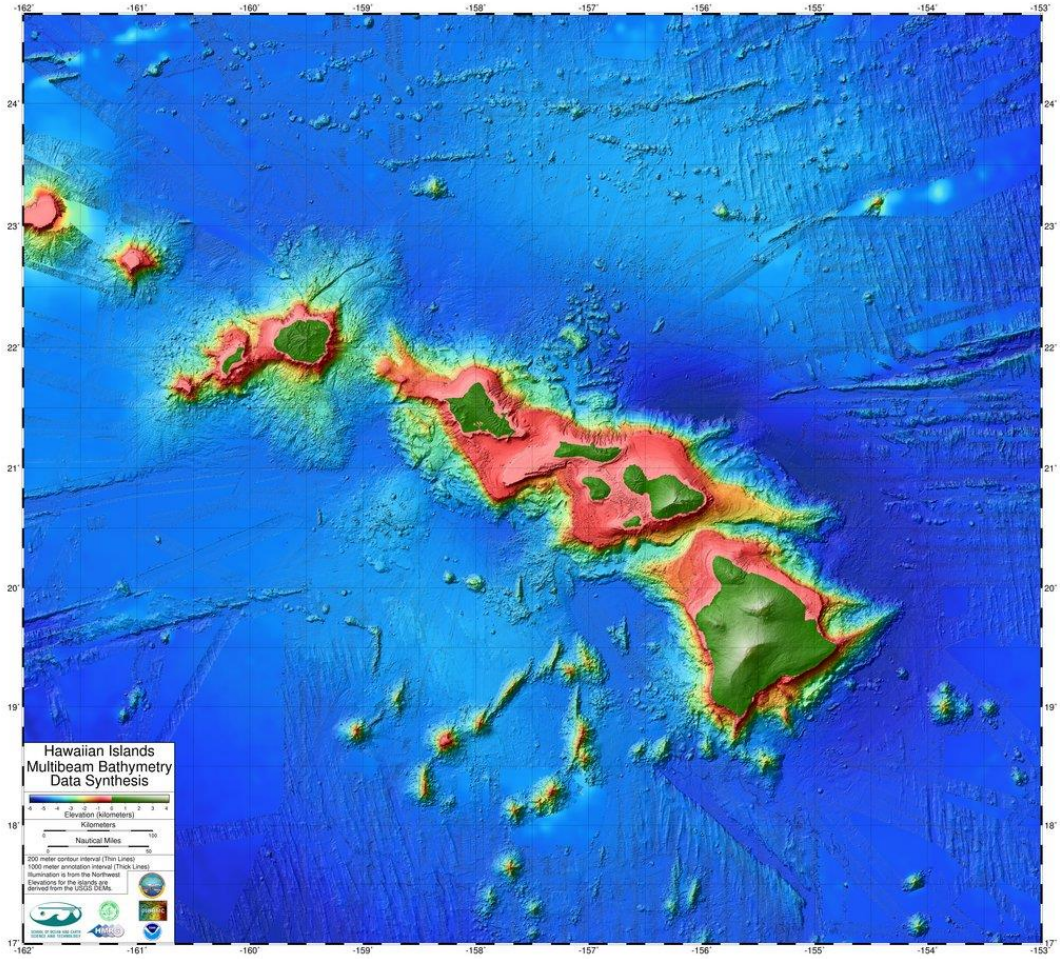
OCS Study
BOEM 2017-021

The Unseen Landscape: Inventory and Assessment of Submerged Cultural Resources in Hawai`i



US Department of the Interior
Bureau of Ocean Energy Management
Pacific OCS Region

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Cover image: Bathymetric map of the Hawaiian Islands. (NOAA)

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The Unseen Landscape: Inventory and Assessment of Submerged Cultural Resources in Hawai`i

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Prepared under BOEM Interagency Agreement M13PG00018
By the National Oceanic and Atmospheric Administration
Office of National Marine Sanctuaries
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US Department of the Interior
Bureau of Ocean Energy Management
Pacific OCS Region
August 18, 2017

BOEM
Bureau of Ocean Energy Management

DISCLAIMER

This study was funded, in part, by the US Department of the Interior, Bureau of Ocean Energy Management, Environmental Studies Program, Washington, DC, through Interagency Agreement Number M13PG00018 with the US Department of Commerce, National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries. This report has been technically reviewed by BOEM and has been approved for publication. The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the US Government, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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CITATION

NOAA Maritime Heritage Program. 2017. The Unseen Landscape: Inventory and Assessment of Submerged Cultural Resources in Hawai`i. US Department of the Interior, Bureau of Ocean Energy Management, Pacific OCS Region, Camarillo, CA. OCS Study BOEM 2017-021. 240 pages, with appendices.

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ACKNOWLEDGEMENTS

This study is the result of work by numerous individuals including employees of NOAA's Maritime Heritage Program, Office of National Marine Sanctuaries, Marine Protected Areas Center, BOEM's Pacific OCS Regional Office, University of Hawaii's Undersea Research Lab, NOAA Office of Marine and Aviation Operations Diving Program, and Honua Consulting Inc., as well as other outside contributors who provided valuable expertise. Thanks go to everyone listed below for their valuable contributions:

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Acronyms and Abbreviations

AAF	Army Air Force
AAB	Army Air Base
ACHP	Advisory Council on Historic Preservation
AFB	Air Force Base
AMTRACK	Amphibious Tracked Vehicle
AUV	Autonomous Underwater Vehicle
BCE	Before Current Era
BOEM	Bureau of Ocean Energy Management
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
BP	Before Present
BSEE	Bureau of Safety and Environmental Enforcement
C	Celsius
CE	Current Era
CFR	Code of Federal Regulations
CLA	Cultural Landscape Approach
CM	Centimeter
DLNR	Department of Land and Natural Resources
DoN	Department of the Navy
EDM	Electronic Distance Meter
EEZ	Exclusive Economic Zone
F	Fahrenheit
FT	Foot
GIS	Geographic Information System
GPS	Global Positioning System
HABS	Historic American Building Survey
HAER	Historic American Engineering Record
HIRSA	Hawai`i Island Recreational Scuba Association
HRS	Hawai`i Revised Statutes
HURL	Hawai`i Undersea Research Laboratory
IAA	Inter Agency Agreement
JBPHH	Joint Base Pearl Harbor-Hickam
KG	Kilogram
KM	Kilometer
LCI	Landing Craft Infantry
LCM	Landing Craft Mechanized
LCT	Landing Craft Tank
LCU	Landing Craft Utility
LGM	Last Glacial Maximum
LMSL	Local Mean Sea Level
LSM	Landing Ship Medium
LST	Landing Ship Tank
LVT	Landing Vehicle Tracked
MAST	Maritime Archaeology Surveying Techniques

MATC	Maui Amphibious Training Center
MCAS	Marine Corps Air Station
MCBH	Marine Corps Base Hawai`i
MHP	Maritime Heritage Program
MHW	Mean High Water
MI	Mile
MM	Millimeter
MMS	Minerals Management Service
MOP	Marine Option Program
MSL	Mean Sea Level
NAD	North American Datum
NAF	Naval Air Field
NARA	National Archives and Records Administration
NAS	Naval Air Station
NEPA	National Environmental Policy Act
NHHC	Naval History & Heritage Command
NHPA	National Historic Preservation Act
NM	Nautical Mile
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NPS	National Park Service
NRHP	National Register of Historic Places
OCS	Outer Continental Shelf
OCS	Office of Coast Survey (NOAA)
OCSLA	Outer Continental Shelf Lands Act
OER	Office of Ocean Exploration and Research (NOAA)
OHA	Office of Hawaiian Affairs
ONMS	Office of National Marine Sanctuaries (NOAA)
PMRF	Pacific Missile Range facility
PPT	Parts Per Thousand
PVS	Polynesian Voyaging Society
QA/QC	Quality Assurance/Quality Control
RGP	Regional General Permit
RIMPAC	Rim of the Pacific Exercise
RN	Record Number (SCR database)
ROV	Remotely Operated Vehicle
RUST	Remediation of Under Sea Threats (NOAA)
S	Second
SCR	Submerged Cultural Resources
SHPO	State Historic Preservation Office
SMCA	Sunken Military Craft Act
STBD	Starboard
TCP	Traditional Cultural Properties
UCH	Underwater Cultural Heritage
UH	University of Hawai`i
US	United States

USACE	US Army Corps of Engineers
USC	United States Code
USGS	United States Geological Survey
USMC	United States Marine Corps
UTM	Universal Transverse Mercator
WGS	World Geodetic System

1. Executive Summary

The development of sustainable energy sources to the level of 70% by 2030, established as a Hawaii statewide goal, includes proposed projects in Hawaii's offshore Outer Continental Shelf (OCS) waters. The Bureau of Ocean Energy Management (BOEM), the regulatory agency for OCS energy proposals, is required to take into consideration the impacts of these activities on archaeological and cultural resources and traditional cultural properties. To meet this mandate, in 2013, BOEM entered into an interagency agreement (IAA No. M13PG00018) with National Oceanic and Atmospheric Administration's Office of National Marine Sanctuaries (NOAA ONMS) for compiling and analyzing cultural resource data for the marine environment surrounding the main Hawaiian Islands. The interagency agreement defined three objectives: 1) develop a database of known, reported, and potential submerged cultural resources e.g., shipwrecks, submerged aircraft (OCS Study BOEM 2017-021); 2) develop a database of land-based historic properties that could be adversely impacted by the alteration of the view of the ocean (OCS Study BOEM 2017-022); and 3) develop a proactive approach with indigenous Native Hawaiian communities in identifying areas of cultural significance (OCS Study BOEM 2017-023). The three-part assessment facilitates the management and protection of cultural resources and properties, and enhances agency communication with local communities.

This report *The Unseen Landscape: Inventory and Assessment of Submerged Cultural Resources in Hawai`i,* provides cultural, environmental and historic context to the database of known, reported, and potential submerged cultural resources inventory (objective #1 above). The report includes a description of the interagency project, research and analysis methods, marine environmental description for the study area, discussion of site formation processes affecting submerged historic properties, cultural landscape summary of cultural and historical changes from the original Polynesian discovery of the islands to the post-World War II period, conclusions, references, and supporting appendices. It is a work of synthesis, providing contextual background and analysis at the cultural landscape level. This report is *not* a compilation of individual ship histories or site descriptions. That information is included within the accompanying database, which features comprehensive referenced site and historical information for the 2,120 known, reported, and potential submerged cultural resources in Hawaiian waters.

Humans have been seafaring from long before the advent of recorded history. The world's ocean covers 71% of the globe, and for navigators it serves as a highway of discovery, migration, trade, and cultural contacts. People of the islands of Hawai`i have been for hundreds of years, and remain so today, intimately connected to the sea, actively engaged in cultural, recreational, military and commercial pursuits, as well as marine resource conservation. This connection has produced a maritime "footprint" or cultural landscape, the physical legacy of submerged cultural resources and historic properties. This first-ever statewide analysis and inventory, *The Unseen Landscape,* is intended to enhance increasing awareness, appreciation, and consideration of these unique resources, in the hopes of continued heritage preservation and protection for future generations.

2. Introduction

2.1. Purpose of This Document

With passage of the Energy Policy Act of 2005, BOEM has assumed jurisdiction for renewable energy development on the OCS, and is required under multiple statutes (Outer Continental Shelf Lands Act 1953, OCSLA; National Environmental Policy Act 1970, NEPA; and National Historic Preservation Act 1966, NHPA) to take into consideration the impacts of OCS activities on archaeological and cultural resources and traditional cultural properties. To meet this mandate, BOEM entered into an interagency agreement with NOAA ONMS for compiling and analyzing data on the Hawaiian Islands. The specific objectives of the Agreement were to:

1) develop a geo-referenced database of known, reported, and potential submerged cultural resources (e.g., shipwrecks, airplanes, etc.) on the Hawai`i OCS emphasizing the use of primary sources;

2) develop a geo-referenced database of land-based historic properties that could be adversely impacted by the alteration of the view of the ocean; and

3) develop a proactive approach to working with the indigenous Native Hawaiian community in order to identify areas of significance that need to be considered in the planning process for offshore renewable energy development.

The purpose of this document, *The Unseen Landscape: Inventory and Assessment of Submerged Cultural Resources in Hawai`i*, is to provide appropriate cultural, environmental and historic context to the inventory of submerged cultural resources database inventory cited in the aforementioned first objective. The report makes use of the cultural landscape approach in order to better categorize and interpret the many varied sites and historic properties surrounding the eight southeastern Hawaiian Islands. This is the first time that a state-wide inventory of submerged cultural resources in Hawai`i has been completed.

2.2. Identifying Native Hawaiian Cultural Properties

Resource management programs for Federal agencies, organized under the National Historic Preservation Act (NHPA) (Public Law 113-287, 54 USC 300101 et seq.), emphasize physical objects and specific bounded locations as "properties" or markers of cultural significance, and these properties are the focus of targeted preservation efforts. Historic properties are material remains of past human activities which meet specific pre-defined National Register criteria, both from historic and Pre-European contact. The NHPA defines a historic property as:

> … any prehistoric or historic district, site, building, structure, or object included on, or eligible for inclusion on, the National Register, including artifacts, records, and material remains relating to the district, site, building, structure, or object. (NHPA 1966, as amended).

Historic properties may also be Traditional Cultural Properties (TCPs), locations that meet specific criteria used for ceremonies or other cultural activities that may leave no material traces,

and may have on-going use important to the maintenance of cultural practices (Parker and King 1998). The role the historic property plays in a community's traditional religion, beliefs, customs, and practices can enhance the property's eligibility to the National Register of Historic Places (NRHP). The Advisory Council for Historic Preservation (ACHP) provides guidance on the role of Native Hawaiian Organizations in the identification of historic properties (*Consultation with Native Hawaiian Organizations in the Section 106 Review Process: a Handbook* 2011), and has acknowledged Native Hawaiian traditional cultural knowledge, beliefs, and practices, and recognized their value in the understanding and preservation of historic properties in Hawai`i (ACHP 2011).

It is important to note that Hawaiian perspectives on cultural resources may sometimes seem unfamiliar to non-Hawaiian resource managers. The foreign emphasis on structures, properties, and specific pre-defined locations, rather than living practices and traditions, may not be ideally suited for Hawai`i. Many Hawaiians maintain active personal connections with the marine environment, placing more importance on intangible practices and traditions, rather than tangible fixed properties. Similar attitudes are seen elsewhere in the Pacific Islands region, such as in the Commonwealth of the Northern Marianas Islands (McKinnon and Carrell 2015: 5).

Understanding indigenous cultural perspectives is critical to cultural resource preservation efforts; cultural resource significance in Hawai`i encompasses far more than just a list of submerged properties. The BOEM – NOAA interagency agreement (IAA No. M13PG00018) recognized this fact and actively solicited Native Hawaiian perspectives and input in the second objective, "land-based coastal historic properties" (OCS Study BOEM 2017-022), and the third objective, "developing a proactive approach to identify areas of significance" (OCS Study BOEM 2017-023).

This inventory report (OCS Study BOEM 2017-021) includes contextual background for the Polynesian discovery and settlement of the islands, and descriptions of selected near-shore Hawaiian property types, but does not inventory Native Hawaiian submerged properties per se, for describing these living practices and traditions in terms suitable to property lists would frequently be inappropriate. Information regarding marine locations that are important to gathering and fishing activities was traditionally the responsibility of specific *konohiki* (resource managers) or families and individuals, and not suitable for general distribution. The more detailed assessment of Native Hawaiian cultural resources is therefore left to the two accompanying studies (above). This study, *The Unseen Landscape: Inventory and Assessment of Submerged Cultural Resources in Hawai`i,* focuses on the many submerged properties of shipwrecks and aircraft around the islands from the historic period.

All three of the OCS BOEM studies are necessary for gaining a more comprehensive understanding of Hawaii's complex tangible and intangible cultural resources setting.

2.3. Identifying Historic Submerged Cultural Resources

The assessment effort focused on the OCS which, for Hawai`i, is defined as the zone of Federal jurisdiction around the islands 3-200 miles from island shorelines. Hawai`i has no shallow continental shelf, for the islands are formed of volcanic activity through the oceanic shelf or plate. The Hawaiian Islands are literally the tops of large subsea mountains, with slopes

dropping quickly to the abyssal plain. In other words, depths increase very quickly in the waters surrounding the islands. Shallow water remote-sensing surveys, used elsewhere to locate submerged cultural resources on continental shelves, are limited to near-shore coastal areas in Hawai`i. Deep water surveys for these types of resources are more complex and expensive, and far fewer have been conducted.

The bulk of information on submerged cultural resources is, therefore, document-based, derived from archives and libraries and collections, and most often describes what was lost, rather than what has been found. Referred to here as "submerged cultural resources" (SCR), the sunken properties that describe elements of Hawaii's historic maritime past are today also collectively known as "underwater cultural heritage" (UCH). Submerged shipwrecks, submarines, and aircraft reflect major parts of Hawaii's recent past, and discoveries of these resources generate public attention to the field of maritime archaeology and heritage preservation.

2.4. The Maritime Cultural Landscape

Maritime archaeologists have often tended to interpret individual sites as isolated properties, but submerged cultural resources are often related to each other, or related to common historic events or historic periods, and should be considered in context. Submerged archaeological sites are never isolated from their surroundings, but are affected by many features outside the normal description of historic properties, such as ocean environment, past and present uses of ocean space, etc. Synthesis in interpretation, therefore, is critical to gaining a better understanding of the cultural significance of individual sites. This report provides cultural and historic contexts that are more comprehensive and holistic in nature, in order to understand the categories of sites and common events or historic periods that give meaning to the many discrete individual entries in the submerged cultural resource database. This is a small part of a maritime cultural landscape approach.

Cultural landscape studies do not represent a new concept, but have long been recognized as useful tools in describing distinct geographical areas of associated cultural and natural features. Dr. Christer Westerdahl first introduced the term "maritime cultural landscape" as an archaeological concept spanning both sea and land, and other scholars since then have further refined the archaeology of maritime landscapes (Westerdahl 1992). There is much more to culture than archaeology, however. Community stakeholders seek recognition of cultural resources beyond historic shipwrecks. Resource managers must make decisions balancing numerous cultural inputs. Until now, though, cultural resource issues have not been understood in a comprehensive manner.

> A Cultural Landscape Approach (CLA) offers a means for looking at the important ways in which specific cultural and environmental processes overlap and influence one another. The intellectual concept of cultural landscapes has been established for nearly a century, but its application to the management of marine resources is quite new. Cultural landscapes identify combinations of human activity and natural areas and resources that have left identifiable cultural and ecological patterns. (MPAFAC 2011)

Associated sites and features of landscapes may be categorized chronologically, thematically, or in other ways depending on the nature of the research question. The goal of this report is to describe and analyze the broad swath of submerged cultural resources in the inventory.

In the island setting of Hawai`i, major social and technological changes were often initiated by the arrival of new groups or specific events. Sometimes new technologies supplanted older ways of doing things; sometimes new activities added to or transformed traditional ways. At other times the old and the new found ways to coexist. The maritime cultural landscape in Hawai`i is dynamic. The historical background provided in Sections 4-9 (below) provides the context necessary for better understanding this changing and evolving maritime cultural landscape as it progresses through identifiable phases or themes:

- Polynesian discovery and Hawaiian settlement
- Early foreign voyagers
- Sailing era, sandalwood, and whaling
- Plantation era and steam propulsion
- US Navy, Pearl Harbor, and WWII
- Contemporary maritime transportation

The cultural landscape approach is central to understanding the significance of Hawaii's submerged cultural resources in a more comprehensive and holistic fashion. Other aspects or "landscapes", such as the physical landscape (environmental criteria) or the legal "landscape" (preservation laws) will also be addressed.

2.4.1. Defining Known, Reported and Potential Resources

The interagency agreement initiating the project directs NOAA to create a database of known, reported, and potential submerged cultural resources. "Known" wrecks are comprised of verified and located resource sites. "Reported" wrecks are comprised of unverified resources which have not been located, but for which there are reliable primary and/or secondary reports of loss in a general area. "Potential" wrecks are comprised of reports in which vessels have gone missing, or are reported adrift, when there is no evidence to indicate where or when they sank (or if they sank at all), as well as those cases where it is simply not possible, due to lack of information, to assess the reliability of the reported loss.

In reference to the criteria used by the NRHP, the database characterizes all wreck entries as: 1) listed; 2) eligible; 3) ineligible; and 4) not determined. The vast majority of reported and/or confirmed sites have not been formally assessed in terms of the Register, and therefore fall under the "not determined" status. This is not equivalent to "ineligible." It is important to note that prior to an actual assessment of the submerged cultural resource, properties should be treated as potentially "eligible" for management and preservation purposes.

2.5. Authorizations

The State of Hawai`i has mandated a goal of achieving 70% clean energy by 2030. In order to meet this goal, development of offshore renewable energy resources and construction of

interisland transmission cables may be necessary. With passage of the Energy Policy Act of 2005, BOEM has assumed jurisdiction for some types of renewable energy development on the OCS. Though the islands of Hawai`i are not "continental" in nature (do not possess a continental shelf), for Hawai`i the OCS is defined as the zone of Federal jurisdiction around the islands 3-200 miles from island shorelines (Figure 1).

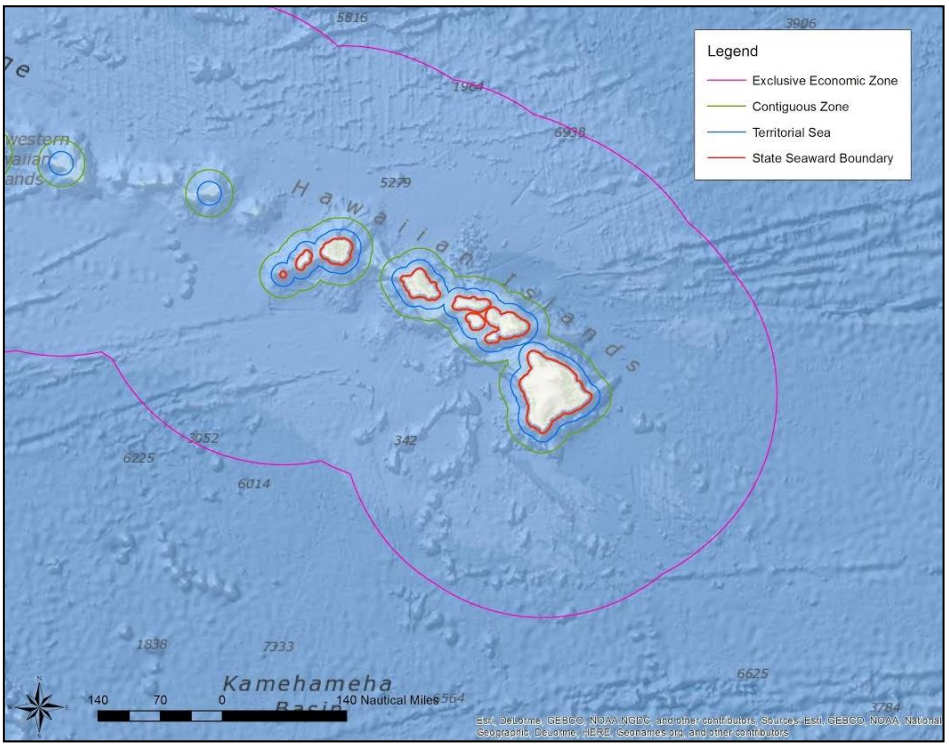

Figure 1: 200-mile EEZ boundary (purple) around the main eight Hawaiian Islands. (NOAA ONMS)

Understanding the types and locations of significant archaeological and cultural resources is essential to their preservation and consideration during planning for offshore renewable energy development. This includes, among others, resources and areas important to the archaeology and history of the Hawaiian Islands, as well as resources and areas important to Native Hawaiian communities, both historical and modern. As planning and development for offshore renewable energy projects increases, the potential for impacts to underwater and terrestrial archaeological, cultural, and historical resources, and traditional cultural properties, will increase as well.

