathanodon*

Gnathanodon speciosus (Forsskål, 1775) Indigenous. Common name: Golden Trevally;
Hawaiian name: ulua pa'opa'o.

1973 Ref - Evans et al., 1974
1973 Ref - McCain, 1974
1973 Ref - McCain, 1975
1978 Ref - Grovhoug, 1979
1996 Legacy Project (Coles et al., 1997)
2006 Ref - Smith et al., 2006
2008 Legacy II Project (Coles et al., 2009)

Genus: *Scomberoides*

Scomberoides laysan (Forsskål, 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

Pearl Harbor - Species Report (Cont.)

Family: CHAETODONTIDAE

Genus: *Chaetodon*

Chaetodon auriga Forsskål, 1775 Indigenous. Common name: Threadfin Butterflyfish.

1973 Ref - Evans et al., 1974
1978 Ref - Grovhoug, 1979
1986 Ref - Lenihan, 1990
1993 Ref - Brock, 1994
1994 Ref - Brock, 1995
1996 Legacy Project (Coles et al., 1997)
2006 Ref - Smith et al., 2006
2007 Legacy II Project (Coles et al., 2009)
2008 Legacy II Project (Coles et al., 2009)

Chaetodon ephippium Cuvier, 1831

1978 Ref - Grovhoug, 1979
1986 Ref - Lenihan, 1990
1996 Legacy Project (Coles et al., 1997)
2006 Ref - Smith et al., 2006

Chaetodon lineolatus Cuvier, 1831

1993 Ref - Brock, 1994

Chaetodon lunula (Lacépède, 1802)

1973 Ref - Evans et al., 1974
1978 Ref - Grovhoug, 1979
1986 Ref - Lenihan, 1990
1996 Legacy Project (Coles et al., 1997)
2006 Ref - Smith et al., 2006

Chaetodon lunulatus Quoy and Gaimard, 1825

2006 Ref - Smith et al., 2006

Chaetodon miliaris Quoy & Gaimard, 1824

1973 Ref - Evans et al., 1974
1978 Ref - Grovhoug, 1979
1996 Legacy Project (Coles et al., 1997)

Genus: *Forcipiger*

Forcipiger flavissimus Jordan & McGregor, 1898

1996 Legacy Project (Coles et al., 1997)

Genus: *Heniochus*

Heniochus diphreutes Jordan, 1903

1973 Ref - Evans et al., 1974 Recorded as acuminatus (Linnaeus).

Family: Cheilodactylidae

Genus: *Goniistius*

Goniistius vittatus (Garrett, 1864)

2006 Ref - Smith et al., 2006 Recorded as Cheilodactylus vittatus.

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 Legacy Project (Coles et al., 1997)

Genus: *Sarotherodon*

Sarotherodon melanopleura (Rüppell, 1852)

1993 Ref - Brock, 1994 Recorded as Tilapia melanopleura.

Pearl Harbor - Species Report (Cont.)