The inventory of cultural and historic resources, including the compilation of historic background information and all available site data, and assessment of site significance where possible, directly addresses Federal preservation mandates under NHPA Section 106 requiring agencies to consider potential impacts to historic properties from proposed undertakings, and Section 110 requiring agencies to identify, evaluate, and protect historic properties under their jurisdictions. The information will also be used to support reviews under NHPA, NEPA and other Federal laws.

2.6. Team Participants

BOEM's Pacific Region is responsible for managing the development of conventional (oil and natural gas) and renewable energy resources (wind and wave) and also mineral resources (sand and gravel) on the OCS offshore California, Oregon, Washington and Hawai`i in an

environmentally and economically responsible way. The Pacific Region functions, relative to these energy and mineral resources and uses, include: lease management, plan administration, environmental science, environmental analysis, resource evaluation and economics. The Bureau also manages the alternate use of existing oil and gas OCS facilities. The Region is responsible for providing information needed to predict, assess, and manage effects from offshore energy and marine mineral exploration, development and production activities on human, marine and coastal environments. The Region also develops environmental documents under NEPA for proposed and ongoing OCS energy and alternate use projects, and for environmental evaluation efforts with other agencies.

NOAA's Maritime Heritage Program (MHP), created in 2002, is an initiative of ONMS. The program focuses on maritime heritage resources within the fourteen designated National Marine Sanctuaries and Marine National Monument of the Sanctuary system, and also promotes maritime heritage appreciation and preservation throughout the entire nation. NOAA is legally responsible for the management of maritime heritage resources within sanctuary boundaries. Congress directs NOAA, through the National Marine Sanctuaries Act, to comply with the Federal Archaeological Program. This is the collection of laws and regulations that pertain to the protection of historical and archaeological properties on Federal and Federally-managed lands.

The University of Hawai`i Undersea Research Laboratory (HURL) specializes in providing scientists with the tools and expertise they need to investigate the undersea environment, including submersibles, remotely operated vehicles, and other cutting edge technologies. This Center, within the School of Ocean and Earth Sciences and Technology at the University of Hawai`i, is funded through a cooperative agreement from NOAA that began in 1980. The Center is now part of NOAA's Office of Ocean Exploration and Research.

Honua Consulting Inc. is a Hawaiian-owned, small business founded in 2003 by Dr. Trisha Kehaulani Watson. Honua Consulting provides a variety of cultural, educational, community, and environmental services, specializing in cultural and environmental impact assessments, community engagement and consultations, education and outreach, cultural monitoring, and community capacity-building. The company is located on the island of O`ahu.

2.7. Report Organization

This report provides the analysis and interpretation of all data collected during the course of this project for the first objective: the database of known, reported, and potential submerged cultural resources (e.g., shipwrecks, aircraft) on the Hawai`i OCS.

Section 1 presents the Executive Summary of this report.

Section 2 describes the background of the project, the research and analysis approaches undertaken for the study, and the team participants who contributed to the study and information sources for the inventory.

Section 3 presents an environmental description of the waters surrounding the main Hawaiian Islands, including basic background information on the geologic, geographic, and hydrologic environments. This section includes general information on the past

frequency of hurricanes and tsunamis in the area. These are the general prevailing parameters which influence individual site and site formation processes.

Section 4 begins the contextual history with the original human discovery of the islands, with general background in Lapita migration theory and a summary of current estimates of original landing and settlement. The discovery of Hawai`i was the result of the longest and boldest marine migration ever accomplished by humans. Polynesian navigation and voyaging technology are introduced, and the basics of Hawaiian fishing and aquaculture are covered as these activities have left a significant signature in coastal Hawaiian waters.

Section 5 explores the European discovery of the islands, along with some of the cultural, biological, and demographic consequences of foreign contact, which proved in many ways to be devastating to the Hawaiian population. Potential archaeological resources that may be associated with these impacts must be understood in this context.

Section 6 covers a period of accelerated change in Hawaiian history, as Pacific trade contacts increase, and Pacific whaling activities reach their apogee, bringing intense social and economic transformation to Hawai`i. This period saw the once-isolated island kingdom more closely bound to regional and global economic activities. The archaeological record of this intensification, particularly for shoreline infrastructure like harbors and landings, increases.

Section 7 describes the era of steam propulsion in Hawai`i, which was dependent on the needs of the plantation system and was itself a social and economic revolution for the islands. Following the illegal overthrow of the kingdom, few obstacles remained in the commercial exploitation of island labor and agricultural resources. The steam industrialization of the islands has left its mark in the surrounding waters.

Section 8 describes, at least from the perspective of submerged cultural resources, the most important aspect of Hawaiian history, the US Navy and the militarization of Hawaiian waters. No other period left such a tangible footprint in the oceans surrounding the islands, for better and for worse. The section describes the strategic military nature of the islands, the specialized tactics of submarine warfare and amphibious craft and naval aviation, the 1941 attack on the island of O`ahu (misleadingly known as the Attack on Pearl Harbor), the intense training operations held among the islands during wartime, and the intentional disposal of ships and other materials during and following the war.

Section 9 describes maritime activities of the past 50 years or so. Container ships, tugs, and barges are now the platforms for commercial operations, leaving their own distinct imprint on the seafloor. Submarine cables, a continuing communications legacy, must be taken into account as well, considering that the earliest cables around the islands were laid over 100 years ago.

Section 10 presents a brief discussion of the results of the study as a whole, concluding with a preliminary analysis of resource distribution patterns across the known maritime cultural landscape.

The body of the report sections is followed by complete References, and appropriate Appendices 1-6.

Due to the high number of confirmed locations/sites (404), full individual vessel descriptions and histories are *not* included in this study *The Unseen Landscape: Inventory and Assessment of Submerged Cultural Resources in Hawai`i*. Only highlights and summaries of archaeological surveys are included for selected representative vessels. All details regarding each specific vessel or aircraft can be found within the database itself, including transcribed journal and newspaper articles, summaries, references etc. Appendix 4 provides an excerpt summary list of the inventory. This study *The Unseen Landscape* accompanies the database and provides a broader landscape-level analysis, rather than individual site descriptions. Statistics generated from the database, selected highlight vessel entries, and implications of resource types for the inventory are the focus of this study for each contextual background section (Sections 4-9).

2.8. Sources for the Inventory

Both known and reported sites within the Federal waters of Hawaii's OCS, from 3-200 miles offshore (1,400 entries), as well as sites within State waters (0-3 miles; 720 entries) were included within the database.

To complete the inventory database of submerged cultural resources, ONMS examined archival and secondary sources that were germane to the study area and revised and populated a database template with confirmed, reported, and potential submerged archaeological resources around the islands of Hawai`i, Kaho`olawe, Kaua`i, Lāna`i, Maui, Moloka`i, Ni`ihau, and O`ahu. The database template provided by BOEM was based on the similar BOEM Pacific OCS study database, with some of the internal fields, menus, and combo boxes being modified for specific Hawaiian island circumstances.

The archival and field sources examined included both primary and secondary sources, and focused on primary sources to the greatest extent possible. These sources included:

- State Historic Preservation Division Library in Kapolei;
- Bishop Museum Library and Archives (including insurance company records of the Dillingham Collection);
- State of Hawai`i public library and archives division;
- Hawai`i Maritime Center manuscripts and library inventory;
- University of Hawai`i library system;
- National Archives and Records Administration (San Bruno CA, Washington DC and College Park MD);
- Public and private libraries and collections (Thrum's Hawaiian Almanac, Richard Roger's database collection, Bob Krauss Memorial Shipwreck Article Database, Bob Lewis aviation list, Craig Fuller aviation list; local recreational and technical diver data);
- Historic newspapers (*Pacific Commercial Advertiser*, *Honolulu Star Bulletin*, *The Friend, Polynesian Paradise*);
- Historic maps and navigation charts (University of Hawai`i Manoa Government Documents section historic maps, NOAA Office of Coast Survey Historical Maps and Chart Collection);

- Archaeological site reports (University of Hawai`i Manoa Marine Option Program reports, Hawai`i Undersea Research Lab (HURL) database, NOAA ONMS Pacific Islands Region internal database);
- Department of Defense navy shipwreck and aircraft database (Naval History & Heritage Command) and legacy report *US Navy Shipwrecks in Hawaiian Waters: an Inventory of Submerged Naval Properties* (Van Tilburg 2003).
- Department of Homeland Security United States Coast Guard records;
- State of Hawai`i database of obstructions (Hawai`i Department of Aquatic Resources artificial reef program);
- US Army Corps of Engineers Honolulu District); State Division of Boating and Ocean Recreation Harbors Division;
- NOAA Resources and Undersea Threats (RUST), Abandoned Vessels Program, MHP internal database for Pacific Islands Region;
- Archaeological survey data from: National Park Service (NPS), HURL, University of Hawai`i Marine Option Program (UH MOP), NOAA MHP and Office of Exploration and Research (OER), including the Pearl Harbor Deepwater Inventory 2005; and
- Online sources (International Registry of Sunken Ships, Northern Mariner Research shipwrecks database 2002, Papakilo Database, Google Earth, Automated Wreck and Obstruction Information System, Electronic Navigation Charts, Hawai`i State wreck inventory).

2.8.1. Accuracy of Information

Accuracy of positions is one of the most challenging obstacles to submerged resource management. Data for the location of resource sites is therefore broken down and categorized as:

1) *confirmed*—resource is verified as located and confirmed/recorded by standard differential Global Positioning System (DGPS) coordinates (datum WGS84 unless otherwise stated); 404 entries or 19% of the inventory;

2) *good*—resource is not confirmed or actually located, but the location is reported to nearest actual minute of latitude and longitude, or reported within a specific offshore lease block, or previously recorded using the former Long Range Navigation (LORAN) system. Resource sites located with moderate to good accuracy could be discovered with a moderate amount of field survey with remote sensing equipment, plus some additional historical research; 134 entries or 6% of the inventory;

3) *fair*—resource reported location is only general, to nearest degree of latitude or longitude, or only reported in reference to a nearby landmark, as in “"8 miles southwest of Upolu Point." Discovery of these resources would be very difficult, requiring considerable time and effort in archival and field investigation; 179 entries or 8% of the inventory;

4) *poor*—resource location is unreliable or very vague, or without any directional component, as in "30 miles off Sand Island" or "between Kaua`i and O`ahu." Vessels listed as adrift without further information as to when or if they sank also fall into this category. Defining survey areas for locating these types of vessels is nearly impossible; 280 entries or 13% of the inventory.

(The remainder of the inventory is made up of entries without position estimates—see 2.9.2. Graphic Representations of Positions below.)

2.9. The Database

The initial template for the project's database was provided by BOEM's 2013 Pacific Coast OCS study *Inventory and Analysis of Coastal and Submerged Archaeological Site Occurrence on the Pacific Outer Continental Shelf* (OCS Study BOEM 2013-0115), with appropriate field additions, subtractions and modifications to conform to the Hawaiian island setting. All of the entries in the database originate in a documented report of resource crash, wreck or loss, or discovery and/or survey of the submerged site.

In total, there are 123 unique data fields within the database, plus categories for: vessel photographs/sketches, diver/Autonomous Underwater Vehicle (AUV)/Remotely Operated Vehicle (ROV) photographs, magnetometer contour images, multibeam bathymetry images, sonar images, and sub-bottom profiler images. (See supplemental document "Maritime Resource Database User Guide" included with the database.) Types of data include (selected excerpt):

- Vessel identification
- Vessel history
- Vessel construction
- Wreck event information
- Site location information
- Archaeological documentation and publication
- Information and outside database sources
- Vessel and/or wreck images
- Site plan, side scan, multibeam and/or magnetometer imagery

2.9.1. Arrangement of Data

The database provides multiple tools and formats for viewing content. The Vessel Form View divides wreck information into five separate form pages: vessel information, spatial information, vessel description, wreck site information, and documentation. Comments under the vessel description page include transcribed journal articles, summarized newspaper features, citations, and more. The Image Form View includes six separate pages for vessel photographs/sketches, diver AUV/ROV photographs, magnetometer data, multibeam data, sonar images, and sub-bottom profiler images. A unique SCR Record Number (RN) provides the specific identification for tracking each of the 2,120 entries. Vessel Form data and Image Form data may also be

viewed in table (Excel) format. Content in the database may be imported to Access and exported to/from many other formats including Excel, Outlook, ASCII, dBase, Paradox, FoxPro, SQL Server and Oracle.

2.9.2. Graphic Representation of Positions

Entries in the database are represented within the Geographical Information System (GIS) product. This map (Figure 2) is a powerful tool for understanding the geographic scope of submerged historic properties and other cultural resources, yet representing estimated (unconfirmed) locations for reported but unlocated sites has always been problematic because estimates are of varying accuracy. In order to address this issue, the GIS map is constructed with several specific layers of data. Green positions correspond to confirmed/located sites (*confirmed* location accuracy); yellow positions correspond to resources not confirmed/located, but ones that could be discovered with a moderate amount of survey (*good* location accuracy); orange positions correspond to resources which have only general location information, where discovery would be very difficult (*fair* location accuracy); and red positions correspond to resources which have only unreliable or very vague position information, where even defining search survey areas would be almost impossible (*poor* location accuracy). Note: the red/vague category still provides enough spatial information for a very rough estimated latitude/longitude. Each of these four categories/layers may be switched on or off in order to portray the range of accuracy in resource locations from confirmed to estimated.

Only a subset of the inventory has been represented on the map, as many do not even qualify under the red/vague category. Only a handful of the more than 750 surface vessels and submarines reported and/or confirmed lost in the Hawaiian Islands have insufficient spatial data to allow for even an estimate of position to be graphically plotted. But, of the 1,375 naval aircraft related entries in the database, 1,115 (81%) are listed simply as lost in "Hawaiian waters" without any more specificity. This is due to both the lack of detail in the original documentation and inconsistencies in completing the naval aircraft crash forms. Many of these aircraft were lost during training flights from the decks of World War II aircraft carriers operating at sea in Hawaiian waters, far beyond the vicinity of island landmarks for easy orientation. Graphically, then, aircraft are far underrepresented in the final GIS product. Of the 2,120 entries in the database, these 1,115 "unmapped" aircraft represent approximately 53%. Therefore, it is important to understand that the GIS map, while potentially revealing distribution patterns of submerged cultural resources of various types, does not graphically represent the entirety of the known or reported inventory. It is also important to understand that most of the marine space around the Hawaiian Islands has *not* been surveyed in a systematic manner for submerged cultural resources; the majority of confirmed data for located sites comes from the handful of archaeological projects, combined with voluntary reports from recreational divers and others. The graphic representation of sites can often be misleading; the map therefore is a powerful but limited tool, and its limitations need to be understood for the proper interpretation of distribution patterns.

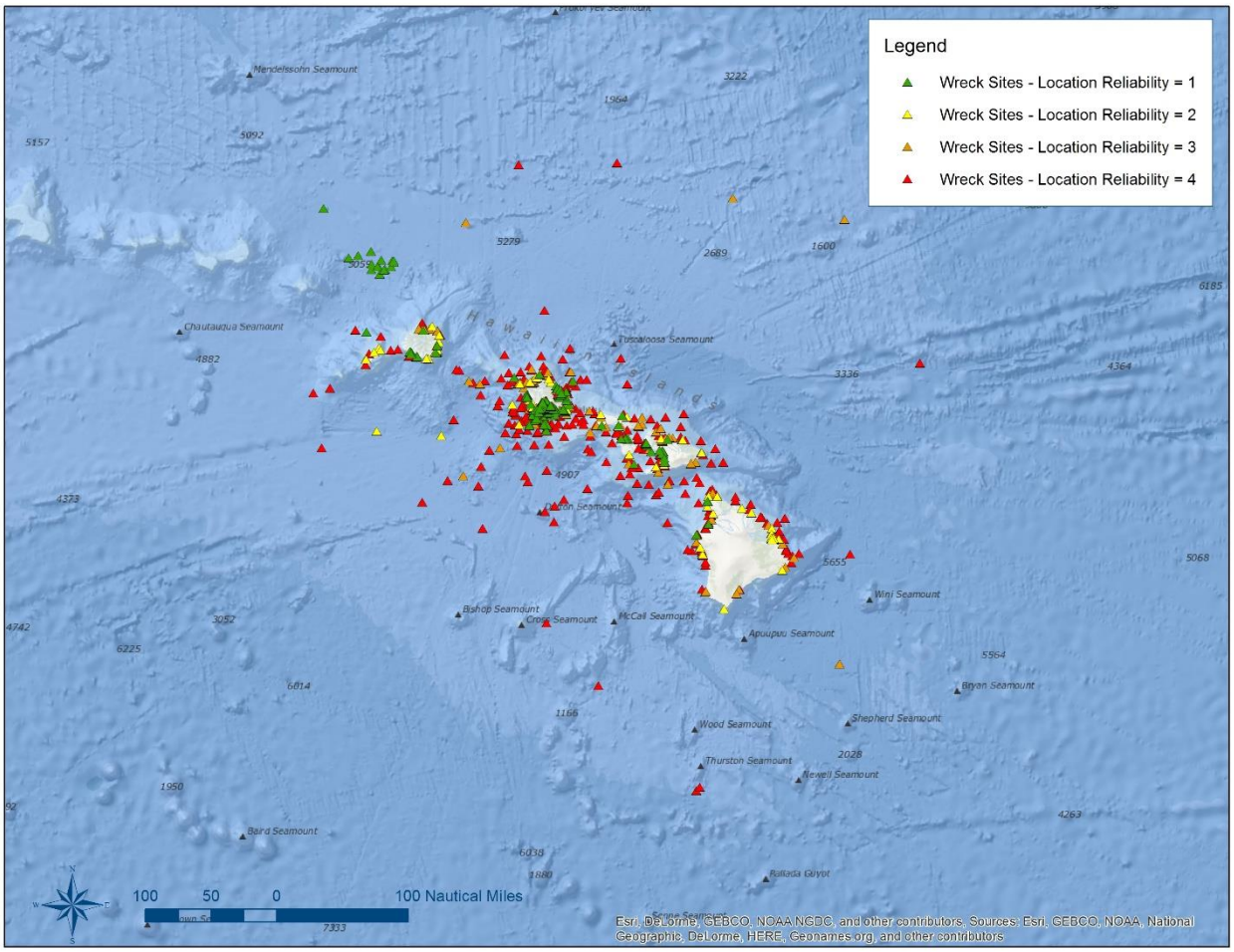

Figure 2: Graphic overview of wreck sites in the main Hawaiian Islands, including location categories 1-4. Not shown: 1,115 aircraft positions (category = 4) simply identified as lost in "Hawaiian waters." (NOAA ONMS)

3. Description of the Marine Environment

3.1. The Pacific Ocean

The Pacific Ocean, spanning nearly 165 million km^2 (64 million mi^2), is the world's largest body of water covering a third of the planet, larger than all the world's land masses combined. It is twice as large as the Atlantic Ocean. The Pacific is defined not only by its waters, which are the planet's deepest, but also by its dynamic shores and islands, many of which were either created or shaped by volcanic forces. The Pacific Rim is also known as the Ring of Fire. It is lined by volcanoes, through which the molten heart of the planet seeps past the ragged edges of the plates that form the earth's crust. It was that tectonic action that created the Pacific as the modern continents began to form some 750 million years ago, and that activity continues as the movement of the Pacific plate shifts and its edges push beneath its neighboring plates.

The vastness of the Pacific is hemmed by the land masses of the Americas and Asia to the east and west, respectively. To the south, the major islands of Indonesia and Papua New Guinea, then Australia and New Zealand form a partial southern barrier. Then, spread across the ocean, are the islands of Micronesia, Melanesia, and Polynesia. There are more islands in the Pacific than anywhere else on earth, in all, some 25,000. Some of these islands, like those of Hawai`i, are the tops of emergent volcanic islands. They are still active, and as the Pacific Plate slowly drifts over this "hot spot" exuding from the planet's mantle, these islands continue to be formed. Others are dormant or dead volcanoes, fringed by coral reefs that top the rims of drowned craters. Such island groups are known as atolls.

The ocean moves around the Pacific's northern hemisphere in a clockwise manner. In the southern hemisphere, the ocean moves counter clockwise. These are the major currents, but there are many lesser and yet important currents that move water not only across distances but up from the depths. On the eastern edge of the ocean – the west coast of North America – one of these is the North Equatorial Current. As it moves past the Philippines, it bends toward Japan, and becomes the Kurushio, or the North Pacific Current, a powerful conveyer belt of water that crosses the Pacific. Off the Aleutians, it forks, separating into the Kamchatka Current, moving into the Arctic's Bering Sea and sweeping southeast past Alaska and British Columbia. A separate current, appropriately named the Alaska Current, circles the Gulf of Alaska and passes Vancouver Island, before looping north. These northerly, looping currents form the Subpolar Gyre.

The North Equatorial's southern movement past these frigid shores and its regional currents carries cold water from them down along the west coast of North America. Known as the California Current, this cold water sinks and then collides with the narrow continental shelf as it passes the coast and then swings at the Equator, warming to rejoin the North Equatorial as it moves to the Philippines to begin its cycle again. This regular circling of the North Pacific forms another vast gyre. Below the North Equatorial is the South Equatorial Current, separated by an Equatorial Countercurrent that flows along the Equator. The South Equatorial pushes east toward the west coast of South America, swinging along it to form the Peru (sometimes called the Humboldt Current). Those warmer waters merge with the colder ones of the Antarctic Circumpolar Current and then swing along the east coast of Australia to rejoin the equatorial and start the cycle again of the South Pacific Gyre.