1994	Ref - Brock, 1995	Recorded as <i>Tilapia melanopleura</i> .
<i>Sarotherodon melanotheron</i> Ruppell, 1852		
1987	Ref - Randall, 1987	Recorded as <i>Tilapia melanotheron</i> .
1996	Spec - BPBM-I 37324	Middle Loch; under hull of U.S.S. "Machinist" Floating Drydock.
2006	Ref - Smith et al., 2006	Recorded as <i>Tilapia melanotheron</i> .
2007	Ref - Brock, 2007	Recorded as <i>Tilapia melanotheron</i> .
Family: GOBIIDAE		
Unidentified Gobiidae		
1996	Legacy Project (Coles et al., 1997)	
Genus: <i>Asterropteryx</i>		
<i>Asterropteryx semipunctatus</i> Rüppell, 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.
2006	Ref - Smith et al., 2006	
2007	Ref - Brock, 2007	
Genus: <i>Bathygobius</i>		
<i>Bathygobius cocosensis</i> (Bleeker, 1854) Hawaiian name: 'o'opu 'ohune.		
1973	Ref - Evans et al., 1974	Recorded as <i>fuscus</i> (Ruppell).
1986	Ref - Lenihan, 1990	Recorded as <i>B. fuscus</i> (Ruppell).
1993	Ref - Brock, 1994	Recorded as <i>B. fuscus</i> .
1994	Ref - Brock, 1995	Recorded as <i>B. fuscus</i> .
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.
<i>Bathygobius cotticeps</i> Steindachner, 1880		
1987	Ref - AECOS, 1987	
<i>Bathygobius fuscus</i> (Rüppell, 1830)		
2006	Ref - Smith et al., 2006	
Genus: <i>Ctenogobius</i>		
<i>Ctenogobius tongarevae</i> (Fowler, 1927)		
1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	
Genus: <i>Eviota</i>		
<i>Eviota epiphanes</i> Jenkins, 1903		
1996	Spec - BPBM-I 37314	N side of entrance channel.
Genus: <i>Gnatholepis</i>		
<i>Gnatholepis anjerensis</i> Bleeker, 1850		
1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	
Genus: <i>Mugilogobius</i>		
<i>Mugilogobius cavifrons</i> (Weber, 1909)		
1991	Spec - BPBM-I 34997	Drainage area E of Blaisdell Park.
<i>Mugilogobius parvus</i> (Oshima, 1919) Introduced.		
1987	Ref - Randall et al., 1993	
1994	Ref - Eldredge, 1994	

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Genus: *Opu*

Opu 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) Indigenous. Common name: Hawaiian Flagtail;
Hawaiian name: āholehole.

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 Legacy Project (Coles et al., 1997)
2008 Legacy II Project (Coles et al., 2009)

Family: KYPHOSIDAE

Genus: *Kyphosus*

Kyphosus bigibbus

(Lacépède, 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 Legacy Project (Coles et al., 1997)

Family: LABRIDAE

Genus: *Anampses*

Anampses cuvieri?

Quoy & Gaimard, 1824

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Genus: *Cheilinus*

Cheilinus bimaculatus

Valenciennes, 1840

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

Genus: *Cheilio*

Cheilio inermis

(Forsskål, 1775)

1973 Ref - Evans et al., 1974
1986 Ref - Lenihan, 1990

Genus: *Coris*

Coris flavovita

Bennett, 1929

1996 Legacy Project (Coles et al., 1997)

Genus: *Gomphosus*

Gomphosus varius

Lacépède, 1801

1996 Legacy Project (Coles et al., 1997)
2006 Ref - Smith et al., 2006

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Genus: *Labroides*

Labroides phthirophagus (Randall, 1958) Indigenous. Common name: Cleaner Wrasse.

1973 Ref - Evans et al., 1974
1996 Legacy Project (Coles et al., 1997)
2008 Legacy II Project (Coles et al., 2009)

Genus: *Oxycheilinus*

Oxycheilinus unifasciatus (Streets, 1877)

2006 Ref - Smith et al., 2006

Genus: *Stethojulis*

Stethojulis balteata (Quoy & Gaimard, 1824) Indigenous. Common name: Belted Wrasse;
Hawaiian name: ōmaka.

1973 Ref - Evans et al., 1974 Recorded as balteatus (Quoy and Gaimard).
1978 Ref - Grovhoug, 1979
1996 Legacy Project (Coles et al., 1997)
2007 Legacy II Project (Coles et al., 2009)

Genus: *Thalassoma*

Thalassoma duperrey (Quoy & Gaimard, 1824) Indigenous. Common name: Saddle Wrasse;
Hawaiian name: hīnālea lau-wili.