3.2. The Hawaiian Archipelago

The entire Hawaiian Archipelago consists of eight main islands plus more than 120 rocks, reefs, atolls, shoals, and submerged seamounts, which stretch for over 2,900 km (1,800 mi) from the island of Hawai`i in the southeast to Kure Atoll in the northwest. The main eight islands inhabit a distinct group to the southeast, while the long chain of atolls and low islands extend to the northwest. The archipelago itself extends from 18 degrees, 55 minutes north to 28 degrees, 25 minutes north and from 154 degrees, 49 minutes west to 178 degrees, 20 minutes west, straddling the Tropic of Cancer. The main Hawaiian Islands group are located approximately 3,860 km (2,400 mi) from the North American west coast and 6,100 km (3,800 mi) from Japan.

The Hawaiian Islands, the most physically isolated group of islands on Earth, feature a very dynamic land and ocean environment. Understanding this environment is crucial for understanding shipwrecks and in interpreting artifact preservation and site formation factors for the many submerged cultural resources among the islands. Specific environmental conditions sometimes vary between discrete locations among the islands themselves, so this section presents a generalized description of environmental influences on submerged cultural resource sites.

3.3. Geologic Background

The Hawaiian Islands are wholly volcanic in origin. The whole chain of submerged and emergent volcanic mountain peaks extends east-southeast and west-northwest in the northern Pacific Ocean. The islands were all formed by the geologic movement of the Pacific lithospheric plate over a stable volcanic "hot spot" or plume of deep mantle material, the plate moving slowly to the north, then to the northwest. The extrusion of magma through the hot spot formed subsea volcanoes, which gradually emerged from the surface of the ocean. The line of the older submerged seamounts (former islands) to younger emergent islands extends from the Kurile trench near Kamchatka to Lō`ihi southwest of the Island of Hawai`i (Figure 3).

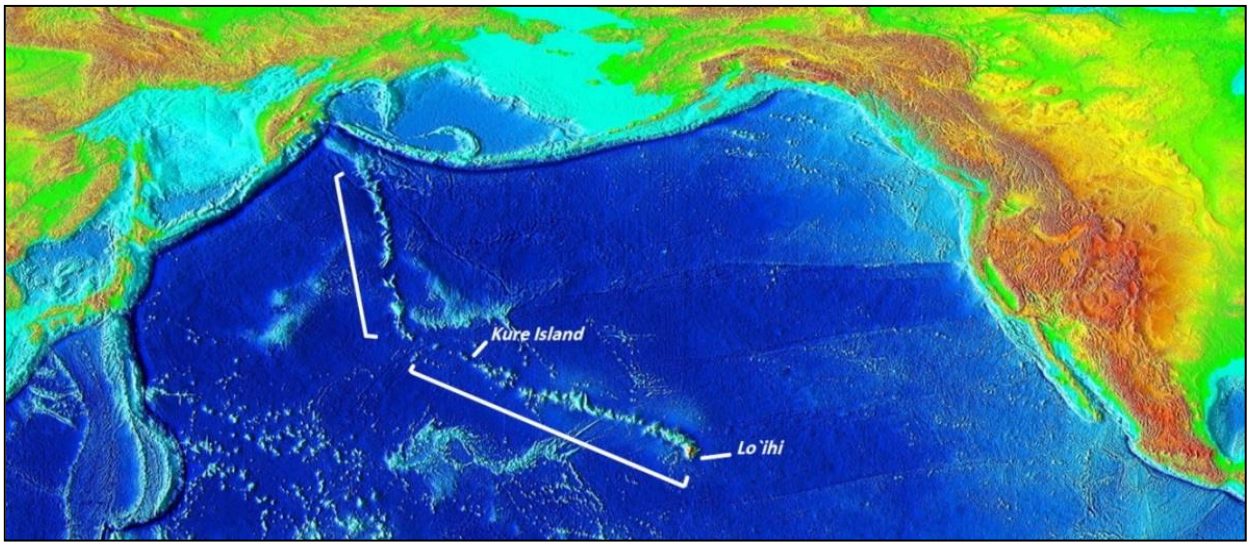

Figure 3: The trail of underwater mountains created as the Pacific plate moves across the hotspot over millions of years, north and subsequently northwest. (National Geophysical Data Center/USGS 2000)

Kure Island at the extreme western end of the emergent chain is approximately 30 million years old. It is an atoll; its volcanic core has eroded beneath the waves, leaving only a ring of corals and coralline substrate. Currently the recent point of magma generation, or hot spot, is located at the opposite end of the emergent islands, to the southeast of the island of Hawai`i. The slowly rising seamount is known as Lō`ihi. The island of Hawai`i is still the site of active volcanism.

The rocks created by the volcanic eruptions among the Hawaiian Islands are basalts, rich in magnesium and iron and poor in alkalies. Many contain visible crystals of green olivine. Later stage lava flows consist of alkalic basalts, rocks containing more alkalies and less magnesium and iron than earlier flows. Sedimentary deposition plays only a small role in island formation. Sedimentary rocks like sandstone only exist in an occasional narrow fringe around the borders of the islands (Armstrong 1983). There are two basic types of basalt lava flows in Hawai`i: *pahoehoe* is the solidified rock from a ropey-textured smooth surface magma flow, and *a`a* is the hardened sharp-edged clinker rock formed by the broken edges of the hardening flow. Lava flows remain an active concern on the island of Hawai`i, continuously covering areas of shoreline and creating new land. Unstable projections of lava flows can lead to landslides or mass wasting, and are important geologic processes both above and below the ocean surface. The iron-rich basalts in the Hawaiian Islands can represent an obstacle to magnetometer surveys for submerged cultural resources.

3.3.1. Ocean Plate Tectonics and Isostacy

Two types of lithosphere, the outermost shell of the planet, make up the earth's multiple plates: oceanic lithosphere and the thicker continental lithosphere. The Hawaiian Islands reside wholly on the section of oceanic lithosphere known as the Pacific plate. Understanding the nature of this plate is important in understanding the ocean depths surrounding the islands. The Pacific tectonic plate is to a certain extent flexible, responding to the weight of the tall volcanoes above it by depressing downwards. The depths immediately around the main Hawaiian Islands appear to result from the sinking of the adjacent seafloor, from the downward loading forces of the heavier (taller) volcanoes of the island of Hawai`i (Armstrong 1983; Grigg 2015). This moat, or Hawaiian Deep, averages 4,800-5,500 m (16,000-18,000 ft) in depth. Near to Hawai`i Island, remnant fossil reef substrate has been found at depths of 1,220 m (4,000 ft), though most corals do not grow below 45 m (150 ft). Surrounding the subsidence of the moat, the lithosphere shows an upward or uplifted bulge of about 300 m (1,000 ft). The radius of this Hawaiian Deep surrounded by the uplifted arch extends only part of the way around the islands, reaching outwards from Mauna Kea volcano on Hawai`i Island about 400 km (250 mi). The islands of Lāna`i, Moloka`i and O`ahu, on parts of the arch, show evidence of uplift (exposed coral substrates) as they slowly move to the northwest over this lithospheric bulge (Grigg 2015). The Hawaiian Deep and the surrounding arch are the geologic settings for many submerged historic properties in Hawai`i.

3.3.2. Tsunami Frequency

Many minor earthquakes are associated with volcanic eruptions, but most of these are too small to be felt. Major earthquakes in Hawai`i are associated with faults rather than volcanoes, and fault movement and seafloor shifts can generate large coastal waves or tsunamis (Fletcher et al

2002). The largest Hawaiian earthquake in historic times occurred in April 1868, and the resulting tsunami generated a wave that, reportedly, dwarfed the coconut trees on the south shore of O`ahu. Since 1820, nine tsunamis have caused moderate to severe damage in the islands (Table 1). Most of these were generated by tectonic activity located on the Pacific Rim, thousands of kilometers away from Hawai`i, though two have originated locally. Tsunami events and subsequent ocean movement have the power to impact many submerged resources in the islands.

Table 1: Historic tsunami events in the Hawaiian Islands

Date	Origin	Effects
1868	Hawai`i	Greatest Hawaiian earthquake recorded, destruction to O`ahu south shore
1946	Aleutian Islands	Wave heights at Hilo over 9 m (30 ft), total 159 tsunami related deaths
1952	Kamchatka Peninsula	
1957	Aleutian Islands	
1960	Chile	Wave bore in Hilo Bay causes destruction
1964	Prince William Sound, Alaska	Last major Pacific-wide tsunami
1975	Hawai`i	Earthquake centered near Volcano National Park, deaths and injuries
1996	Peru	
2011	Japan	Fukushima reactor damage; Hawai`i harbor damage

It would be difficult to determine the exact effects that tsunami events can have in specific areas due to the complex nature of wave mechanics in the Hawaiian Islands. Tsunami waves can refract or bend around islands in the "wrap around" effect. They can also reflect off of islands and strike what might be considered sheltered coasts. In any case, they can have a significant impact on coastal communities and resources, both on land and in the sea (Dudley and Lee 1988). Due to the high degree of seismic activity in the Pacific basin, the Hawaiian coastline can be considered to be under continuous tsunami threat (Fletcher et al 2002).

3.4. Geographic Background

3.4.1. Mid-Pacific Island Formation

Pacific islands that originate as submarine mountains, grow in size through volcanic processes, then subside and erode with time can be classified by general stages of island "growth," stages which are regulated by volcanic, erosional, and even biological activity (Morgan 1996). Young, active volcanic islands consist of high, rocky basaltic peaks, with traces of caldera rims and cinder cones. The main Hawaiian Islands are characterized by such landforms, and deeply cut

valleys and steep volcanic cliffs. Middle-aged islands exhibit more extensive coral reef growth around their fringes, while the original core volcano, having shifted away from the active magma hot spot, disappears downwards with time due to isostatic subsidence and erosional forces. As the basalt continues to erode and finally sinks below the surface of the water itself, only the coral ring or atoll may remain, along with low sandy islands.

From young shield volcano to weathering calderas and reefs to true coral reef atolls, Pacific islands move through distinct land forms with age (Gulko 1999). In Hawai`i, the lower older atoll environments are found to the northwest. Higher rocky peaks can be found from Necker and Nihoa Islands south. The Hawaiian Islands exhibit the whole range of characteristics from both high volcanic to low coral atoll formations (Grigg 2015).

3.4.2. Coral Reef Ecosystem and Reef Zones

Geological processes and stages of island "growth" affect the formation and depths of Pacific coral reefs. Reefs move through stages of fringing (adjacent to the island), barrier (separated from the island), and atoll (circular, no island). Most reefs in the main Hawaiian Islands are fringing reefs. Only a few locations, such as Kāne`ohe Bay for example, feature older barrier reef environments. Both corals (invertebrates) and coralline algae are the main builders of the reefs. Coral reef ecosystems thrive within a relatively narrow band of physical parameters, such as turbidity, water temperature, and nutrient load (Gulko 1999). To remain stable, reef ecosystems must balance processes of growth with processes of erosion. On many shallow water sites, corals and coralline algae have overgrown SCR resources (Van Tilburg 1997; 2002; 2014).

Mechanical weathering of rocks forms only a small portion of sand in Hawai`i. The majority of white sands come from the breakdown of coral skeletons, which are composed of calcium carbonate. Surf action accounts for some of this sand, but a surprising amount is actually produced by parrot fish (sp. *Scarus*), which crush corals in their beaks and evacuate the sand elsewhere. Prevailing winds can build localized sand dunes along the coast. Many areas underwater in the near shore environment can be characterized as sand substrate, coral reef substrate, or mixed coral/sand spur and groove topography. In some places geomorphic features like submarine canyons serve to channel detritus to deeper waters. Calcareous sands, mud, and gravel of shallow water origin make up the principal sediments near the islands. Pelagic brown clays dominate over most of the deeper sea floor regions (Armstrong 1983).

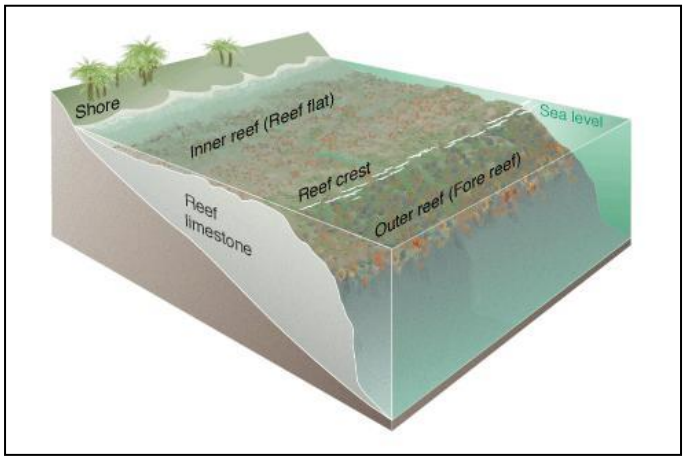

Figure 4: Barrier reef zonation. (Coral Reef 2017)

Islands and oceans "form" coral reef ecosystems, and in turn coral reefs affect their immediate environments. An idealized cross section of the near shore zones (Figure 4) highlights the reef's role in forming seaward barriers and dissipating wave energy. Immediately offshore is the shallow reef flat or bench zone, a wave-swept area dominated by coral cover and reef fish.

Seaward of the reef crest is the reef slope zone, dropping to depths of 20-30 m (65-100 ft). Deeper along this fore reef, below 30 m (100 ft), is a rubble zone, characterized by accumulations of broken coral fragments (beyond optimum coral growth depths).

3.5. Hydrographic Background

3.5.1. General Climate

The Hawaiian Islands are known world-wide for their temperate, comfortable climate. Considering the relative southerly latitude of the islands compared to the continental United States, there is relatively little uncomfortable heat. This cooling is due to the prevailing northeasterly trade winds, which may blow unceasingly for weeks. The prevailing trade winds are a function of a semi-permanent high pressure cell, an anti-cyclonic circulation known as the North Pacific or Hawaiian High (Juvik and Juvik 1998). This high-pressure cell weakens in the winter season and strengthens during the summer (Figures 5 and 6). Northeast trade winds usually blow between 21-39 kilometers/hour or kph (13-24 miles/hour or mph). In near shore locations, diurnal heating and cooling can give rise to onshore breezes during the day and offshore breezes at night.

The climate in Hawai`i is dominated by two seasons: summer between May and October, when the weather is warmer and the prevailing trade winds are more persistent; and winter between October and April, when the weather is cooler, and the prevailing trade winds are more

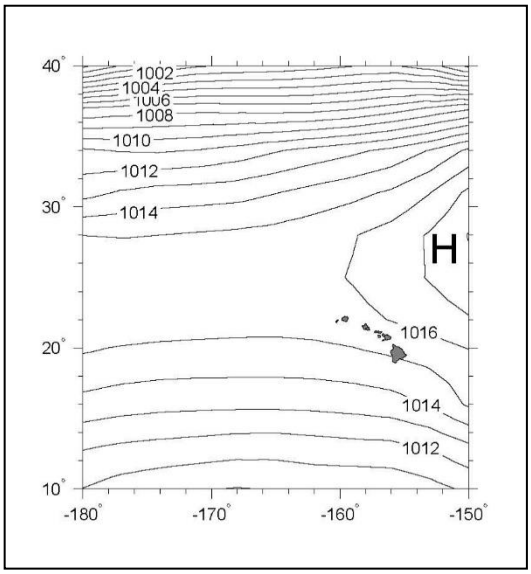

Figure 5: Average surface pressure in the Central Pacific for winter; Units: mbar. (Flament et al 1998)

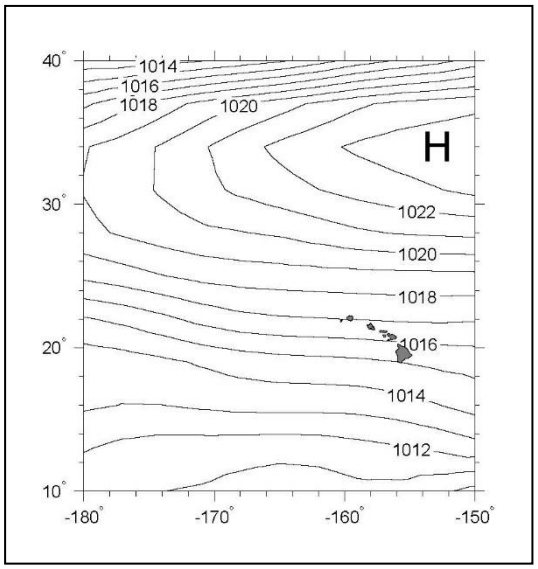

Figure 6: Average surface pressure Central Pacific for summer; Units: mbar. (Flament et al 1998)

interrupted by intervals of cloud and rain. This is mirrored by the movement of the North Pacific High, which shifts northward in the summer and southward in the winter (Flament et al 2017).

North Pacific storms, anti-cyclonic circulation, generally migrate eastwards between 35 and 65 degrees north latitude, the majority of their impact usually missing the Hawaiian Islands. The main islands are subject to strong northern swells in the winter months, and occasional southern swells in the summer. The Northwestern archipelago can also experience severe storms in the winter, impacting SCR resources on exposed shorelines.

3.5.2. Ocean Conditions

The Pacific Ocean is the largest ocean in the world and therefore possesses the greatest amount of fetch or linear ocean surface for the development of waves and swells. The Hawaiian Islands emerge in the middle of the North Pacific as a linear ridge, their shores and near shore environments exposed to powerful swells generated from a great distance, as well as waves generated more locally. Wave erosion in Hawai`i continuously cuts into the edges of the volcanic islands and forms sea cliffs. Sea caves and arches may also form, particularly where there are remnant hollow lava tubes along the coast. There are four basic types and sources for waves in Hawai`i:

- Trade wind waves from the northeast may be present all year. These are largest from late spring until late autumn, with heights from 1-3 m (4-12 ft) and periods from 5-8 seconds;
- North Pacific swells, generated by distant storms, are common in the winter and early spring. These have greater heights at 2.5-4.3 m (8-14 ft) or more and periods of 10-17 seconds. Periods of high surf between October and March can last for several days;
- Kona Storm waves may strike the shores from passing southern storms at any time, with heights of 3-4.5 m (10-15 ft) and periods of 8-10 seconds;
- Southern Swell waves, generated by Antarctic winter storms, have heights only of 0.3-1.2 m (1-4 ft) and longer periods of 14-22 seconds (Armstrong 1983).

Surface ocean currents in Hawai`i, averaging between 20 to 30 cm/s (0.4 to 0.6 knots), are generally driven from east to west by the prevailing easterly trade winds, a portion of the larger North Pacific clockwise circulation of gyre. Ocean current eddies forming to the leeward (west) of the islands, as well as the diurnal mixed tides, can influence the strength and direction of near shore currents, scouring the seafloor around SCR resources (Figure 7). Surface currents, in turn, affect deeper ocean currents, their influence decreasing with depth. Below 1,000 m (3,300 ft), deep ocean currents average generally less than 5 cm/s (0.1 knot), and their patterns are not entirely known (Flament et al 2017).

The average surface ocean temperature around the Hawaiian Islands is 24 Celsius (C) or 75 Fahrenheit (F) in winter and 27 C (81 F) in summer (Figures 8-9). Temperatures decrease with depth, but the current eddies and ocean mixing around the islands generally prevents the formation of a distinct thermocline between surface and deep ocean temperatures (Flament et al 2017). On the west coast of Hawai`i Island, near the Natural Energy Laboratory of Hawai`i, the ocean temperature at 1,000 m (3,000 ft) is approximately 5 C (41 F), closer to the constant near freezing temperatures of the deep ocean (Makai Ocean Engineering 2017).

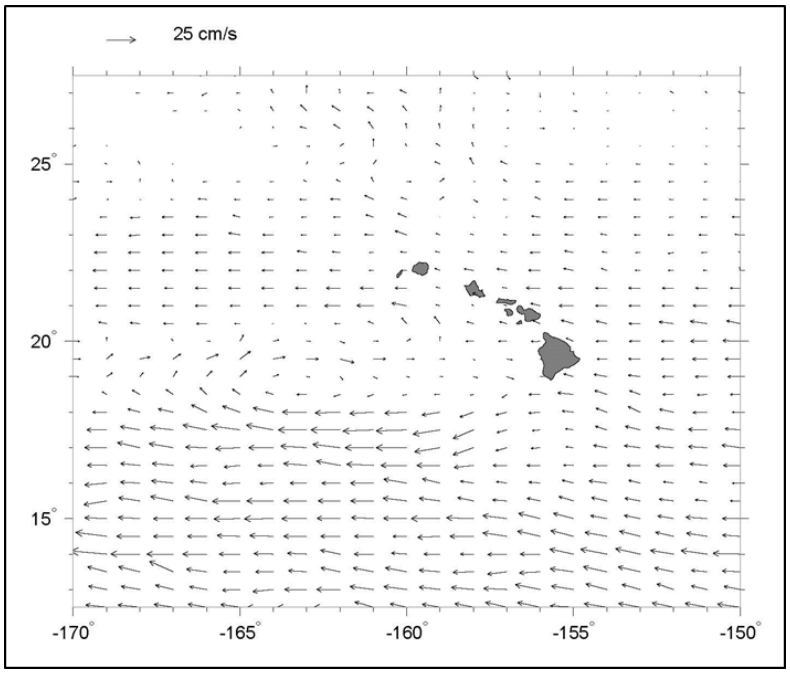

Figure 7: Average surface current flow, National Ocean Data Center, NOAA; units: cm/s (25 cm/s = 0.5 knot). (Flament et al 1998)

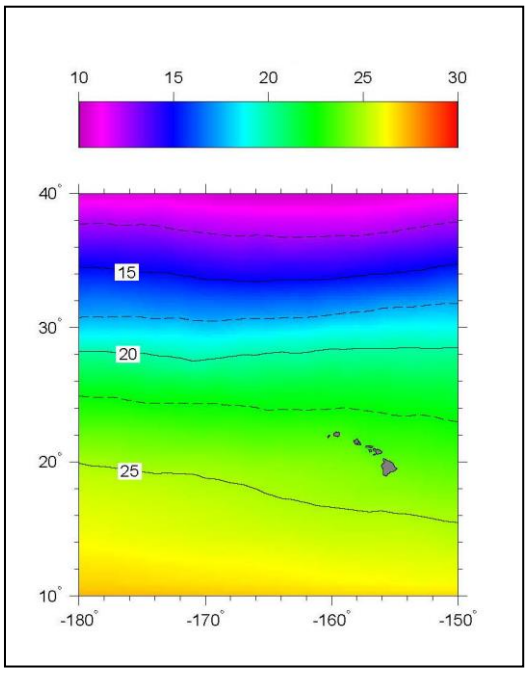

Figure 8: Average surface water temperatures for coolest period (February to April); units: degrees Celsius. (Flament et al 1998)

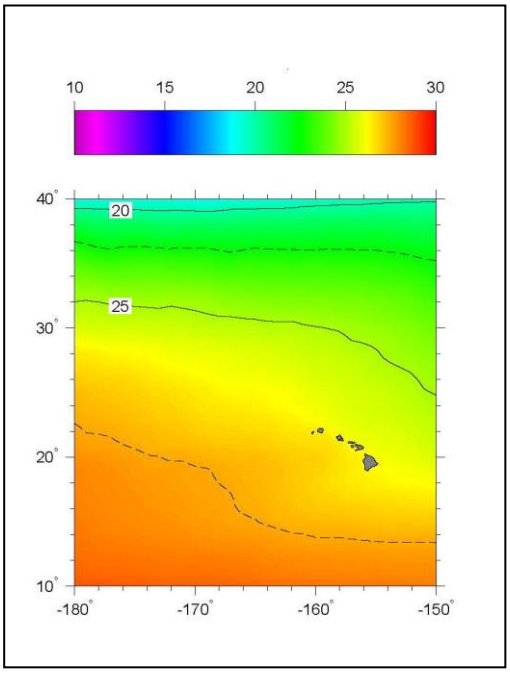

Figure 9: Average surface water temperatures for warmest period (August to October); units: degrees Celsius. (Flament et al 1998)

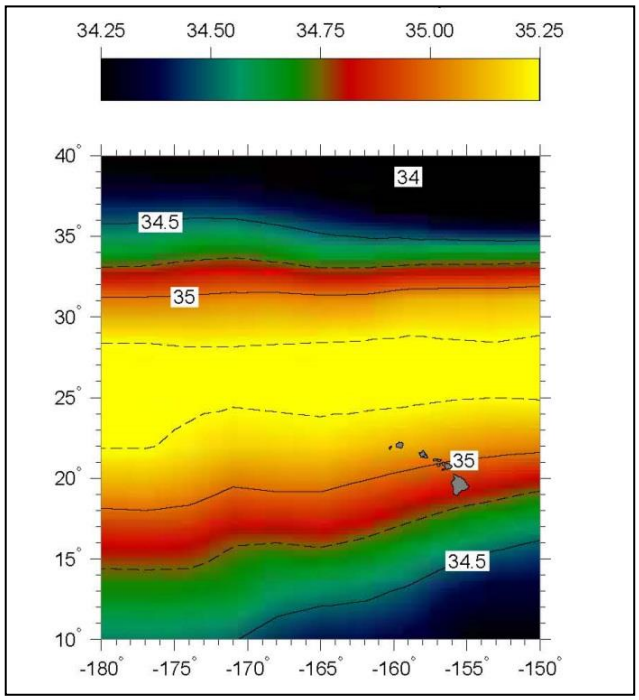

Figure 10: Annual average surface salinity; units: ppt. (Flament et al 1998)

Beneath the mixing zone of the upper surface waters lies the main thermocline or temperature change, which by standard convention consists of the isothermal line of 10 C (50 F) degrees. Thermocline depth in Hawaiian waters varies between 457 m (1,500 ft) in the northwest to 244 m (800 ft) in the southeast of the islands (Juvik and Juvik 1998). Below the thermocline ocean temperatures decrease rapidly to 5C (41 F) degrees at 700 m (2,300 ft), and then more gradually to 2 C (36 F) degrees at extreme depths. Temperature plays an important role in SCR deterioration rates and site formation processes.

Salinity levels are generally higher in equatorial regions where evaporation exceeds precipitation, but they drop off beyond 15 degrees north latitude where there is greater rainfall (Figure 10). In Hawai`i salinity levels generally fall between 34.1 and 35.2 parts-per-thousand (ppt). Oxygen concentrations tend to be relatively low in warm equatorial waters, though are almost always near saturation at the surface levels (Fairbank 1966).

The salinity profile in the Central Pacific ocean near Hawai`i reflects the higher salinity of surface waters, 35.2 ppt to a depth of 150 m (500 ft), due to evaporation; then the intrusion of heavier sinking colder water from the north, bringing with it lower salinity water of 34.1 ppt to a depth of 500 m (1,670 ft). This is followed by a gradual increase in salinity with increasing depth to 34.7 ppt for deep abyssal waters (Flament et al 2017) (Figure 11). Salinity influences conductivity in seawater, therefore affecting the electrochemical deterioration of SCR sites.

The concentrations of nutrients like nitrates and nitrites are relatively small at the surface of Hawaiian waters but increase with depth, reaching 40 micromole/kilogram (µmole/kg) or more at around 700 m (2,300 ft) (Figure 11). This distribution illustrates the lack of vertical mixing forces in the waters of

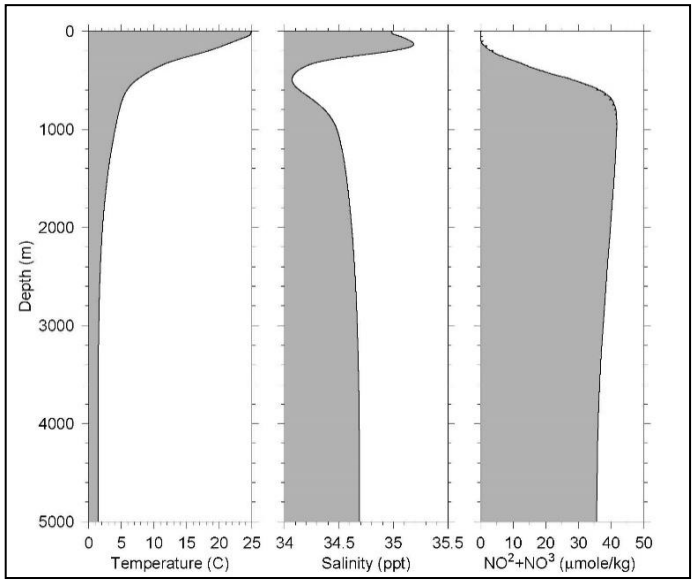

Figure 11: Average vertical distribution of temperature, salinity, and nutrients (nitrate+nitrite) at Ocean Station Aloha; units: degrees Celsius, ppt, and µmole/kg of nutrients. (Flament et al 1998)

the Central Pacific. The sun-lit upper layers of the ocean to 100 m (330 ft) notably lack the nutrients necessary for the abundant growth of phytoplankton, the microalgae which are the base of the marine food chain. These nutrients only begin to accumulate at depths where there is no light to support photosynthesis. Upward mixing forces transporting these nutrients back to the sun-lit upper waters play an important role in the ecosystem. Such upwelling of deep ocean water can occur during powerful winter storms, or hurricanes (Flament et al 1998). Depth and nutrient loads affect biological growth on hard substrates like SCR resources.

3.5.3. Hurricane Frequency

Tropical storm and hurricane season in Hawai`i stretches seasonally from June through October. Waves can reach extreme heights of 3-11 m (10-35 ft) and occur generally on the east, south, and west-facing coastlines, though occasionally north-facing shores are impacted (Fletcher et al 2002). The long-term frequency for hurricane events is not clear; they appear to be quite variable. Prior to 1950, tropical storms were not called hurricanes at all but tropical cyclones. The advent of meteorological satellites, though, has revealed that hurricanes in the central Pacific are more frequent than previously expected. Documentation has only increased in recent decades.

Most hurricanes originate in the Pacific waters off the Central American Coast or those of Southern Mexico. They generally approach the Hawaiian Islands from the east and from the south, gradually losing power as they track over cooler waters (Schroeder 1993). Most pass far to the south of the islands, but since 1950 there have been five major hurricanes that have caused significant damage directly to the islands of the state (Table 2). Hurricanes can generate powerful and sustained swells and water movement, impacting SCR resources in many ways.

Table 2: Most powerful Pacific hurricanes affecting Hawai`i since 1950 (Schroeder 1993)

Date	Name	Track and Notes
1957	Nina	Moving northwest, to the south of the island chain, record winds in Honolulu; estimated $1M in damages
1959	Dot	Northwest, north, northwest, directly over Kaua`i; $6M property damage
1982	Iwa	Moving to the northeast, crossing Kaua`i, $250M property damage on Kaua`i and O`ahu
1986	Estelle	Westward, passing to the south, floods on O`ahu; $2M in damage
1992	Iniki	Westward then north, directly over Kaua`i; by far the most devastating event, causing over $2.2B in damages

3.5.4. Sea Level Changes

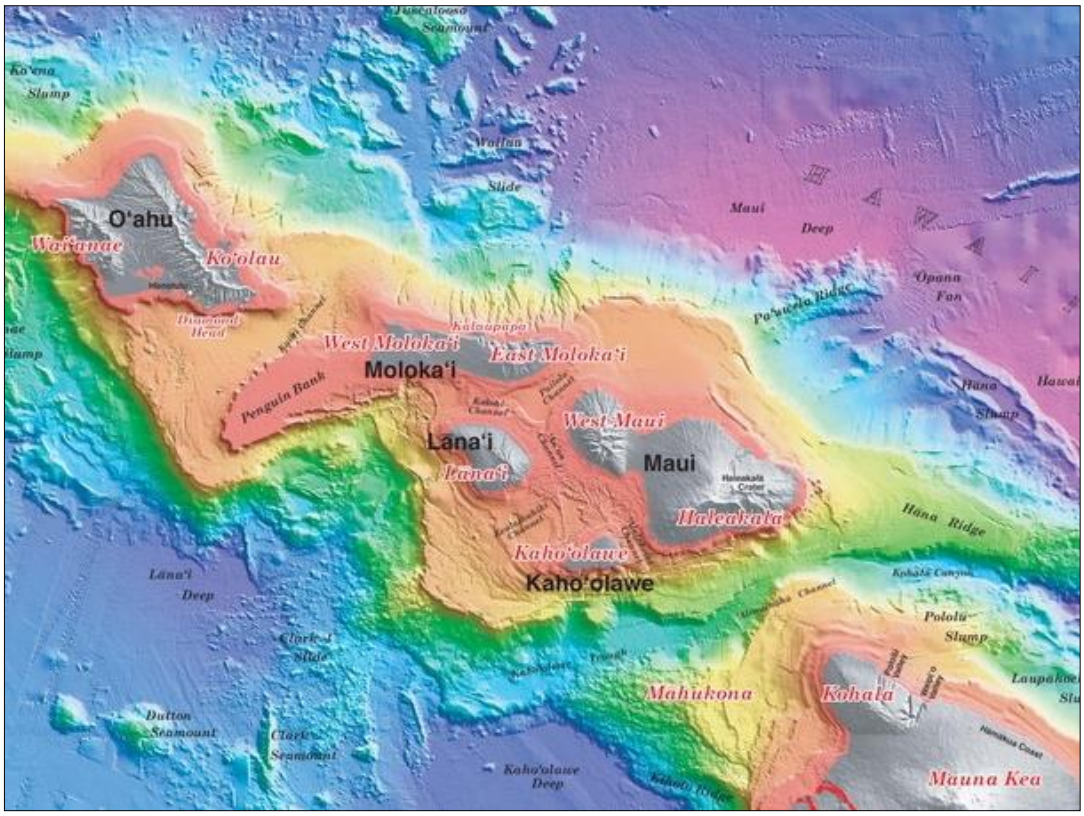

Figure 12: Excerpt of bathymetry image of the Hawaiian Islands, showing the Maui Nui now-submerged land shelf. (USGS 2017a)

Like many places in the world, land that is now submerged around the islands of Hawai`i was exposed during the Last Glacial Maximum of the late Pleistocene epoch. The best estimate for sea stand during the glacial maximum around the islands is that ocean levels relative to the islands dropped to between 113 and 135 m (370 and 442 ft) below their current level (Clark et al., 2001) during the Last Glacial Maximum some 19,000 years Before Current Era (BCE). Certain geomorphic features, like wave-cut terraces and eroded valleys, have thus been inundated and now characterize the near shore bathymetry. Maui Nui ("Greater Maui") is the geologic term for the single-island land mass during the glacial maximum, emergent now as the separate islands of Maui, Moloka`i, Lāna`i, and Kaho`olawe (Figure 12).

The main Hawaiian Islands today are surrounded by submerged shelves, which were cut by wave erosion during these lowered sea-level stands (Grigg 2015). Near shore submarine canyons are best developed north of Moloka`i, northeast of O`ahu, and northwest of Maui. There is some variation in the depths of these features due to the isostatic effect of Hawai`i Island and the movement of the islands over the Hawaiian deep and lithospheric bulge (Armstrong 1983; Grigg 2015).

Following the glaciation periods of the Pleistocene, the Holocene spans from 9,700 BCE to the present. This warming period encompasses the development of major human civilizations, and the transition to urban lifestyle. Relative sea level is believed to have risen rapidly from this low

stand in the late Pleistocene to its present level around 5,000 years Before Present (BP) during the mid-Holocene. In fact, due to the warming periods of the subsequent Holocene, sea level continued to rise to about 2 m (6 ft) above current-day levels for a period, as evidenced by deposits of unconsolidated carbonate sands and cobbles above the shorelines around the islands. This Holocene highstand occurred around 3,000 years ago before dropping back down to the present level (Grossman and Fletcher 1998).

In summary, the seafloor surrounding the main Hawaiian Islands has been shaped by a sequence of powerful long-term forces. Initially, volcanism created the high islands over the Pacific hotspot. Isostacy, through the sheer weight of the large volcanoes, depressed the Pacific plate creating the Hawaiian deep and surrounding bulge. Mass slumping and catastrophic landslides reshaped shorelines. Living coral reefs created carbonate substrate (Figure 13). Changing sea levels left wave-cut terraces, submerged valleys, and remnant deep fossil reefs. Through time, erosion and biological activity produced calcareous and siliceous materials to be deposited as deep ocean sediments. This is the geologic setting for SCR among the islands.

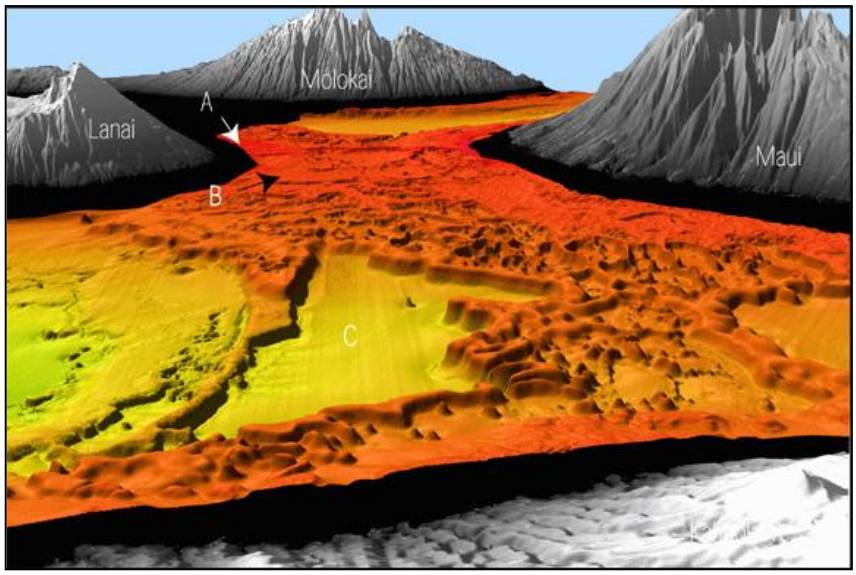

Figure 13: Exaggerated oblique seafloor view between Moloka`i, Lāna`i, and Maui. The sparse red regions are the living reefs in depths of less than 40 m (130 ft); dark orange areas are drown reef platforms and pinnacles in depths between 50 and 85 m (165 and 280 ft). (USGS 2017b)

3.5.5. Implications for Early Hawaiian Sites

Lapita migration theory (below) proposes rough dates of the spread of island voyagers and colonists to areas of the Pacific, but the more specific dates of the settlement of the Hawaiian Islands has been a matter of contention for a number of years. Currently, archaeological evidence based on a summary of fieldwork and the refinement of past radiocarbon dates suggests that the initial Polynesian discovery and colonization of the Hawaiian Islands occurred between approximately 1,000 and 1,200 Current Era (CE) (Kirch 2011).

Previous research suggested earlier dates for the discovery and settlement of the islands, in the timeframe of 300-800 CE, hundreds of years earlier than this (Jennings 1979; Kirch 1985). Other more recent research places the discovery of Hawai`i even later, sometime between 1,190-1,290 CE (Wilmshurst et al 2011). Settlement dates are still the subject of active debate and

scholarly research. This range of possibility, though, does not change the implication of sea level on the geography of settlement of the islands.

Combining these relatively late dates of discovery and settlement for all of the above estimates (compared to many other locations) with the known history of sea level change in the Hawaiian Islands, reveals that there is very little chance for the discovery of submerged habitation sites in near-shore waters, not to mention the 5-320 km (3-200 mi) OCS zone, in Hawai`i. Long before the arrival of the first Polynesians in these islands, relative sea levels were close to what they are today. Possible submerged cultural resources in Hawai`i are, therefore, not habitation sites, but the cultural footprints of coastal gatherers, aquaculture sites, warriors, fishermen and seafarers.

3.6. Site Formation Processes and Hawaii's Environment

From their original discovery and settlement by voyaging Polynesians, to their importance in the sandalwood and whaling trades, to the more recent remains left behind by World War II in the Pacific, the Hawaiian Island chain has accumulated a material record of perhaps 1,000 years of maritime activity. Much has of course decayed, turned into reef through biological processes, floated away, or been destroyed. The remaining submerged material record, however, testifies to Hawaii's uniquely diverse maritime traditions.

Hawaii's dynamic marine environment has important consequences for submerged archaeological site formation processes. Understanding these processes is essential for the discovery, assessment, and interpretation of submerged resources. Kieth Muckelroy, generally regarded as a pioneer in maritime archaeology, included a detailed analysis of site formation processes in his 1978 *Maritime Archaeology*. Although Muckelroy's concepts were developed in the British Isles, his list of attributes that shape the nature of submerged archaeological sites highlights the need to carefully consider Hawaii's marine environment in archaeological interpretation (Table 3).

Table 3: Muckelroy's environmental attributes for site formation processes in the British Isles (Muckelroy 1978)

Step	Environmental Attribute
1	Maximum offshore fetch within 30 degrees perpendicular to the coast
2	Sea horizon from the site (i.e. sectors with more than 10 km/6.2 mi open water)
3	Percentage of hours with winds in excess of force 7 (near gale 51-61 kph/28-33 knots)
4	Maximum speed of tidal streams across site
5	Minimum depth of site
6	Maximum depth of site
7	Depth of principal deposit on site
8	Average slope of seabed over whole site
9	Underwater topography (proportion of site with geologically recent deposits
10	Nature of coarsest material in these deposits
11	Nature of finest material within these deposits

These environmental influences over time can have a marked effect on the nature and appearance of the submerged archaeological site, as can anthropomorphic impacts like wreck salvage or looting. Muckelroy conceived of these natural and cultural influences as distinct processes impacting the original property (ship) in distinct phases, during which material could be removed ("filtered"), redistributed ("scrambled"), or even deposited on site (Table 4). Understanding the marine environment and selected processes and impacts influencing SCR sites in the Hawaiian Islands over time is essential to archaeological interpretation.

Table 4: The phased evolution of a shipwreck site (Muckelroy 1978)

Process/stage	Impact	Notes
Original vessel		
Wrecking event	Selected material floats away	Reorganization of original structure, a scrambling and extraction filter
Salvage operations	Selected material removed	Anthropomorphic impacts, a material extraction filter
Disintegration	Selected material removed	Mechanical/chemical/biological deterioration, a material extraction filter
Sea bed movement	Site features and artifacts moved	Redistribution of artifacts, a material scrambler; can include deposition of material, can reintroduce salvage, disintegration
Excavation	Site features and artifacts uncovered	Can reintroduce salvage, disintegration
Observed site		

3.6.1. Wrecking Processes

There are many reasons that vessels are lost in island waters: intentional deposition (scuttling or target exercises), collision, grounding, storms, etc. Vessel losses can sometimes be gentle in nature, such as ships sinking at their moorings and settling directly to the bottom. Losses can also be extremely violent events, such as wooden vessels grounding in the surf and being broken apart on sharp coral reefs. In any event, what was once a highly ordered and intact object will be damaged and redistributed, and buoyant materials will float away. In Muckelroy's terminology, the wrecking event can be both a scrambling filter and an extraction filter (Muckelroy 1978).

Possible wrecking process patterns are discernable in certain Hawaiian coastal environments. Archaeologists have conducted site surveys of half-a-dozen wooden-hulled sailing vessels in the remote atolls of the Papahānaumokuākea Marine National Monument, noting similarities in distribution. In most cases, distribution of site features amidst the spur-and-groove coral reef topography of the atolls suggests that the ships ran aground bow first, dropping their heavy ballast as the wooden hulls were torn apart. To seaward, the vessel's stern and rudderpost pounded in the swells, often unshipping the rudder itself. All lighter elements of topside structures, mast and rigging components, were quickly carried over the near shore reef and into the calmer waters of the interior lagoon (Van Tilburg 2007a; O'Regan et. al. 2008).

Interpretation of the historic record of lost vessels shows that grounding near landings and historic channel entrances is a large contributor to the submerged resource. Many near shore locations in Hawai`i feature a high-energy marine surf environment, capable of breaking apart wooden vessels, and eventually destroying iron and steel-constructed boats and ships as well. The volcanic shorelines and exposed coasts of the islands do not feature many naturally protected bays or harbors. These conditions, combined with the fringing or barrier reefs and sharp submerged lava rocks in near shore waters, have led to a great number of shipwrecks in Hawai`i. An initial examination of the reported positions of shipwrecks reveals clusters around the locations of historic landings, especially on the windward or eastern sides of islands where vessels needed to maneuver upwind out of harbors through narrow reef passages (Van Tilburg 1999).

Prevailing winds, narrow channels, shallow reefs, and island orientations can also combine to form ship traps, areas of naturally occurring concentrations of shipwrecks (Gould 2000). The north shore of the island of Lāna`i, locally referred to as Shipwreck Beach, is the best example of this phenomenon. Trade winds can push all flotsam and jetsam into the Pailolo channel between Moloka`i and Maui. The gap between islands acts as a wind funnel, intensifying gusts and depositing material directly onto Shipwreck Beach (Van Tilburg 2001). Any vessel that broke its moorings at Lahaina would end up on Lānai's reefs, and ship owners (possibly including the US Navy) intentionally abandoned old vessels there by simply casting them adrift upwind from this treacherous shore.