1996 Legacy Project (Coles et al., 1997)
2006 Ref - Smith et al., 2006
2008 Legacy II Project (Coles et al., 2009)

Thalassoma umbrostigma (Rüppell, 1838)

1979 Ref - AECOS, 1979 Off Pearl Harbor.

Family: LUTJANIDAE

Genus: *Lutjanus*

Lutjanus fulvus (Bloch & Schneider) Introduced. Common name: Blacktail Snapper;
Hawaiian name: to'au.

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 Legacy Project (Coles et al., 1997)
2006 Ref - Smith et al., 2006
2007 Legacy II Project (Coles et al., 2009)
2008 Legacy II Project (Coles et al., 2009)

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: *Moolgarda*

Moolgarda engeli (Bleeker, 1858)
2006 Ref - Smith et al., 2006 Recorded as Vulamugil engeli.

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

Pearl Harbor - Species Report (Cont.)

1996 Legacy Project (Coles et al., 1997)
2006 Ref - Smith et al., 2006

Family: MULLIDAE

Genus: *Mulloidichthys*

Mulloidichthys auriflamma Forsskål, 1775

1973 Ref - Evans et al., 1974

Mulloidichthys flavolineatus (Lacépède, 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 Legacy Project (Coles et al., 1997)
2006 Ref - Smith et al., 2006

Mulloidichthys vanicolensis Valenciennes, 1831 Indigenous. Common name: Yellowfin Goatfish; Hawaiian name: weke 'ula.

1996 Legacy Project (Coles et al., 1997)
2006 Ref - Smith et al., 2006

Genus: *Parupeneus*

Parupeneus bifasciatus (Lacepède, 1802)

2006 Ref - Smith et al., 2006

Parupeneus cyclostomus (Lacepède, 1801)

2006 Ref - Smith et al., 2006

Parupeneus multifasciatus (Quoy and Gaimard, 1825) Indigenous. Common name: Manybar Goatfish; Hawaiian name: moana.

2007 Legacy II Project (Coles et al., 2009)

Parupeneus mutifasciatus Quoy & Gaimard, 1824

1996 Legacy Project (Coles et al., 1997)

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 Legacy Project (Coles et al., 1997)
2006 Ref - Smith et al., 2006

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: weke pahulu; weke pueo. NE side of West Loch channel.

1996 Spec - BPBM-I 37325

Upeneus vittatus (Forsskål, 1775)

1992 Spec - BPBM-I 35395
1993 Spec - BPBM-I 37064

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Family: POLYNEMIDAE

Genus: *Polydactylus*

Polydactylus sexfilis (Cuvier & Valenciennes, 1831)

1973 Ref - Evans et al., 1974
1978 Ref - Grovhoug, 1979

Family: POMACANTHIDAE

Genus: *Pomacanthus*

Pomacanthus imperator (Bloch, 1787)

2006 Ref - Smith et al., 2006

Family: POMACENTRIDAE

Genus: *Abudefduf*

Abudefduf abdominalis (Quoy & Gaimard, 1824) Indigenous. Common name: Hawaiian Sergeant; Hawaiian name: mamo.

1973 Ref - Evans et al., 1974
1978 Ref - Grovhoug, 1979
1986 Ref - Lenihan, 1990
1994 Ref - Brock, 1995
1996 Legacy Project (Coles et al., 1997)
2006 Ref - Smith et al., 2006
2007 Legacy II Project (Coles et al., 2009)
2008 Legacy II Project (Coles et al., 2009)

Abudefduf sordidus (Forsskål, 1775)

1973 Ref - Evans et al., 1974
1986 Ref - Lenihan, 1990
2006 Ref - Smith et al., 2006

Genus: *Dascyllus*

Dascyllus albisella Gill, 1862 Indigenous. Common name: Hawaiian Dascyllus; Hawaiian name: mamo.