Steel vessels lost in deeper waters are likely to exhibit greater integrity than those in shallow-water sites. Observations of deep water wreck sites reveal, however, greater incidence of implosion of sealed compartments, debris scatter from the wreck descent, and impact damage from bottom contact itself, including scarring of the seafloor.

3.6.2. Chemical Deterioration

As in many of the world's oceans, the chemical or electrochemical weathering or deterioration of shipwrecks in Hawai`i expresses itself mainly in the corrosion of iron and steel in the marine environment. In general, when iron is combined with water and oxygen, ferrous oxy-hydroxide or rust is produced (Rodgers 2004). This process can be exacerbated by dissimilar metals in contact with each other, causing galvanic corrosion. Indirect estimates of deterioration rates can be made by measurements of conductivity on the surface of submerged features (Figure 14).

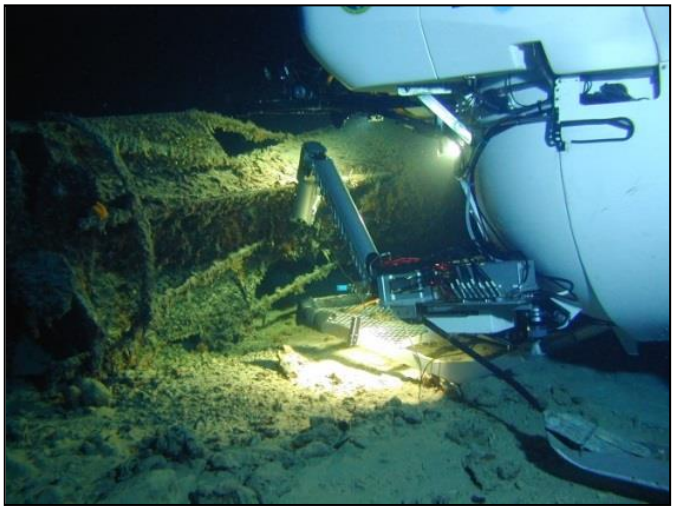

Figure 14: HURL Pisces IV measuring conductivity through the corrosion surface of the Japanese midget sub (RN740). (HURL/NOAA ONMS 2005)

Figure 15: Encrustation and coral growth over the double-expansion steam engine of the SS *Kaua`i* (RN375), lost in 1913. (NOAA ONMS)

Additionally, the chlorides and calcium carbonate present in seawater can combine with corrosion products to form a concretion layer on the surface of the iron or steel object. In this process, iron ions move away from the surface of the metal and chlorides move towards it. When combined with the deposition of calcium carbonate material, a solid encrustation can form around the artifact or feature (Figure 15). Over time complete encrustation of a metal object can lead to anaerobic conditions developing within the encrustation shell. That may initially slow deterioration rates, but not prevent all deterioration; sulphate reducing and methanogenic bacteria can colonize the anaerobic encrustation, ultimately weathering the iron into a black liquid (Rodgers 2004). Dr. Colin Pearson's *Conservation of Marine Archaeological Objects* (1987) provides a suitable reference for these critical processes for both shallow water and deep-water wrecks in Hawai`i.

There is no large database for corrosion rates of deep ocean wreck sites in Hawai`i, and the environmental parameters at each wreck location may slightly differ in significant ways. However, the National Park Service's Submerged Resources Center, in partnership with other agencies, has developed a low-impact model for measuring *in situ* corrosion rates (Russel et al 2006). This model has been successfully tested on the USS *Arizona* (RN274) at Pearl Harbor, and also transferred and applied to the Japanese midget sub (RN740) sunk outside the harbor on December 7th, 1941. During the 2005 research dives, several small samples of marine concretion were recovered for analysis in the metallurgical and chemistry laboratories at the University of Nebraska–Lincoln, and X-ray diffraction measurements were subsequently conducted at the Air Force Research Laboratory at Eglin Air Force Base, Florida. Preliminary results suggest a corrosion rate of 0.05 mm per year, equivalent to a metal thickness loss of 0.9 mm (0.035 in) over a 60-year period (Wilson et.al. 2007). The midget sub's original hull material consisted of 8mm (0.3 in) cold rolled MS44 steel plate. It must be stressed that this does not provide a general corrosion model for all wrecks, but demonstrates the possibility of gaining a specific understanding of corrosion rates at selected sites.

3.6.3. Biological Impacts

In Hawai`i, biological impacts play an important role in site formation processes. Besides the numerous microorganisms that ingest and thrive on organic substances in the marine environment, the warm water temperatures allow the shipworm, *Teredo navalis*, to burrow destructively into the wood of historic shipwrecks. This shipworm is able to reproduce in waters having a range of salinity from 5 to 35 ppt, and temperature from 11 C (52 F) to 25 C (77 F), well within the ranges of near shore waters in the Hawai`i (Smithsonian Marine Station 2017).

Therefore, most wreck sites in the islands consist of non-wooden remains, with planks and other wooden components only occurring occasionally when buried in sediments or anaerobic muds in protected back reefs and lagoons. Warm clear waters also encourage coral growth, and hard substrates like iron and steel shipwreck sites make excellent substrates for colonization. In waters shallower than 18 m (60 ft), coral growth can completely obscure wreck site objects. In addition to the studies done on the USS *Arizona* (RN274) and USS *Utah* (RN780) by the National Park Service and associated agencies, there are a few other papers relating to the interaction of wreck sites with the biological environment in Hawaiian waters (Calhoun and Pico 1996; Van Tilburg 2002).

Biological erosion on shallow sites also includes the feeding habits of reef-grazing species like parrotfish (Sp. *Scarus*) which scrape algae from reef corals (or any hard substrate) with their beaks. Scraping scars have been observed on corals, ceramics, and the concretion layer on iron/steel features.

Shipwrecks both shallow and deep can serve as solid substrate and habitat for marine invertebrate and fish communities. Coral and coralline algae are the chief reef builders of Hawaii's shallow marine ecosystem. Shallow water wreck sites can relatively quickly become covered in reef structure. In Hawai`i coral growth averages 2-3 mm (0.08-0.12 in) per year. Optimal conditions in warm clear marine waters can produce a rate of 7-10 mm (0.28-0.39 in) per year. Numerous older historic wreck sites in shallow waters have become cryptic sites, almost completely covered in coral reef.

Deep shipwreck sites also provide habitat and substrate for marine invertebrate and fish communities. On a 2015 survey dive to the American World War I-era submarine *S-19* (RN522), sunk off O`ahu's south shore in 1938 at a depth 414 m (1,358 ft), biologists counted over 44 different marine species making their home on the deep wreck site, an unusually high number (Figure 16).

Figure 16: Biological community on the bow of submarine S-19 (RN522), depth 414 m. (NOAA OER)

3.6.4. Hybrid Process: Rusticles

More correctly classified as a hybrid bio-chemical process, the formation of rusticles came to public attention through research on the HMS *Titanic* wreck site (Cullimore and Johnston 2003). Rusticles have been well documented on World War II shipwrecks in the Gulf of Mexico (Overfield 2005). They have also been recorded on numerous World War II steel shipwrecks in Hawaii's deep ocean settings (Figure 17). These rust "icicles" and other rusticle forms appear to be a complex symbiotic community of microbes, bacteria and fungi that live off the iron

Figure 17: Rusticle formation, view from the Pisces V into the cab of a WWII AMTRACK (RN578); O`ahu. (NOAA ONMS)

oxides, produced by the electrochemical deterioration of iron in seawater. Henrietta Mann has identified what appear to be twenty different species of bacteria in the *Titanic*'s rusticles alone (Pellegrino and Cullimore 1997). Over time, the rusticle process promotes the virtual melting away of the steel shipwreck, particularly deeper steel wrecks less protected by concretion formation, more frequent in shallow waters (Overfield 2005).

3.6.5. Currents, Seabed Movement and Deposition

Throughout the Hawaiian archipelago, protected locations for wreck sites are relatively rare, consisting mainly of lagoons in atoll settings in the Northwestern Hawaiian Islands, back reef areas between fringing reefs and shores in the main eight islands to the southeast, and the few developed harbors. Even in relatively protected areas, large sections of steel shipwrecks can still be repositioned by passing tropical cyclones and hurricanes (Van Tilburg 2002). This has occurred in the Northwestern Hawaiian Archipelago even when such storms do not cause any damage to the main islands. Historic boilers from shallow sites almost 100 years old have been tossed ashore in recent storms. Whole ships sunk as artificial reefs have been moved out of location, or sometimes reoriented 180 degrees during hurricane events (Dive Seven 2017). Any investigation of a particular site, therefore, must take into account the historical record of hurricane and tsunami events, linking site location with the direction and intensity of the natural phenomenon.

The result of this punishing dynamic environment is the destruction, in relatively short order, of most historic wooden shipwrecks lost along the coast. Fortunately, the greatest period of American naval activity in Hawai`i coincides with the age of iron and steel hulls and steam propulsion (Van Tilburg 2003). The influence of iron, steel, and steam material culture may therefore be over-represented in the archaeological record, compared to the influence of wooden ships and sail. Many wooden schooners and other commercial sailing vessels have been lost in near shore waters, yet those wreck sites are more ephemeral in nature than steamship wreck sites consisting of heavy steam engines, boilers, and propeller shafts in close association. Rigging, pieces of iron or steel hull, and other relatively heavy cargo and artifacts will be redistributed and scattered in holes or *pukas* in the reef and depressions in the spur and groove coral topography. Fortunately, steamship wrecks have considerable archaeological value, as has been demonstrated in many locations, despite the deterioration processes for iron in the marine environment (McCarthy 2000).

Deep-ocean wreck sites can also be subject to seabed movement and effects from ocean currents. The site of the World War II Japanese midget sub (RN740), discovered by the Hawai`i Undersea Research Laboratory in 2002, lies in approximately 400 m (1,300 ft) depth (Figure 18). Scouring from the ocean currents have removed the sediments and undercut the sea floor beneath the bow and stern portions of the submarine, leaving these ends unsupported and subject to structural failure (Delgado et al 2016). Scour craters at these depths have formed around many of the landing craft and AMTRACKS disposed south of the entrance to Pearl Harbor.

Figure 18: Deep scour beneath the bow of the Japanese midget sub (RN740) near Pearl Harbor. (NOAA ONMS)

Terrestrial sediment transport in the Hawaiian Islands originates in the upland mountains and flows via valleys and stream-bed erosion to the back reef and fringing reef zones. Once in the near shore environment, sediments are carried by longshore currents in alternating directions, dependent on the shore profile, season, etc. Beach surveys show strong seasonal variability in sediment movement, with net erosion occurring in the summer and net accretion in the winter (Eversole and Fletcher 2003).

Sedimentation rates can be higher where development and agricultural runoff change the coastal landscape. For example, erosion on the island of Kaho`olawe, initiated by years of intensive use as a naval target range, has also led to a deeper sediment load in some areas around the island. Kāne`ohe Bay also provides an example of this, where high runoff rates combined with the local sewage outfall, leading to approximately 3 m (10 ft) of biogenic ooze being deposited over SCR sites, including the historic World War II PBY mooring area in the southeastern sector (Van Tilburg 2000).

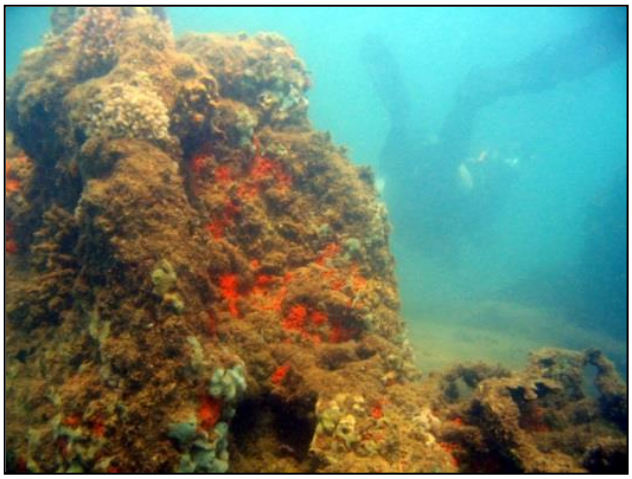

Figure 19: Sediments, sponges and encrustation cover the USS *Arizona* (RN274). (NOAA ONMS)

Sediments and biofouling organisms that thrive in the warm nutrient-rich waters of Pearl Harbor have created a protective layer over the wreck of USS *Arizona* (RN274) (Figure 19). The measurement of this layer has been an important factor in the National Park Service's study of the corrosion rates on the site (Russell and Murphy 2004). Many SCR sites like the USS *Arizona* exhibit the combined phenomena of the wrecking process, concretion formation, chemical and biological deterioration, sedimentation, etc.

From the process of wrecking, to the disintegration of perishable materials, to the colonization of materials by invertebrate

organisms, to the erosion and site changes caused by seabed movement and the mechanical effects of waves and current, Hawaii's underwater environment has actively shaped its wreck sites in numerous ways and will continue to do so.

3.6.6. Illegal Salvage and Looting

In Hawai`i, the academic pursuit of maritime archaeology is relatively new, initiated on a small scale in 1987 by the University of Hawaii's Marine Option Program through an annual weekend scholarly seminar. For the State of Hawai`i, both cultural and natural resources fall under the management and protection of the Department of Land and Natural Resources. Unfortunately, the State has never had its own program in underwater or maritime archaeology, and has not possessed a survey capacity in this field. Consequently, official enforcement or protection actions are few, and statistics non-existent.

Many recreational divers in Hawai`i are unaware of the state and Federal laws which protect certain SCR sites, and therefore inadvertent damage to accessible sites has an impact to the resource in the islands (Van Tilburg 2015). Artifacts are often moved and "cached" by divers, or taken from sites in a mistaken effort to "rescue" them from the sea. Some divers, of course, are aware of the illegality of these actions but, motivated by personal gain, loot specific items, such as console instruments or rusted machine guns from WWII naval aircraft (Figure 20). Occasionally these items appear for sale on Ebay. Unfortunately, this type of damage over time due to benign neglect and lack of management capacity is common in many locations in the Pacific. Understanding the *in situ* values of wreck sites for multiple stakeholders is critical to addressing this problem (Edney 2006).

Figure 20: Top view of salvaged-damaged aft turret of a PB4Y-1 Liberator naval aircraft (RN867), showing removal of starboard machine gun, documented 9/31/06. (NOAA NMFS)

Deep-water sites are not immune to possible illegal salvage and looting. Certain transiting private parties, who have access to their own manned submersibles, have expressed interest in the past for locations of significant deep-water World War II wrecks (Terry Kerby oral communication to authors 2006).

3.7. Preservation Mandates in Hawai`i

3.7.1. Federal Mandates

In 2014 Ole Varmer, with NOAA General Counsel, completed the BOEM-funded *Underwater Cultural Heritage Law Study* (OCS Study BOEM 2014-005), offering a useful analysis of the existing Federal laws protecting SCR throughout the United States' OCS. In addition, the study identifies gaps in protection and recommends specific legislative changes (Varmer 2014). The *Underwater Cultural Heritage Law Study* therefore provides a detailed overview of Federal preservation mandates which apply in the waters surrounding the Hawaiian Islands, and may be accessed at the BOEM Environmental Studies Program Information System website. Selected Federal preservation laws which may have a direct or indirect effect on Hawaii's OCS include:

- River and Harbors Act of 1899
- Antiquities Act of 1906
- Historic Sites act of 1935
- Submerged Lands Act of 1953
- Outer Continental Shelf Lands Act of 1953
- National Historic Preservation Act of 1966
- National Environmental Policy Act of 1969
- National Marine Sanctuaries Act 0f 1972
- Coastal Zone Management Act of 1972
- Clean Water Act of 1972
- Archaeological and Historic Preservation Act of 1974
- Archaeological Resources Protection Act of 1979
- Abandoned Shipwreck Act of 1987
- Sunken Military Craft Act of 2004

3.7.2. State Mandates

Hawai`i Revised Statutes (HRS) Chapter 6E establishes the State Historic Preservation Program as part of the Department of Land and Natural Resources which carries out Hawaii's historic preservation mission and controls and manages all state historic properties (HRS 2011). Chapter 6E defines historic property as any building, structure, object, district, area, or site, including heiau and underwater sites, which is over fifty years old. Furthermore, the statute makes clear that all historic property located on lands or under waters owned or controlled by the State shall be the property of the State, and that the control and management of the historic property shall be vested in the State's Department of Land and Natural Resources. The statute makes the State responsible for conducting a statewide survey and inventory to identify and document historic properties, aviation artifacts, and burial sites, including all those owned by the State and the counties.

Chapter 6E specifically states that it is unlawful for any person, natural or corporate, to take, appropriate, excavate, injure, destroy, or alter any historic property or aviation artifact located upon lands owned or controlled by the State or any of its political subdivisions, except as permitted by the Department of Land and Natural Resources.

The Constitution of the State of Hawai`i recognizes the value of conserving and developing the historic and cultural property within the State for the public good (HRS 2011). The legislature declares that the historic and cultural heritage of the State is among its important assets and that the rapid social and economic developments of contemporary society threaten to destroy the remaining vestiges of this heritage. The legislature further declares that it is in the public interest to engage in a comprehensive program of historic preservation at all levels of government to promote the use and conservation of such property for the education, inspiration, pleasure, and enrichment of its citizens.

4. Polynesian Discovery and Settlement Era 1000-1778

As humanity spread across the globe after leaving Africa, the shores of Southeast Asia and Indonesia were settled, and from there Australia was likely reached some 40,000 to 60,000 years BP by people who took to the sea and crossed to that continent (Flood 2006). From what is now New Guinea, other people moved out, across the water to reach the Solomon Islands some 30,000 years BP. Others migrating into Asia, would eventually push north and south, some eventually crossing into North America. The peoples that lived on the shores of the Pacific evolved into separate, diverse cultures in Southeast Asia, Indonesia, China, Japan, Korea, Siberia, and the many cultures and indigenous peoples of North, Central and South America over the next tens of thousands of years (McDougall 2004).

4.1. Lapita Migration Theory

The Pacific itself remained unpopulated until it was explored and settled by indigenous mariners thousands of years ago. Beginning some 6,000-8,000 years BP, Austronesian-speaking people moved south into Southeast Asia, likely through what is now the island of Taiwan (Howe 2006). A portion of this great migration may have moved northwards into Micronesia, but groups clearly continued voyaging eastward (Figure 21). Archaeologists came to identify this group as the Lapita culture, named for the spread of Lapita style dentate-stamped pottery, a crucial marker artifact within the assemblage of cultural items and traits associated with these voyagers. Some 3,600 years BP, Lapita people crossed the ocean to the Fiji/Tonga/Samoa area of Polynesia, where their descendants remained for more than a thousand years, and distinctive elements of Polynesia culture first emerged (Green 1979).

Some 2,000 years BP, the Polynesian descendants of the Lapita culture voyagers (dentate-stamped pottery did *not* continue to spread beyond the Fiji/Tonga/Samoa homeland area) spread out across millions of square kilometers to settle the rest of the Pacific's islands. In a series of bold exploratory voyages made possible by the sailing capacities of long-distance voyaging canoes and the proven methods of traditional non-instrument navigation, all of Eastern Polynesia appears to have been settled by around 700 CE (Irwin 2005). It is from Eastern Polynesia, from Tahiti and the Marquesan Islands, that the remote corners of the Polynesian triangle, Rapa Nui (Easter Island), Aoteroa (New Zealand), and Hawai`i, were finally discovered and settled (Irwin 1994). Trade and contact between islands and peoples connected some of these cultures, as did oral traditions of the great migrations across the Pacific. Some of these people may have also reached the shores of North America in their voyaging canoes. On the coasts of the Americas, the people and cultures there developed their own sea craft, some journeying by sea to trade, like the Maya, others to harvest or hunt, like the Chumash, others to raid, like the Haida (McDougall 2004).

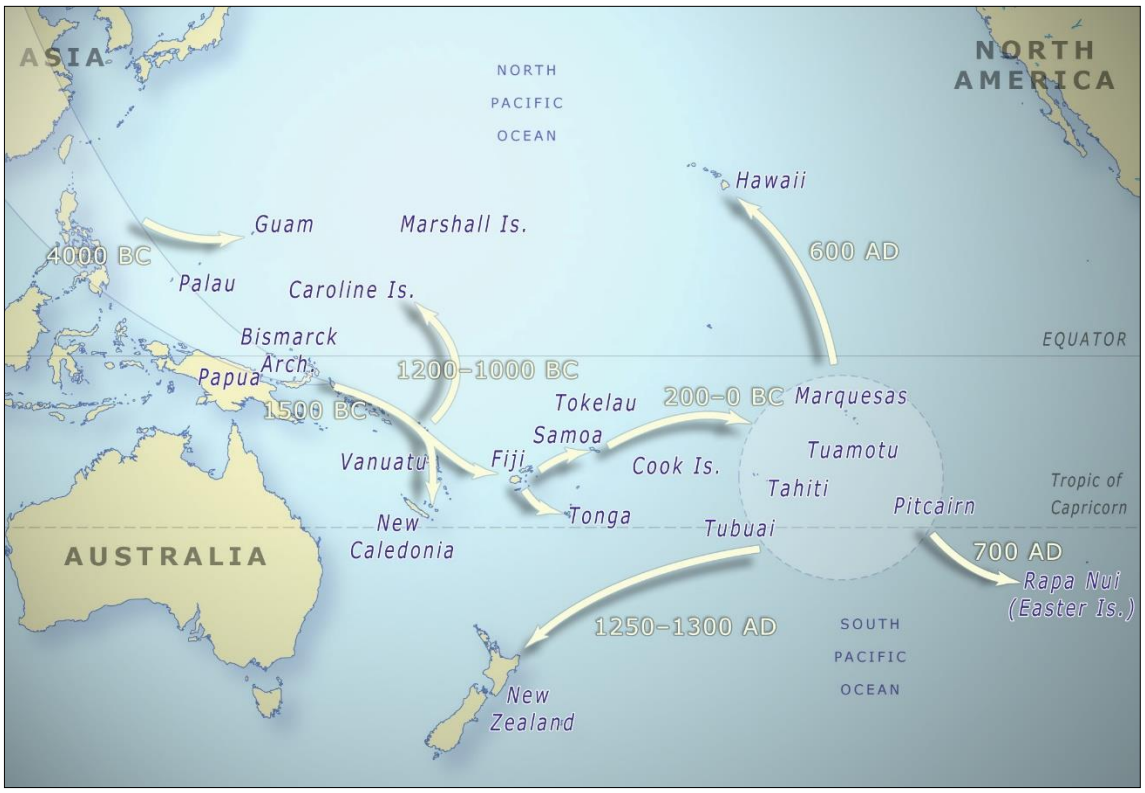

Figure 21: Pacific ancient migration routes based on the Lapita model. (Te Ara—The Encyclopedia of New Zealand 2017)

The vastness of the Pacific remained unknown to the European world, however. Other than the Polynesians and indigenous local hunters, fishermen and traders, it remained empty of outside vessels and peoples. Some have suggested that within the last thousand years, Chinese seafarers may have traveled into and across the Pacific, but there is no definite proof that even the exceptional seafarers of the Ming Dynasty reached the shores of the Americas (Leland 1875; Menzies 2008; Finlay 2004). The first known to reach those shores from abroad were Europeans, who pushed into the Pacific from both sides – Asia and the Americas - within decades of Columbus' trans-Atlantic voyage of 1492 CE.

4.1.1. Implications for the SCR Inventory

Lapita-style artifacts are critical to tracing the proposed migration of original voyages from Melanesia and the Bismarck Archipelago into the Fiji-Tonga-Samoa area and the heartland of Polynesian culture. Lapita pottery has *not* been found in Hawai`i, and is *not* known to have been a cultural tradition beyond around 250 BCE. This suggests that Polynesians of the Western Pacific may have no longer had a use for ceramic pottery prior to further voyaging expansion to the Marquesas or Tahiti, for ceramics were not manufactured by Polynesian societies at any time in East Polynesian prehistory (Smith 2002). It is highly unlikely that Lapita sites would be found underwater in the Hawaiian Islands.

4.2. Navigation and Voyaging Technology

Over hundreds of years, double-hull voyaging canoes, guided by specialists trained in non-instrument navigation, moved eastwards into the Pacific, bearing the men and women and all necessary supplies to support permanent remote settlement (Kirch 2000; Howe 2006). That achievement relied on traditional wayfinding techniques. Navigators used solar and celestial observations of the sea, and swell direction and ocean temperature to maintain their course beyond the sight of land. Cloud color and patterns, swell reflection and refraction, paths of migratory sea birds, and a host of other signs were used to enlarge the detection radius of small islands and low atolls. This consistent proven package of cultural knowledge was passed down generation-by-generation to apprentice navigators, esteemed members of their island communities (Lewis 1972).

The successful colonization of remote islands and atolls which lay unseen beyond the horizon also relied on the technical capacity of the double-hulled oceanic voyaging canoe, or *wa`a* in Hawaiian (Finney 1994). These were advanced vessels, well designed for their environments (Figure 22). Parallel wooden dugouts, their sides raised by hull planks or strakes lashed together with natural cordage, were joined by cross beams that also supported the deck. Sails were often natural plaited fibers carried in curved "crab-claw" masts. A steering oar in-between the hulls at the stern provided control. Voyaging canoes were designed for and capable of handling adverse, as well as fair, sailing conditions (Irwin and Flay 2015). There were many different canoe designs across the Pacific, but the largest types were double-hulled and decked sailing vessels for long oceanic passages (Haddon and Hornell 1936).

Reference works by Irwin and Flay, Haddon and Hornell, Kirch, Howe and others provide authoritative sources for understanding the cultural and environmental challenges and the technical evolution of Pacific voyaging canoes (Irwin and Flay 2015; Haddon and Hornell 1936; Kirch 2000; Howe 2006). The speed and carrying capacity of many types of canoes impressed eighteenth and nineteenth-century explorers such as Captain James Cook (Ledyard 1783). The voyaging canoe design was clearly the preeminent Pacific vessel of ancient exploration and migration, a capable platform for colonizing remote islands and therefore of immense cultural importance (Finney 1994).

Figure 22: Hawaii maritime conference group on board the voyaging canoe replica *Hawai`iloa,* 2000. (H Van Tilburg)

4.2.1. Canoe Construction

The initial voyages of discovery and migration of Polynesians to the islands of Hawai`i were accomplished in a series of ventures, first from the Marquesas and then from Tahiti (Kirch 2000). These were challenging long-distance open-ocean voyages crossing the equator and transiting different oceanographic and climatological regimes. Voyaging required

technologically sound vessels. These double-hulled canoes were carved from a single log, often measuring longer than 30 m (100 ft). The tree would be selected by a *kahuna kalai wa`a* or master canoe craftsman and then cut, dragged and hollowed out by a group of men until it was ready for lashing (Holmes 1993). The *wa`a kaulua* (double-hulled canoe) used to migrate through the Pacific were very large, made specifically for transporting people, plants, and livestock (Howe 2006).

Precursors to the modern-day catamaran, Pacific voyaging canoes achieved their stability through their double-hull design rather than through heavy ballast (Haddon and Hornell 1936). Submerged wreck sites (unintentional or accidental losses while in-use) for voyaging canoes may therefore be very rare, if they exist at all, in the Pacific. Without the need for ballast, the vessel itself is buoyant and will not settle onto the seafloor. Pacific voyaging canoes are not likely to be discovered as submerged wreck sites. The features of voyaging canoes which have been discovered in-situ have been found not at submerged sites but at shoreline terrestrial wet site locations, such as estuaries (Sinoto 1983; Johns et al 2014).

Despite the overall transition to powered vessels, the importance of voyaging and voyaging canoes has remained central to the cultural identity of Hawaiians. This significance has been captured and celebrated by scholars and artists such as Herb Kawainui Kane (1928-2011), whose research and illustrations of the canoes of Polynesia have illuminated these craft and the traditions of their navigators. Kane's work has produced a collection of architectural drawings, paintings and text which contributes greatly to our understanding of what these vessels looked like and how they were handled and navigated the oceans (Davies ND).

4.2.2. Wayfinding

Once the canoe was prepared and provisioned it would set out to sea. Traditional navigators could identify and name up to 150 stars, and they knew the proper procedures of crossing from the northern to the southern hemisphere (Finney 1994). Navigators used all elements and senses available to them to lead their voyage, paying close attention to stars, wind, waves and currents in order to calculate the proper heading. Concepts of this non-instrument navigation cultural package, such as expanded target landfall, have been documented by anthropologists like Dr. David Lewis (*We, the Navigators,* 1972) and others. Archaeological, linguistic, and traditional evidence indicate that, after the discovery of Hawai`i, two-way voyaging between Hawai`i and Tahiti was conducted, probably between the 12th and 14th centuries (Kirch 2000). Then, it ceased for unknown reasons. There is no record of subsequent long ocean voyages from Hawai`i and it is believed that long distance navigation from Hawai`i vanished for nearly five centuries (Lewis 1972).

4.2.3. Revival of Pacific Voyaging

The current revival in Pacific voyaging canoes and traditional non-instrument navigation started with a unique Hawaiian fusion of experimental archaeology and cultural awakening in the 1970's. In 1973 anthropologist Dr. Ben Finney, artist Herb Kane, and local sailor Tommy Holmes formed the Polynesian Voyaging Society and, using both traditional and modern materials (plywood-fiberglass-resin), led the effort to create a performance-accurate replica of an

ancient *wa`a kalua* canoe for the investigation of sailing capacity and past oceanic migration in the Pacific. The double-hulled canoe *Hōkūle`a,* meaning "Star of Gladness" (Hawaiian name for Arcturus, the zenith start of Hawaii's latitude 19-degrees north), was launched in 1975 and was soon on her way to Tahiti, re-creating the early two-way voyaging routes that had originally settled the Hawaiian Islands (Finney 1994). On board the canoe was Pius Mau Piailug, a Micronesian navigator from Satawal Island who shared his knowledge of traditional navigation with the canoe's crew.

Hōkūle`a* is a two-masted open-deck replica of a Hawaiian double-hulled voyaging canoe or *wa`a kaulua and measures 18.9 m (62 ft) long, 4.6 m (15 ft) wide, and has a steering oar rather than a rudder (Figure 23). There is no engine or outboard for propulsion. The canoe displaces approximately 27,000 pounds when fully laden with supplies and crew of 12-16 sailors (Finney 1994). Since her inaugural voyage, *Hōkūle`a* has made numerous passages throughout the Hawaiian Islands and to Micronesia, Polynesia, Japan, and North America, covering more than 242,000 km (150,000 nm) in the Pacific, all using non-instrument wayfinding techniques and traditional celestial navigation. Today, numerous other voyaging canoes have been constructed in the Pacific and in many places the knowledge of traditional wayfinding has been preserved. The Polynesian Voyaging Society (PVS) continues its mission as a non-profit research and education corporation based in Honolulu (PVS 2017).

Figure 23: Performance-accurate replica *Hokule`a,* offshore of Honolulu. (H Van Tilburg)

4.2.4. Implications for the SCR Inventory

Canoe construction, voyaging and interisland sailing, and navigation were and are important activities in Hawai`i. Despite the initial dismissal of non-European navigation by mainstream academic authorities, the knowledge and technical skills required for intentional Pacific voyaging is now better understood as central to the cultural identities of many Pacific people (Finney 1994). Sites and properties associated with traditional navigation, both the transmission of cultural knowledge and the creation of voyaging canoes, must be interpreted in this light, as elements of cultural identity itself. These include landings associated with voyages, canoe construction areas, canoe anchoring or mooring areas, and coastal features that serve as navigational landmarks.

4.3. Fishing and Aquaculture

In ancient Hawai`i, fishing was the most varied and extensive food procuring occupation (Hiroa 1957). Besides different types of equipment needed for hook-and-line, trap, net, noose, and spear fishing, swimming and diving skills were necessary, as well as an intimate familiarity with

the reef and near shore waters. Hawaiian fishermen were familiar with both shallow and deep fishing grounds: deep sea fishing was known as *lawai`a o kai uli*; fishing grounds in shallow depths to 145 m (480 ft) were called *kukaula*; intermediate grounds of variable depths were named *ka`aka`a*; and deep fishing grounds between 360 and 730 m (1,200-2,400 ft) were known as *pohakailoa,* named for the heavy sinkers used in deep waters (Hiroa 1957). Grounds could be located at sea by using visual line-ups (transits) to coastal landmarks and mountain ranges (Maly and Maly 2003).

Fishing hooks had a wide range of sizes and designs, and were made from several different materials, including pearl shell or turtle shell, and bone, including whale ivory and human bone (Hiroa 1957). Stone sinkers for fishing lines and nets can be categorized by shapes and by the perforations or grooves used to attach the line. Sinkers ranged in weight from less than 100 g for shallow gear to 2 kg (4.5 lbs) for heavier plummet weights on deep sea gear (Hiroa 1957). Submerged traditional fishing sites have been located and surveyed in shallow waters near Waikiki, identified by the accumulation of stone breadfruit-type (octopus) sinkers (Van Tilburg 2015).

4.3.1. *Ko`a*

Kū`ula* (carved stone gods) and *ko`a (coral platform fishing shrines) were often built near the shoreline, usually on low promontories overlooking the sea. Larger *heiau* (religious structures) were usually set further back from the shore, but at times they can be found just above the high tide line. *Ko`a* may also refer to traditional fishing locations and submerged structures or features which attract or possess abundant fish, located by visual line ups to the shore (Maly and Maly 2003).

4.3.2. Coastal Fishponds

Figure 24: The *makaha* or gate in the seaward wall of the He`eia fishpond in Kāne`ohe, O`ahu. (NOAA ONMS)

The history of *loko i`a* (traditional Hawaiian fishpond systems) dates back more than 500 years BP and is supported in extensive oral histories (Keala et al 2007). Some types of fishpond were inland/upland, co-located with agricultural activities. Several different styles of rock-walled fishponds evolved: *loko wai*—inland freshwater pool; *loko i`a kalo*—kalo field agricultural ponds; *loko kuapa*—coastal ponds with semi-circular seawalls of lava rock and rubble; *loko `ume iki*—coastal walled fish traps. Most fishponds were coastal structures (Figure 24), varying widely in size from less than half a hectare to 242 ha (600 ac) (Keala 2007). *Loko kuapa* or semi-

circular coastal ponds, capture the circulation of the tides through *`auwai* or sluice gates in the seawall. Streams added the nutrients from agricultural runoff to the brackish waters, creating ideal conditions for the cultivation of juvenile fish. Large *loko kuapa* required the labor of thousands of people for construction, and constant maintenance (Daws 1968).

Loko i`a* were an important part of Hawaii's complex and sustainable natural resource management system. Cultivation and propagation centered on many different fresh and salt-water plants and animals, with the primary species being the prized *`ama`ama* (mullet) and *`awa (milkfish). An inventory in the early 1900s found 360 *loko i`a* in the islands and identified 99 active ponds with an estimated annual production total of about 308,450 kg (680,000 lbs), including 220,450 kg (486,000 lbs) of *`ama`ama* and 88,000 kg (194,000 lbs) of *`awa. Loko i`a* were extensive operating systems that produced an average of 180-270 kg (400–600 lbs) per acre per year, a significant amount considering the minimal amount of fishpond "input" and maintenance effort apparent by that time (Keala 2007). Increasing immigration and foreign influences during the nineteenth and twentieth centuries, coupled with industrialization, and urbanization had a devastating impact on the traditional Hawaiian resource management systems in Hawai`i (Watson 2013).

Hawaiian fishpond systems, *loko i`a*, are some of Hawaii's most significant traditional cultural resources. They are biocultural articulations of Hawaiian innovation in the areas of engineering, education, hydrology, aquaculture and biology. Further, they demonstrate traditional Hawaii's capacity in sustainability, food sovereignty and natural resource management (Watson 2013). (Described further in OCS Study BOEM 2017-022 and OCS Study BOEM 2017-023.)

4.3.3. Revival of Fishpond Aquaculture

In the past decade, there has been a renewed interest in the repair and operation of traditional Hawaiian fishponds for their cultural, economic, and ecological value. Community organizations and traditional fishpond practitioners face the challenge of maintaining and restoring fishpond systems. Government regulations often restrict activities in the near shore area and the process to obtain permits can be complicated. The unique, fragile, and sometimes rugged environments in which they are located compound the difficulty of Hawaiian fishpond revitalization (Watson 2013). Due to their unique ecosystems, engineering and complex biological functioning, Hawaiian fishponds are subject to a myriad of regulations and oversight by a host of different agencies. The end result is that obtaining the necessary permits and approvals to restore, repair, maintain and reconstruct fishponds is both costly and time-consuming.

Supported by NOAA's Humpback Whale National Marine Sanctuary, a Regional General Permit (RGP) with the U.S Army Corps of Engineers Honolulu District Office was established in 2015 allowing the State to streamline the permitting process by utilizing a single application process for restoration activities. The objective of the RGP is the restoration, repair, maintenance and reconstruction of *loko i`a* in Hawai`i. This action promises to stimulate traditional Hawaiian cultural activities, the restoration of fishpond systems and their related ecosystem services.

4.3.4. Implications for the SCR Inventory

Loko i`a are properties which may be impacted by coastal development projects (Figure 25). Located fish pond properties associated with traditional fishing and aquaculture may be eligible for NRHP inclusion as sites or districts (groupings of related sites) reflecting prehistoric and/or historic activity of major events (Criterion A), major figures in history (Criterion B), or sites which have yielded, or may be likely to yield, important cultural information (Criterion D). Additionally, the significance of Native Hawaiian traditional fishing and aquaculture sites may be enhanced by their status as traditional cultural places, and as locations where communities have traditionally carried out economic or other cultural practices important in maintaining their historic identity.

During Section 106 cultural resource consultations mandated by the NHPA and conducted by the Hawaiian Islands Humpback Whale National Marine Sanctuary in 2014, the topic of underwater *ko`a* was raised multiple times on islands across the state. These types of cultural properties are considered very important to traditional fishing and sustenance. The exact locations, though, are sensitive, as these fishing properties represented traditional environmental knowledge of individuals or individual families, information not appropriate for public or agency distribution (Van Tilburg 2015).

Figure 25: Fishpond outer wall (upper left) and interior fish traps at Kaloko Honokōhau, island of Hawai`i. (NOAA ONMS)

4.3.5. Project Summaries

Several maritime archaeology projects have been conducted on coastal fishing and aquaculture sites in the Hawaiian Islands, as part of the regular Maritime Archaeology and Surveying Techniques (MAST) course, offered by the University of Hawai`i (UH) Marine Option Program (MOP). In 1997 student divers employed a theodolite and Electronic Distance Measurement instrument (EDM) to map the outlines of the fishpond wall and interior fish trap holding areas at

Kaloko Honokōhau National Historic Park on the Kona Coast of the Island of Hawai`i (Van Tilburg 2014).

One near-shore fishing site was surveyed by the UH MOP student divers in 1996. Students in the field survey, assisted by UH Anthropology Department graduate Michael Pfeffer, mapped an accumulation of hundreds of fishing lures surrounding specific topographical reef features offshore from Waikiki beach on O`ahu. These bread loaf-shaped basalt sinkers were part of a multicomponent octopus lure, or *leho he`e* (Maly and Maly 2003). The distribution of lost lures suggests hundreds of years of fishing activity at this specific location and submerged reef feature. Project records for both of these surveys are held by NOAA's Maritime Heritage Program and the University of Hawai`i Marine Option Program.

5. Foreign Arrivals Era 1778-1830

5.1. Europeans in the Pacific: the China Connection

Europeans had a very pragmatic reason for seeking routes to the Pacific in the late 15th and early 16th centuries. Long before that, China and its Southeast Asian neighbors had developed an extensive maritime trade network. Initially focused coastally and extending to nearby states in what is now Korea, Japan, and Southeast Asia, in time trade reached the Indian Ocean, the coast of Africa, and the Persian Gulf. Arab and Indian traders introduced goods as well as their religions to the region. In exchange, Chinese and other Asian trade goods reached the Roman and later the Byzantine and European world by way of the famous maritime silk route. As Frank notes, there was a "world system" at play in this period, in which "the core regions, especially of industrial production, were in China and India; and West Asia and Southeast Asia also remained economically more important than Europe" (Frank 1998). To gain better access to the rich commodities of Asia, Europeans ultimately sought direct oceanic routes to the Pacific and thence to Asia starting in the late 15th century.

European voyages commenced as Portuguese navigators gradually worked down the west coast of Africa, around the Cape of Good Hope in 1498, and from there into the Indian Ocean to tap into the Indian market (Boxer 1969). The accounts of the first explorers revealed the potential for high-value commodity exchange, and voyages of exploration were soon followed by those of spice traders. First the Portuguese, then later the Spanish and English traders, entered the western Pacific by following the route of earlier Arab seafarers across the Indian Ocean, through the Straits of Malacca and thence to the spice islands of Indonesia. In 1512 – 1513, Portuguese mariners António de Abreu and Francisco Serrão reached Mallorca. In 1513, Portugal's Jorge Alvarado reached China. In the same period, 1519-1521, a bolder voyage by explorer Ferdinand Magellan entered the eastern Pacific from the opposite direction, by way of the tip of South America, discovering the strait that now bears his name (Joyner 1994). Magellan crossed the ocean to the Philippines, which the named Las Islas Filipinas in honor of the Spanish king, Felipe. Magellan died on the voyage, but his lieutenant Juan Sebastian Elcano brought the survivors of his expedition home. What followed was Spanish settlement in the Philippines, with a major outpost founded at Manila in 1571. The Portuguese, meanwhile, had established trading posts in China at Macau in 1513, in Timor in 1515, and finally at Nagasaki, Japan in 1543 (Tracy 1990). Within the next decades, English and Dutch competitors followed the Portuguese across the Indian Ocean and into Southeast Asia (Boxer 1965).

The Dutch gained a competitive foothold in Indonesia to open their own spice trade, establishing their own fortified trade outpost at Batavia, and then commenced direct trade with the Japanese in competition with the Portuguese. The Spanish, however, ultimately prevailed against other European competition in terms of Pacific trade (Shaw 1988; Spate 1988). They did this through the founding of their outpost at Manila in 1571 and the establishment of annual transpacific galleon voyages. This came in the aftermath of their conquest of Central and South American indigenous empires. Spanish maritime activities in the Pacific focused on this regular trade with Asia, using the Philippines as a base of operations from which annual "Manila" galleons carried spices, ceramics, silks, beeswax, and treasure across the Pacific to Acapulco Mexico in exchange for South American silver (Schurz 1939; Díaz-Trechuelo 1988). Goods were then transshipped across the isthmus and carried across the Atlantic by the Spanish West Indies fleet. This

lucrative trade remained an important Spanish maritime activity through the early 19th century. It also inspired the development of a handful of Spanish Pacific ports to serve coastal trade, such as Acapulco, Panama City, Callao, Guayaquil, and Valparaíso, Chile (Early et. al. 1998; Ward 1993).

The richness of Spain's American empire, and the lure of seizing Asian goods and South American silver by means of pirate attacks on Spanish shipping in the Pacific, inspired England to challenge the European notion of the Pacific as a "Spanish lake" as early as the 1577 voyage of Francis Drake (Bawlf 2004). The English also engaged in direct competition and outright warfare with the Dutch in the East Indies, although they would not prevail in the Pacific until the 18th century (Boxer 1965; Cook 1973; Frost 1988; Fisher and Johnston 1993). In fact, despite the presence of these various European powers in the Pacific, the true economic power was Asia, particularly the vast empire of China (Frank 1994). The acquisition and control of the riches of China would dominate the dreams of European monarchs and later European entrepreneurs and capitalists for centuries. It was that China trade that first attracted European attention to Hawai`i (Gibson 1992).

After having initially been part of regional Polynesian voyaging contacts, the Hawaiian Islands now came into communication with a new regional transpacific exchange, this time initiated by the arrival of sailors from the other side of the world. The period of early non-Hawaiian interactions with the islands brought with it tremendous changes, ultimately reshaping the established political, social, economic, and military norms of the kingdom (Daws 1968). This did not, however, occur overnight. Following Captain Cook's visit in 1778-1779, only a few years passed before foreign merchant vessels appeared in this area, soon followed by Captain George Vancouver's 1791-1795 British expedition to the Pacific. Rather than an abrupt demarcation, the period of foreign arrivals should be considered as the beginning of a transition, one in which Hawaiian society and culture is changed by the capabilities of foreign technology, the profitability of the provisioning trade for foreign ships, and the appeal of foreign religions.

5.2. Potential Spanish Contact in Hawai`i

Soon after the remnants of Magellan's small fleet completed their circumnavigation in 1522, the challenge for Spanish navigators was clear. Instead of continuing westward through Southeast Asia, Spain now sought to find a way back across the Pacific and back to Mexico from their newly established trade entrepôt in the Philippines, thus avoiding conflict with their Portuguese enemies (Boxer 1969). In 1565, navigator Andrés de Urdaneta located the prevailing westerlies of the North Pacific, and soon after that Spanish merchantmen began annual transpacific commerce to-and-from Acapulco and Manila, initiating 250 years of the Pacific Manila galleon trade (Schurz 1939).