1973 Ref - Evans et al., 1974
1978 Ref - Grovhoug, 1979
1996 Legacy Project (Coles et al., 1997)
2006 Ref - Smith et al., 2006
2007 Ref - Brock, 2007
2007 Legacy II Project (Coles et al., 2009)
2008 Legacy II Project (Coles et al., 2009)

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).
2006 Ref - Smith et al., 2006

Family: SCARIDAE

Genus: *Calotomus*

Calotomus carolinus (Valenciennes in Cuvier and Valenciennes, 1840)

2006 Ref - Smith et al., 2006

Calotomus spinidens (Quoy & Gaimard, 1824)

1973 Ref - Evans et al., 1974
1978 Ref - Grovhoug, 1979

Genus: *Chlorurus*

Chlorurus psittacus (Forsskål, 1775)

1996 Spec - BPBM-I 37327 NE of Ford Island.
2006 Ref - Smith et al., 2006 Recorded as Scarus psittacus.

Chlorurus sordidus (Forsskål, 1775) Hawaiian name: uhu.

1973 Ref - Evans et al., 1974 Recorded as Scarus sordidus Forsskal.

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1993	Ref - Brock, 1994	Recorded as <i>Scarus sordidus</i> .
1994	Ref - Brock, 1995	Recorded as <i>Scarus sordidus</i> .
2006	Ref - Smith et al., 2006	Recorded as <i>Scarus sordidus</i> .
2007	Ref - Brock, 2007	Recorded as <i>Scarus sordidus</i> .

Genus: *Scarus*

<i>Scarus sp.</i>	Indigenous.	Common name: Parrotfish.
1973	Ref - Evans et al., 1974	juvenile.
1986	Ref - Lenihan, 1990	
1996	Legacy Project (Coles et al., 1997)	
2008	Legacy II Project (Coles et al., 2009)	

Scarus rubroviolaceus **Bleeker, 1849**

2006	Ref - Smith et al., 2006
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Family: SPHYRAENIDAE

Genus: *Sphyraena*

<i>Sphyraena barracuda</i>	(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	Legacy Project (Coles et al., 1997)
2006	Ref - Smith et al., 2006

Order: PLEURONECTIFORMES

Family: BOTHIDAE

Genus: *Bothus*

<i>Bothus pantherinus</i>	(Rüppell, 1830)
1973	Ref - Evans et al., 1974

Order: TETRAODONTIFORMES

Family: DIODONTIDAE

Genus: *Diodon*

<i>Diodon holocanthus</i>	Linnaeus, 1758	
1973	Ref - Evans et al., 1974	
<i>Diodon hystrix</i>	Linnaeus, 1758	Indigenous. Common name: Spiny Balloonfish.
1973	Ref - Evans et al., 1974	
1978	Ref - Grovhoug, 1979	
1979	Ref - AECOS, 1979	Off Pearl Harbor. Recorded as <i>D. hystrix</i> .
1996	Legacy Project (Coles et al., 1997)	
2006	Ref - Smith et al., 2006	
2008	Legacy II Project (Coles et al., 2009)	

Family: MONACANTHIDAE

Genus: *Pervagor*

<i>Pervagor spilosoma</i>	(Lay & Bennett, 1839)
1973	Ref - Evans et al., 1974

Family: OSTRACIIDAE

Genus: *Lactoria*

<i>Lactoria fornasini</i>	(Bianconi, 1846)
1996	Legacy Project (Coles et al., 1997)

Genus: *Ostracion*

<i>Ostracion meleagris</i>	(Shaw and Nodder, 1796)	Indigenous. Common name: Spotted Boxfish; Hawaiian name: moa.
2008	Legacy II Project (Coles et al., 2009)	

Pearl Harbor - Species Report (Cont.)

Ostracion meleagris camurum (Jenkins, 1901)

1973 Ref - Evans et al., 1974
1978 Ref - Grovhoug, 1979
1996 Legacy Project (Coles et al., 1997)

Family: TETRAODONTIDAE

Genus: *Arothron*

***Arothron* sp.**

Hawaiian name: makimaki.