West-bound galleons sailed south of Hawai`i closer to the equator; east-bound ships ran up to 35-40 degrees north to make their crossing with the favorable westerly trades of the North Pacific circulation, turning south for Acapulco after arriving on the West Coast of the continent (Díaz-Trechuelo 1988). There is no known Spanish record for the discovery of Hawai`i, though Spanish discoveries in the 16th century were often treated as State secrets, protected from the eyes of competitors and enemies alike (Schurz 1939).

Extracting the wealth of Asia depended on Spanish ships capable of crossing the Pacific. Many of these galleons with large strongly braced hulls were built in the Philippines under the direction of Spanish shipwrights, and proved more economically efficient than the smaller caravels and naos that preceded them (Gardiner 1994). For a long period, these large slow vessels, laden with silver from the New World or with wealthy trade goods from China, were sought-after as prize targets by many nations (Paine 2013). Over the many years of the manila galleon route, some 40 Manila galleons went missing in the Pacific (Schurz 1939). The wreck sites of these wealth-laden vessels have, likewise, been long sought-after targets. Most of the lost galleons met their demise in the Philippines and the Mariana Islands. The locations of a handful of others (approximately 10), though, remain unreported.

5.2.1. Alleged Galleon Wrecks in Hawai`i

Despite the current lack of existing physical and archival evidence, some researchers have speculated on the possibility of Spanish contact with the Hawaiian Islands prior to the arrival of Captain Cook, and more specifically to the possibility of a galleon wreck in Hawai`i (Dahlgren 1973; Stokes 1939). Depictions of "mystery" islands on historic 17th and 18th century Pacific charts, combined with loose interpretations of Hawaiian oral histories referring to shipwrecked survivors, have been cited (Hayes 2002).

> While Umi reigned upon the eastern coast of the island, one of his cousins, Keliiokaloa reigned on the western coast, and held his court at Kailua. It was in the reign of this prince, about two centuries before the voyage of Captain Cook, that a ship was wrecked at Keei, in the district of Kona, not far from the spot where the celebrated English navigator met with his death in 1779. It was then towards 1570 that men of the white race landed for the first time on the group. A man and a woman, having escaped from the wreck, landed upon the beach at Kealakekua. On reaching the shore, these unfortunates prostrated themselves upon the lava with their faces on the ground, whence arose the name of Kulou (bowing down), which is still borne by the place which was the witness of this scene. The shipwrecked foreigners speedily conformed themselves to the habits of the natives, who assert that there still exists in our day a family of chiefs descended from these two whites. (Remy 1865)

At various times claims by a number of different private parties have been made alleging the discovery of traces of a Spanish galleon in the channel between Kaua`i and O`ahu, or on the Kona side of the island of Hawai`i. As of 2017, however, none of the claims of alleged 16th century Spanish shipwrecks have been confirmed or positively identified.

5.2.2. Implications for the SCR Inventory

Archaeological sites like submerged shipwrecks which have not been located or assessed cannot be judged either eligible for, of ineligible for, the NRHP. Older wooden shipwreck sites in highly dynamic marine settings in particular may suffer from a lack of integrity. Powerful marine site formation processes may simply scatter and destroy so much of the original vessel that there simply is not enough left to be found significant, according to the Register's specific criteria (Delgado 1992). However, if a wreck is found with sufficient diagnostic artifacts in

concentration, the older wooden shipwreck site may possibly be eligible for NRHP inclusion as an archaeological site (artifact concentration) rather than relatively intact wreck or discrete object (NHPA 1966). Potential Spanish galleon sites, given the lack of early historic-period information of the Manila galleon trade and the consequences of early cultural contacts, could then be eligible under Criterion A historic event, foreign contact in Hawai`i. Additionally, such older sites buried in sediments or embedded in coralline substrate might be eligible under Criterion D, due to their potential for significant historical and archaeological information, if those sediments or substrates had protected sufficient materials.

5.3. Euroamerican Discoveries

5.3.1. Captain James Cook

Cook was an accomplished and experienced navigator and surveyor, and was experienced with cultural contacts elsewhere in the Pacific. Nonetheless, encounters between such differing cultures were fraught with misunderstandings, despite Cook's best efforts to control the situation and his crew.

Cook's initial landing in 1778 was at Waimea on the island of Kaua`i, where he called for fresh water. His two ships, HMS *Discovery* and HMS *Resolution*, returned to Hawai`i in 1779, landing at Kealakekua Bay on Hawai`i Island, where his appearance coincided with the peaceful celebrations of the Makahiki festival (Kuykendall 1967). Provisioning the visiting British sailors must have been difficult, given the need to provide for the multitude of Hawaiians gathered at the bay for the event (Obeyesekere 1992). Departing a month later, but then returning to Kealakekua Bay to carry out repairs to the *Resolution*'s foremast, the British were not as welcome as they had been previously (Ledyard 1783). A misunderstanding developed over a ship's boat, and Captain Cook was killed on the rocky shores of the bay.

The three exploratory voyages of James Cook (1768 through 1779) were significant for initiating patterns of maritime trade in the Pacific (Frost 1988). Sailors on Cook's crew noted the wealth and abundance of natural resources in remote locations of the Pacific, such as the fur seals along the Pacific Northwest Coast (Gibson 1992). The voyages also brought about the first known encounter between Europeans and Hawaiians. Cook did more than visit; his expedition's charts were the first to accurately map and depict the Pacific. The British government then publicly unveiled Cook's discoveries to the European world by publishing his journals and charts, and this essentially opened the door for the subsequent contacts and trade and migration to follow. Had any European power previously known of the location of the Hawaiian Islands, the secret was now out of the bag. Other vessels would soon sail in Cook's wake, the next foreign vessel arriving in 1785. The strategic location of this new Hawaiian port-of-call would prove a boon to European and American merchants extending themselves into the lucrative China trade (Gibson 1992). But the event had momentous consequences for Hawaiians as well. Once the Hawaiian Islands were charted by foreign navigators, there would be no stopping the foreign ships from landing, and previously unknown diseases initiated a demographic catastrophe for the Hawaiian people.

5.3.2. Invasive Diseases

The impact of invasive diseases to the native communities of Hawai`i was severe, for Hawaiians had never in their history faced an unseen threat like them. From a very conservative population estimate of approximately 250,000 Hawaiians in 1778 (other models suggest between 800,000-1,000,000 at the time of contact), the population of Hawaiian, and even part-Hawaiian, ancestry fell to around 84,000 by 1850 and to its nadir of around 37,500 by 1900 (Dye 1994; Pirie 1978). That is a decline of 85% of the native Hawaiian population over a century. While Cook's discovery on his third and final voyage is certainly a watershed moment in the history of exploration of the Pacific, many people today understand that cultural contacts are inherently very risky, and can have both beneficial and negative impacts. The achievements of the great navigators during the European Age of Discovery in the 18th century are inseparable from this darker legacy in many parts of the world.

5.3.3. Hudson Bay Contacts in the Pacific

The abundant natural resources impressed the new navigators of the Pacific, and merchant enterprises were soon to follow. When Cook's crew realized their profits selling their sea otter pelts in China, news of the demand for this commodity, known also as "soft gold," touched off a commercial race, and ships quickly flooded the Pacific Northwest coast (Gibson and Whitehead 1993). By the end of the 18th century, the pursuit of otter pelts dominated Pacific maritime trade (Gibson 1992; Malloy 1998). British and American ships realized their first round of profits trading manufactured items for furs on the Northwest coast. A second round of exchange brought greater wealth as they traded the furs in China for tea, porcelain and other goods. Then, finally, there was the third round of exchange selling Chinese luxuries in Europe or the eastern seaboard of the United States. Other Pacific opportunities existed in Spain's remote and soon to be independent Pacific colony of California. In California, they traded Chinese goods for bullion, minted coin and California's hides and tallow (Dana 1911). The hides and tallow, a by-product of the vast herds of cattle on the huge ranchos, were shipped to the east to feed the growing industrial centers of leather-production around Boston (Ogden 1941).

What followed was the establishment of outposts on the Northwest Coast for trapping, hunting and trade with the natives for other furs. By the 1820s, the maritime fur trade was passing into the hands of the Americans, but on land, Britain's Hudson's Bay Company dominated, controlling most of the fur trade in British North America, and establishing forts from Oregon to British Columbia (Galbraith 1957). The Company also supported a fleet of coastal trading ships, including the steamer SS *Beaver*, from their headquarters at Fort Vancouver on the Columbia River (McKay 2007). The ocean served as a highway, linked to an emerging global market. Ships from England brought manufactured goods that were either exchanged for fur at Fort Vancouver or off the decks of company ships. American maritime fur traders brought goods from Boston to trade with their native partners, including items the British would not trade – liquor and guns (Gibson 1992).

5.3.4. Sandalwood Voyages

Foreign merchants, attempting to address the long-standing China trade deficit and find something worthy of exchange at Canton, soon discovered another product acceptable to the

Chinese market. Merchants began seeking out sources of fragrant sandalwood (g. *Santalum*), found throughout South Asia, Australia, Indonesia, and the Pacific Islands, and frequently used as scented wood for fine furniture and incense in China (Gibson 1992). Hawaii's endemic variety (*Santalum freycinetianum*, also known as *`iliahi*) grew only in the wet forests at elevations above 250 m (HawaiianHistory 2017). Much of this resource was soon stripped from the mountains, as chiefs ordered the *maka`ainana*, or commoners, to transport Hawaiian sandalwood logs down from the mountains for sale to the waiting ships. In time, some of the Hawaiian chiefs themselves fitted out their own vessels for commercial sandalwood voyages to the Hong merchants in Canton (Mills 2000). Much of the profit from the sandalwood trade was used to expand the Hawaiian interisland fleet, as chiefs either purchased or had built scores of foreign-style sailing vessels for their own uses (see Section 6.1 19th Century Hawaiian Fleets, below). This quest for sandalwood profits, though, placed a great hardship on the common people, as labor was disrupted and crops went neglected (Dougherty 1992). Topsail schooners and brigs, some of them in the advanced stages of rot, went immediately into this interisland trade (Mills 2000).

For these distant European merchants in the Pacific, the Hawaiian Islands were a critical stopping point for provisions. During the pre-Cook contact period, each island may have been more self-sufficient in terms of food and agricultural resources. But as the provisioning business was stimulated by foreign ships, an early commercial interisland trade was initiated (Daws 1968). During the first few decades of the 19th century, agricultural goods which could be sold began to move towards the few harbors where the large foreign vessels congregated. The *ali`i* or chiefs, monopolized this commerce, making large profits from the shipment of pigs, fruits and vegetables, and salt (Thomas 1982). Secondary locations began to funnel supplies to Fairhaven, soon to be known as Honolulu. The Pacific fur trade, the Hudson Bay Company, and the sandalwood trade were early pathways for the commodification of lifeways in the Pacific and Hawai`i, the transition from a resource-based barter economy to a market-based monetary system (Dougherty 1992). The transition would soon accelerate with the social and economic changes associated with advent of Pacific whaling (see Section 6.2 Pacific Whaling Activities, below).

5.4. Asian Drifters

The possibility of early contacts with the Hawaiian Islands may not be limited to Europe and the West. In 1875 Charles Walcott Brooks, a member of the California Academy of Sciences and former Counsel of Japan as well as attaché of the Japanese embassy, presented an historical report on drifting junks encountered by European and American observers, entitled *Japanese Wrecks Stranded and Picked Up Adrift in the North Pacific Ocean, Ethnologically Considered as Furnishing Evidence of a Constant Infusion of Japanese Blood among the Coast Tribes of Northwestern Indians* (Brooks 1875). This was actually a follow-up report on Horace Davis' *Record of Japanese Vessels driven upon the Northwest Coast of America and Its Outlying Islands* which had come out three years earlier (Davis 1872). Brooks' report provides a fairly accurate picture of more than 60 documented cases of Asian vessels lost throughout the Pacific between the years 1613 and 1875 (Figure 26). In many cases, survivors were discovered on remote coasts or on board the drifting wrecks themselves. Depictions of Asian junk wrecks even appear on historic charts of the Hawaiian Islands and are recorded in historic newspapers

(Connell 1933). One historic account provides documentation of a Japanese vessel wrecked near O`ahu:

> A junk, laden with fish, and having nine hands on board, left one of the southern islands of the Japanese Group, for Jeddo, but, encountering a typhoon, was driven to sea. After wandering about the ocean for ten or eleven months, they anchored on the last Sunday in December, 1832, near the harbor of Waialea, Oahu. Their supply of water had been obtained from casual showers. On being visited, four persons were found on board; three of these were severely afflicted with scurvy, two being unable to walk and the third nearly so. The fourth was in good health and had the sole management of the vessel. After remaining at Waialea for five or six days, an attempt was made to bring the vessel to Honolulu, where she was wrecked off Barber's Point, on the evening of January 1, 1833. Everything but the crew was lost with the exception of a few trifling articles… (Webber 1984; also Plummer 1991)

An 1870 account reported that the bark *Gambia*, sailing "among the small islands to the northeast of the Hawaiian group," noted that on "many other islands and rocks visited were found wrecks of Japanese junks," including at Midway, where "on the east side are the remains of two Japanese junks, their lower masts stranded high up on the beach," with another junk wreck found on Ocean Island nearby (Webber 1984). In Brooks' findings, at least one dozen Japanese sailing junks were cast by accident onto the North and Central Americas' coastline (Brooks 1875).

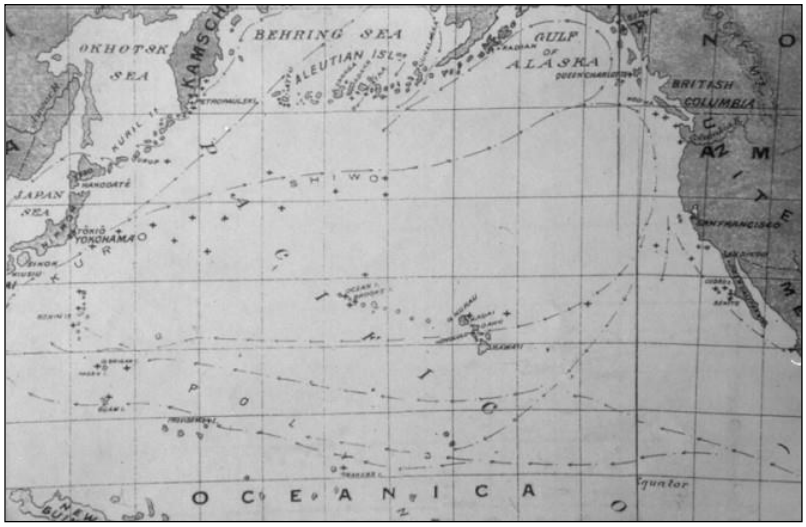

Figure 26: Brooks' map of Japanese junk drift voyage routes in the Pacific. (Brooks 1875)

Part of the difficulty faced by Japanese coastal sailors may have been the design of their vessels themselves. Japanese junks were intentionally built in a manner unsuited for the open ocean, with overly large unsupported stern rudders (Plummer 1991). Seagoing craft, by regulation, could not be seaworthy enough to make a long ocean voyage, only coastal trips in protected waters. This was a form of indirect governmental control of seafarers during the *Sakoku* or "closed country" period enacted by the *Shogun* or military ruler, a way of assuring that subjects of the empire could not leave the country without permission (Murdoch 2004). An unknown number of Japanese craft vanished between 1636 and 1854, when the *Sakoku* period finally ended, carried away by the Pacific Kuroshio current with broken rudders.

Unfortunately, for those Japanese sailors lucky enough to survive the Pacific drift voyage and find rescue, returning to Japan could be quite difficult. Native Japanese returning from abroad could be viewed as spies or traitors and imprisoned or even killed. The most famous of these

surviving Japanese drifters was known by Americans as Manjiro or John Mung. Manjiro was rescued by an American whaler in 1841, received education in America and later served as an interpreter for Admiral Perry in 1853 when Japan was forcibly opened by the American Navy (Webber and Webber 1999).

5.5. Significance of European and Asian Contacts

The maritime competition for Pacific resources, which provided the context for early European and American engagement with Hawai`i, had repercussions far beyond the early decades of the century. Russia, also eager for a commodity to trade with the Chinese, already knew of the rich sea otter furs off the Northwest Coast following their exploration of the northern Pacific, most notably by Vitus Bering in 1742 (Dunmore 1991). To tap into the clearly valuable furs of the area, the Tsar authorized the southern Alaska settlement of Sitka in 1784 to be the base of operations for the Russian America Company, which continued to exploit the region's furs as a trade commodity through the mid-nineteenth century (Dmytrshyn et. al. 1988).

Other commodities played a role in this transpacific competition. Ships transiting through the Hawaiian Islands could then make passage to the southwest and cruise among the South Pacific islands and Southeast Asia for the unique marine echinoderm called trepan or bêche-de-mer, also known as sea cucumber (class *Holothuroidea*). Shark fins and swallows' nests were also culinary delicacies. As one commodity after another was depleted, however, the Chinese merchants returned to their demand for precious silver, exacerbating the foreigner's trade deficit (Spence 1991). British entrepreneurs turned to a new but illegal product, opium. Shipping it from British-controlled India, both American and British merchants thwarted Chinese customs laws and enforcement efforts to flood China with the drug. When China protested, Britain declared war, and a defeated Chinese Empire was forced to open numerous treaty ports and allow increased importation of opium (Beeching 1975). The wealthy merchants (both Chinese and European) became rich, and the poor became addicted. The long-term consequences of this unequal drug trade in China would resurface years later as an association between opium and contract labor populations in Queensland, Valparaiso, California, and Hawai`i (Hong 2006).

One other result of the provisioning business was the introduction of foreign plants and animals to the islands, to further supply visiting ships with produce and meat. Pumpkins, melons, squash, oranges, beans, cabbage, cucumbers, radishes, onions, cotton, and tobacco were planted, and cattle, sheep, goats and horses introduced, with consequent impacts to the physical landscape (Gibson 1992). The center of much of this introduction was O`ahu, and its deep-water port, Honolulu, literally meaning "protected bay." Kamehameha moved his court to Honolulu in 1804 to take advantage of its central role in the kingdom's maritime trade, making it a growing center of population and the principal port in the islands (Daws 1968). By 1822, Honolulu had a population of some two to three thousand, and a fleet of approximately a dozen interisland trade vessels brought goods from other islands for the bustling trade with foreign ships (Gibson 1992). The new capitol grew very quickly, its commerce drawing migration from the outer islands.

5.5.1. Implications for the SCR Inventory

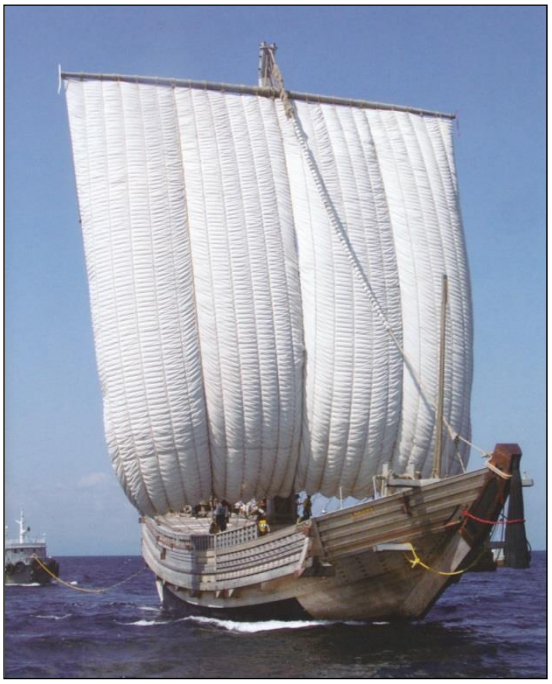

Figure 27: The *Michinoku-maru,* replica Japanese *bezaisen* Edo-period (1603-1868) sailing on Aomori Bay. (Dr. Kon Masaaki image in Brooks 2015)

During this period a variety of different vessels plied the Pacific and, therefore, may have left an archaeological signature in the Hawaiian Islands (Figure 27). Shipwreck properties, however, cannot be assessed in terms of the NRHP until they are located and the site is surveyed. To date in the main eight Hawaiian Islands, there have been no discoveries of SCR sites associated with these early decades of foreign arrivals (prior to 1820). The earliest shipwrecks located in the Hawaiian Islands to date (2017) are the remains of two British whalers, discovered at Pearl and Hermes Atoll in the remote Northwestern Hawaiian Islands by NOAA divers in 2004. The whalers *Pearl* and *Hermes* were lost on April 24th 1822, transiting from Honolulu to the Japan Grounds (Van Tilburg 2010). However, if features or sites were ever discovered in the main Hawaiian Islands and found to be associated with the early non-Hawaiian contact period, whether Euroamerican or East Asian in character, such resources could possibly speak to seafaring trade and cultural contacts in the early Pacific, assuming the sites retained any historical or archaeological information (Table 5).

Hawai`i, as a cultural mixing pot, has a tradition of local Asian ship construction dating back to the early days of the 20th century (Table 6…also see 7.4 Local Sampan Fishing Fleets, below). Many of these early locally-built Asian vessels retained traditional Japanese construction features. There is the small potential, therefore, of the discovery of SCR East Asian wreck site features from one of two quite different contexts, Hawai`i-built Japanese sampans and drift junks from afar.

5.5.2. Associated Inventory Sites:

Table 5: Highlighted inventory entries for the foreign arrival period

SCR Record Number	Highlighted entry vessel name	Notes
856	Unknown (Asian junk-drifter)	Reported by local newspapers as wrecked at Waialua
850	Arthur	British brig (Captain Barber) reported lost 1796 near Barber's Point

Table 6: Pacific wooden-hulled sailing vessels in the inventory

Type	Description	Number in inventory
wa`a kaulua	double-hulled open-decked voyaging canoe with two masts carrying oceanic sprit-matt sails, and steering oar.	0
galleons	large three-masted merchantman with high fore and aft castles; square-rigged on fore and mid mast and lateen sail on mizzen mast.	0
ships	large three-masted vessel with square-rigged sails on all masts.	8
barks	a vessel of at least three masts which is square rigged on all, with the exception of the mizzen mast being fore-and-aft rigged.	17
brigs	a two-masted vessel square-rigged on both masts.	9
brigantines	a two-masted vessel square rigged on the fore mast only.	2
sloops	an older naval term for small vessels which did not fit into any minor classes of small warships (Dear and Kemp 1976: 540).	14
junks	vessels with transom bows and sterns, and multiple gaff-rigged masts with batten sails (construction significantly different from European designs).	1

6. Social and Economic Changes Era 1830-1880

Major changes were introduced to Hawai`i in the early decades of the 19th century even though initial contacts were limited, sporadic, and unpredictable, with only a handful of foreign vessels arriving every few years (Quanchi and Adams 1993). The few British and American merchant vessels which started to appear in 1785, on their voyages from the Pacific Northwest to China, traded guns for provisions. In 1790, chief Kame`eiamoku of Maui and his Hawaiian warriors captured the schooner *Fair American*, companion vessel to the American merchant ship *Eleanora* (Captain Simon Metcalfe). Foreign gunners, muskets, swivel cannon, armed war canoes, and the *Fair American* itself soon proved to be important factors in the fierce battles to unify the Hawaiian kingdom, as Kamehameha I, a chief from the island of Hawai`i, sought to conquer the neighboring islands (Daws 2006). Imported technology and foreign advisors would continue to play an important role, until the demise of the kingdom in 1893.