1949 Spec - BPBM-I 25886
1996 Spec - BPBM-I 37318
Company (HECO) Sheet piling in thermal discharge from Hawaiian Electric
Waiau Plant.

Arothron hispidus

(Linnaeus, 1758) Indigenous. Common name: Stripebelly Puffer;

Hawaiian name: 'o'opu-hue.

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 Legacy Project (Coles et al., 1997)
2006 Ref - Smith et al., 2006
2007 Ref - Brock, 2007
2007 Legacy II Project (Coles et al., 2009)
2008 Legacy II Project (Coles et al., 2009)

Genus: *Canthigaster*

Canthigaster coronata

(Vaillant & Sauvage, 1875)

1973 Ref - Evans et al., 1974 Canthigaster coronatus (Randall, P.C.).

Canthigaster jactator

(Jenkins, 1901) Indigenous. Common name: Whitespotted Toby.

1973 Ref - Evans et al., 1974
2008 Legacy II Project (Coles et al., 2009)

Class: REPTILIA

Family: Chelonidae

Genus: *Chelonia*

Chelonia mydas

(Linnaeus, 1758)

2007 Ref - Brock, 2007

Appendix F: Annotated Bibliography of Pearl Harbor Published and Unpublished Literature

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Visual survey and water quality analysis of area offshore of Iroquois Point N. of P. H. Channel entrance. Communities typical of wave stressed coral reef under influence of discharge from sewage outfall from Fort Kam WWTP.
- 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.
Basic descriptive resource for Pearl Harbor and all Oahu nearshore marine environments, containing extensive annotated references.
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Plan submitted to test toxicity of dredged material from Magazine Loch, P. H. prior to disposal at sea.
- AECOS. 1982. "Dredge material testing for maintenance dredging of Magazine Loch, Pearl Harbor, Hawaii," Rep. No. AECOS No. 277a. PacDiv Naval Facilities Engineering Command, Honolulu.
Results of toxicity of testing of dredged material from Magazine Loch, P. H. prior to disposal at sea. No test organisms showed any toxic effects.
- AECOS. 1983. "Bioassay testing of dredged materials for dredging , Pearl Harbor, (Phase II) Naval Station, Pearl Harbor, Hawaii. Prefinal report.," Rep. No. Contract No. 62742-81-C-0139. M & E Pacific Inc., Honolulu. Results of toxicity testing and chemical analyses of dredged material from numerous sites in East Loch, P. H. prior to disposal at sea. No test organisms showed any toxic effects from sediments, which contained trace metals organohalides, PCB's and petroleum hydrocarbons.
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- AECOS. 1990. "Laboratory results. Bioassay and bioaccumulation for Pearl Harbor dredged material disposal," Rep. No. Contr. No. DACW83-89-D-0006. PacDiv Naval Facilities Engineering Command, Honolulu. Results of toxicity testing and bioaccumulation of chemicals from dredged material from numerous sites in Pearl Harbor. No test organisms showed any toxic effects, but bioaccumulation of metals was found for *Penaeus vannamei* and *Mercenaria mercenaria*.

- AECOS. 1993. Environmental assessment,, sea wall and drainage system at 98-165 Aiea Kai Way, Kaluaao, 'Ewa, O'ahu, Rep. No. AECOS No. 742, Honolulu. Brief EA describing effects of modifying existing seawall to mitigate flooding
- Alton, H.. 1972. Oysters perish at Pearl Harbor. In "Honolulu Star Bulletin", pp. A-3, Honolulu. Massive dieoff of more than 90% of 3.5 million oysters in West Loch reported by unknown causes. No mortality observed in East or Middle Lochs.
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- Anon. 1902. Pearl Harbor. *Paradise of the Pacific* **15**, 36-37. Description of progress of channel dredging to be to depth of 30 ft and width of 200 ft, and waters teeming with mullet. Map on back cover gives depths from latest government surveys at that time.
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