At least 109 foreign ship arrivals were registered in the kingdom between 1790 and 1820 (Judd and Lind 1974). The first formal Protestant mission, organized by the American Board of Commissioners for Foreign Missions, arrived in Hawai`i on the ship *Thaddeus* in 1820. The *Thaddeus* was actually preceded by one year by the first whaling ships and whaling crews to arrive in Hawaiian waters, the New England vessels *Balena* and *Equator* (Starbuck 1878). The landscape of Honolulu came to reflect subsequent social and economic transformations, soon populated with grog shops, churches, printers' shops, and ships' chandlers (supplies).

6.1. 19th Century Hawaiian Fleets

The introduction of European-style vessels had immediate impacts in the islands (Daws 1968). Schooners and brigs were much larger than many of the Hawaiian canoes, and capable of carrying more people and goods between the islands. Foreign ships brought about changes in transportation, trade, and also in the military. By 1810 Kamehameha I ultimately succeeded in unifying the islands under a single ruler, the first to do so (Kamakau 1961). This unification was accomplished mainly by force, with armed war fleets (Thomas 1983). Following this period of internal strife, Kamehameha and his chiefs then promoted the purchase, as well as the construction, of foreign-style vessels.

Profits from the provisioning trade gave the chiefs of Hawaii the ability to build and also to purchase foreign-style vessels (Johnston 2015). Many foreign sandalwood merchants, aware of this desire, traded vessels that were far past their prime, in lieu of cash (Mills 2000). Dr. Peter Mills, in his article titled "Bridging the Gap between Ship and Shore: exploring the relationships between Western maritime culture and the people of Hawai`i," provides an annotated inventory of over 35 Hawaiian-owned foreign-style ships, brigs and schooners (Mills 2000).

Owning watercraft of foreign design became an aspect of political conquest, chiefly status, large-scale transport of people between islands, and the collection of chiefly tribute--particularly in sandalwood (Johnston 2015). Furthermore, these vessels facilitated the Hawaiian chiefs' entry into World Systems trade networks, sailing to the Pacific Northwest, California, Central Polynesia, Melanesia, and Canton (Mills 2000).

6.1.1. Implications for the SCR Inventory

Early vessels of the Hawaiian Fleet have been discovered; the brig *Ha`aheo o Hawai`i*, lost on April 6th 1824, is the second oldest shipwreck to be discovered in the Hawaiian Islands (Table 7). The historical and archaeological potential for shipwrecks of this period of social change in the islands may feature multiple or cross-cultural interpretations. Dr. Paul Johnston's study of King Liholiho's (Kamehameha II) brig *Ha`aheo o Hawai`i* (formerly *Cleopatra's Barge*) highlights this type of multicultural interpretation (Johnston 2015). Vessels which cross the cultural divide must, therefore, be interpreted from two different cultural perspectives in their construction, modification, and use.

6.1.2. Associated Inventory Sites

Table 7: Highlighted entries for the Hawaiian fleet period

SCR Record Number	Highlighted entry vessel name	Notes
323	*Ha`aheo o Hawai`i*	Early Hawaiian fleet (*Cleopatra's Barge*) excavated by Smithsonian Museum, Hanalei Bay, Kaua`i
801	*Kahalaia*	Early Hawaiian fleet vessel, possibly corresponds with the "8-cannon" site identified on Kaua`i

6.1.3. Project Summaries

In 1995 Dr. Paul F. Johnston, curator of maritime history at the Smithsonian Institution's National Museum of American History in Washington D.C., began his first season of survey work in Kauai's Hanalei Bay, searching for the remains of *Ha`aheo o Hawai`i* (formerly *Cleopatra's Barge*), an American brig built as a luxury yacht by George Crowninshield, Jr. at Salem, Massachusetts in 1816. The ship, 100 feet long on deck and lavishly fitted out, had been sold to Kamehameha II in 1820 for 8,000 piculs of sandalwood. The brig soon went into interisland service, conducting the royal court between locations throughout the kingdom. After four seasons of hydraulic removal of the sand overburden, thousands of Hawaiian, Euroamerican, and Chinese artifacts were recovered, conserved, and have been returned to the island of Kaua`i for exhibition (Johnston 2015). The entire project is described in Johnston's 2015 work *Shipwrecked in Paradise:* Cleopatra's Barge *in Hawai`i* (Texas A&M University Press).

First reported by a local diver on the island of Kaua`i in 2004 to NOAA staff, the unidentified wreck site of a possible interisland sailing vessel was surveyed informally by NOAA Maritime Heritage Program and East Carolina University maritime archaeologists in 2005. The site was "rediscovered" by another local diver in 2009. The wreck site lies outside Nawiliwili harbor within a turbulent rocky cove. The site consists of multiple cannon, anchor, iron ballast, and encrusted debris. All features are attached firmly to the coralline-covered rocky bottom. Informally known as the 8-cannon site, the variety of older cannon styles and their

Figure 28: Cannons (RN832) covered by concretion amidst site debris, Kaua`i 2005. (NOAA ONMS)

distribution and lack of carriage hardware indicate that these may have been carried as ballast in a wooden sailing vessel (Figure 28). Correlation between historic loss reports and the type of artifacts and location suggests (but does not confirm) one possible identification for the cannon site as the *Kahalaia* (RN801), a local schooner in the interisland trades between 1840-41. The vessel *Kahalaia* was reported wrecked outside of Nawiliwili Harbor on Kaua`i in July 1841 (Thomas 1982). A formal survey of the site is still pending.

6.2. Pacific Whaling Activities

Whaling was the United States' first truly global industry, driving the early economy and diplomacy of the country and spreading American influence and interests across the Pacific, from Australia's shores to Pacific islands, the coast of Asia, and into the Arctic (Starbuck 1878; Dolin 2008; Barr et al 2017). As an American maritime presence grew with the shifting of its principal whaling fleet into Pacific waters, the US government responded with the creation of the Pacific Squadron (Johnson 1963). This was part of a desire to make the Pacific "a vast American lake, the bridge to the wealth of the Far East from trading and whaling" (Dudden 1992). By the 1820s, American whalers had spread into the Central Pacific and were exploring for new whaling grounds. Ships not only needed provisions, they needed crews; whaling captains constantly needed to recruit for labor.

Hawaiians quickly adapted the skills necessary to sail and work foreign vessels, and many young Hawaiian men found employment on board whaling vessels, venturing for the first time in hundreds of years, beyond the waters of the Hawaiian Kingdom. Dr. David Chappell refers to this period as a "second diaspora" of renewed native Hawaiian travel throughout the Pacific on Euroamerican ships (Chappell 1997). (According to Chappell, the first diaspora consisted of the initial discovery of the islands by Polynesians, and the third is now possible through modern migration on airliners.)

6.2.1. Pelagic and Shore Whaling in Hawaiian Waters

Whalers hunted many types of marine mammals for their oil, but not all were equal in terms of potential profits. The 1819 appearance of American whalers in the Hawaiian Kingdom was soon followed by the critical discovery of the sperm whale fishery on the Japan grounds by Captain Joseph Allen of the American whaler *Maro* in 1820, located to the west of the Hawaiian archipelago (Starbuck 1878). The greater profits from the lucrative spermaceti oil, which produced a much purer light and finer lubrication, quickly drove the expansion of the whaling industry to new heights (Dolin 2008). Increased whaling traffic put more and more pressure on

the small harbors and shipyards of the islands. Whalers at Honolulu and Lahaina were mainly transshipping cargo, resting their crews, loading provisions, and paying off or recruiting sailors for voyages (Ellis 1991). Some open ocean whaling did occur near the Hawaiian Islands, though the major whaling grounds were elsewhere.

This seems strange, given the thousands of humpback whales that today migrate annually from their feeding grounds in the Gulf of Alaska to their calving grounds in Hawaiian waters. Researchers have speculated that this whale migration may be a relatively modern phenomenon. Hawaiians themselves are not known to have conducted active whaling, though beached whales were a valuable resource. Examination of Hawaiian myths, traditions, rituals, petroglyphs, language, and early 19th century articles fails to yield specific evidence of any major humpback whale annual migration prior to the 19th century (Herman 1979). Shore whaling stations were established in Hawai`i as early as 1847, and existed through the 1870s, when declines in oil prices drove the small industry out of business (Lebo 2010). At its peak there were upwards of a dozen shore whaling establishments operating on at least four islands: O`ahu, Maui, Kaho`olawe, and Hawai`i (Figure 29). Despite the possible lack of major whale populations in the immediate island vicinity, whaling vessels were bound for the islands in the hundreds. Fresh food, a warm climate, and hospitable population in Hawai`i made extended whaling voyages of two to three years possible for New Englander sailors far from home.

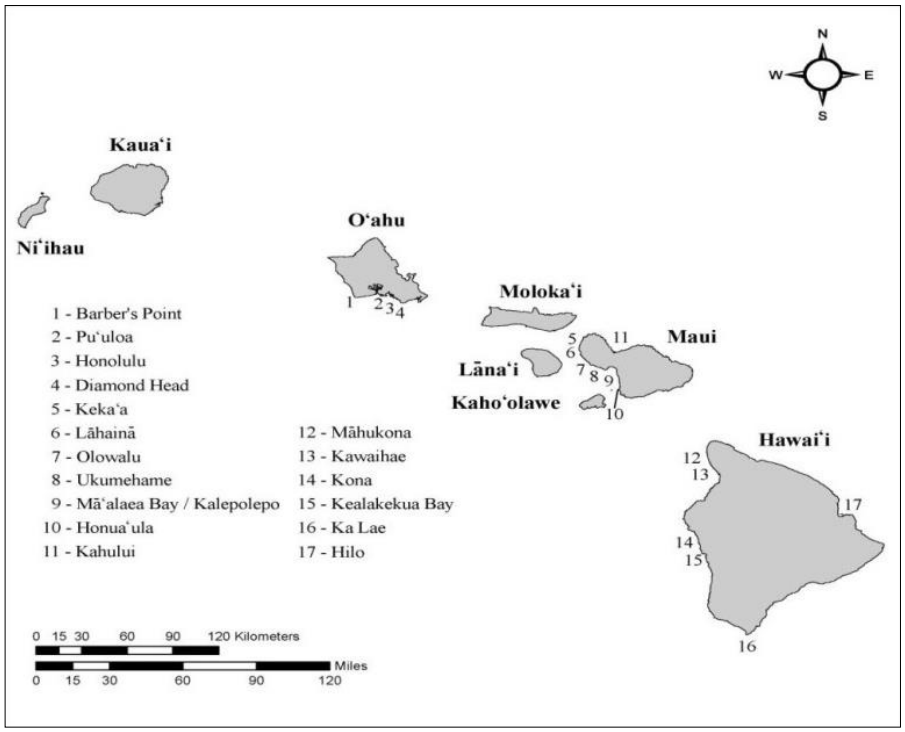

Figure 29: Places of whale sightings, shore and bay whaling in Hawai`i during the mid-19th century. (Kahahane in Lebo 2010)

6.2.2. Impacts of Pacific Whaling

Figure 30: The *Charles M. Morgan*, last surviving 19th century whaling vessel, at Mystic Seaport Museum, CT. (NOAA ONMS)

American vessels came to dominate Pacific whaling grounds, and particularly the sperm whale fishery, towards the mid-19th century (Figure 30). For Hawai`i, whaling helped shape the kingdom's political and economic development during the young nation's formative years, particularly with legislative efforts aimed at both protecting its domestic labor force and ensuring economic development (Lebo 2013). Where 60 whalers had called at the islands in 1822, almost 600 were annually making port by 1845 (Starbuck 1878; Judd and Lind 1974). This increase resulted in large numbers of young Hawaiian men sailing abroad for shares or wages, and many did not return. Hawaiian communities sprang up in British Columbia and the Pacific Northwest, and in New England (Koppel 1995). Recruitment levels were so high, that at one point Hawaiians and other Pacific Islanders (*kanakas*) comprised more than one-fifth of the entire American whaling fleet (Chappell 1997). By the 1830's the Hawaiian Government was forced to enact bonds and regulations in an effort to assure that whaling captains returned young men to the islands (Lebo 2010).

Native Hawaiians also formed a key part of the fleet of the Hudson's Bay Company, especially on the coastal voyages as well as regular trade trips by Company ships carrying lumber and salmon from the Pacific Northwest to Hawai`i (Koppel 1995). Salt Spring Island in particular, one of the Gulf Islands between mainland British Columbia and Vancouver Island, featured a large overseas Hawaiian community.

6.2.3. Implications for the SCR Inventory

All of this activity has left an imprint on the maritime landscape of the islands. Historic documents record at least 20 whaling ships that met their ends in the main Hawaiian Islands.

- *Tamerlane* 1892 (Hawai`i),
- *Jefferson* 1842 (Kaua`i),
- *Young Hero* 1857 (Maui),
- *Paulina* 1860 (Maui),
- *Drymo* 1845 (Maui),
- *Lyra* 1830 (Maui),
- *John P. West* 1892 (Moloka`i),
- *Helvetius* 1834 (O`ahu),
- *Oscar* 1838 (O`ahu),

- *Paragon* 1828 (O`ahu),
- *Catherina* 1834 (O`ahu),
- *Tobaco Plant* 1849 (O`ahu),
- *Charles Drew* 1850 (O`ahu),
- *Marquis de Terenne* 1855 (O`ahu),
- *Royal George* 1825 (O`ahu),
- *Helvetia* 1856 (O`ahu),
- *Mercury* 1849 (O`ahu),
- *Nauticon* 1856 (O`ahu),
- *Winslow* 1858 (O`ahu).

The database contains complete details on these whaling vessel losses. Specific wreck sites for these have not yet been identified, though divers have, in the past, reported scattered finds of bricks and even try pots and other equipment near the harbors of Honolulu and Lahaina. Frequently, 19th century whalers would break apart the oil-soaked brick try works on their decks following a successful voyage, as their oil-soaked bricks became a fire hazard (Lytle 1984).

Whaling shipwrecks from this period have not been located in the main Hawaiian Islands, though early whalers were lost there (Table 8). The only discoveries of this type in the Hawaiian archipelago have been made in the northwestern atolls. Due to the intensity of whaling activities, of re-provisioning and transshipment and repair during the 19th century, it is likely that there are associated resources and features in Hawaii's waters that have yet to be discovered. If such features are located, they could be significant if the wreck sites retained historical or archaeological information.

6.2.4. Associated Inventory Sites

Table 8: Highlighted entries for the whaling period

SCR Record Number	Highlighted entry vessel name	Notes
851	*Royal George*	Very early wreck, whaler lost 1825 (one of the oldest wrecks in the islands)
846	*Marquis de Terenne*	French whaler lost near O`ahu

Pacific whaling vessels during this period consisted of a variety of stout built barks, brigs, schooners and ships. For whalers, though, it was not necessarily the vessel construction or type of rig (sails) that set them apart. All whalers, however, relied upon a common set of modifications and equipment or "whalecraft" carried on board in order to catch and process whales at sea, and that is what distinguishes them as a class (Lytle 1984). Whalers featured multiple heavy boat davits for carrying and launching whaleboats; weather deck try works built from bricks to boil or "try out" the whale oil; large iron try pots for the try works; heavy iron blubber hooks for heaving the product over the sides; a specific set of harpoons, lances, flensing knives; gallows frames for storage of the additional spars and tools, etc. In the archaeological context, these possible associated resources and features are more likely to be artifacts carried on board rather than the vessel itself.

6.2.5. Project Summaries

Historic documents indicate ten 19th century British and American whalers lost among the low uninhabited atolls, islands and reefs within the modern-day Papahānaumokuākea Marine National Monument. Five of these have been located and surveyed during NOAA research missions in the Monument: *Parker* (Kure Atoll), *Pearl* (Pearl and Hermes Atoll), *Hermes* (Pearl and Hermes Atoll), *Gledstanes* (Kure Atoll), and *Two Brothers* (French Frigates Shoal). Survey reports for whaling sites in the Northwestern Hawaiian Islands are located with NOAA's Maritime Heritage Program (Maritime Heritage Program 2016). Local divers in the 1970's made informal reports of whaling artifacts scattered in the historic anchorage area outside Honolulu Harbor; these have not yet been confirmed.

6.3. Early Harbors in Hawai`i

Hawai`i has always been a maritime location, and yet Hawaiian deep sea and coastal sailing and paddling canoes, well suited to their environments, had no need of extensive coastline infrastructure. The need for harbors and protected shipyards increased with the boom in vessel traffic following the expansion of Pacific whaling during the 19th century (Thomas 1983). In the early years, there were no truly protected wharves or natural basins where ships could anchor in safety and put people and cargo ashore. Open roadsteads, sheltered areas where vessels could lie at anchor close to shore, and open-beach surf landings, were the norms for the transport of both passengers and products. The development of protected harbors, reflecting different periods and activities, is an expression of the consolidation of maritime activity during the economic and technological changes of the 19th and 20th centuries (Karmon 1980). The reshaping of our modern coastline testifies to our need for maritime infrastructure (Figure 31).

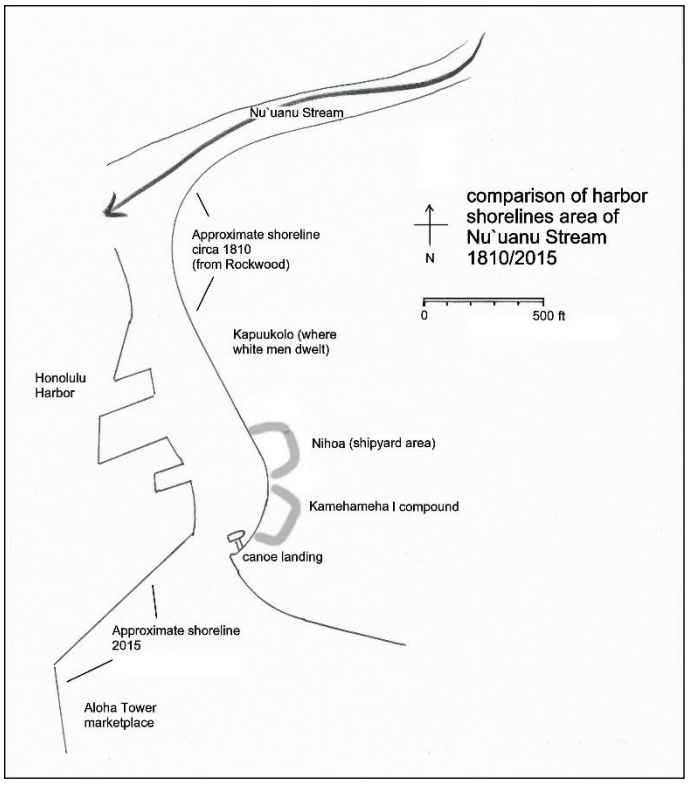

Figure 31: Comparison sketch of Honolulu Harbor shorelines 1810-2015 (first wharf at canoe landing). (NOAA ONMS)

6.3.1. Honolulu

Honolulu Harbor, today the state's main commercial port on the south shore of O`ahu, owes its beginnings to natural selection. Originally the fresh water and sediments from Nu`uanu stream entered the sea where the harbor is today and inhibited coral growth, leading to the natural formation of a large coastal basin within the fringing reef from 7 to 11 m (24 to 36 ft) depth and good holding ground in the rough coral sand. A narrow channel through the coral reef 1.2 km (0.75 mi) in length gave access to the protected basin (*Pacific Commercial Advertiser* 1857).

Captain William Brown of the English ship *Butterworth* was the first European to survey and anchor in the harbor in 1795, which he named "Fairhaven" (Daws 2006). Previously, ships calling at the Sandwich Islands anchored further east at Waikīkī Roads, where local canoes lightered cargo ashore through the surf (*Pacific Commercial Advertiser* 1857). Foreign preference for the deep-water protected harbor, known to Hawaiians as *Ke Awa O Kou* or "harbor of Kou," shifted the location of burgeoning commerce. King Kamehameha moved his Waikīkī residence closer to the harbor, in order to tighten control on the valuable sandalwood trade (Historic Hawai`i Foundation 2016).

In 1825 the harbor gained its first wharf, consisting of a sunken ship placed at the foot of Nu`uanu Avenue (Hawai`i State Department of Transportation 1997). James Robinson, a survivor of the wrecked British whaler *Hermes*, founded the first shipyard in Honolulu in 1827. Robinson and his shipmates had fashioned a schooner on the beach of a distant atoll and, upon completing the rescue voyage, sold the boat, using the proceeds to open the first foreign shipyard of the kingdom (Young 2012).

Merchants, ship chandlers, and tavern owners converged on the harbor, driving an economic boom in trade and in provisioning and outfitting ships. The harbor provided an endless supply of good water, salt beef, pork, flour, potatoes, and firewood (Hawai`i State Department of Transportation 1997). Subsequent harbor improvements included the steam tug *Pele* for hauling vessels through the narrow channel, and the arrival of a steam dredge for the construction of new wharves (Young 2013a). The harbor became the center of all business, industry, and agricultural activity (Figure 32).

The economic and strategic importance of Honolulu and Hawai`i was also clear to naval planners. In 1860, following the agreement to lease the land from the Kingdom, the US Navy established a coaling station at Honolulu harbor, which eventually became known as Naval Station Hawai`i (NHHC 2015a). Improvements by the Navy were soon underway at nearby Pearl Harbor, and by 1921, the harbor returned to its purely commercial role, enhanced by increased maritime traffic through the Panama Canal. Soon piers, turning basins, marine railways, and warehouse facilities expanded. During the plantation era the harbor was the agricultural lifeline with the continental US. Honolulu shifted from breakbulk cargo to containerized services early on in the marine transportation revolution (Karmon 1980). Today Matson ships, as well as tugs and barges, continue to serve the state's principal city and port (Hawai`i State Department of Transportation 1997).

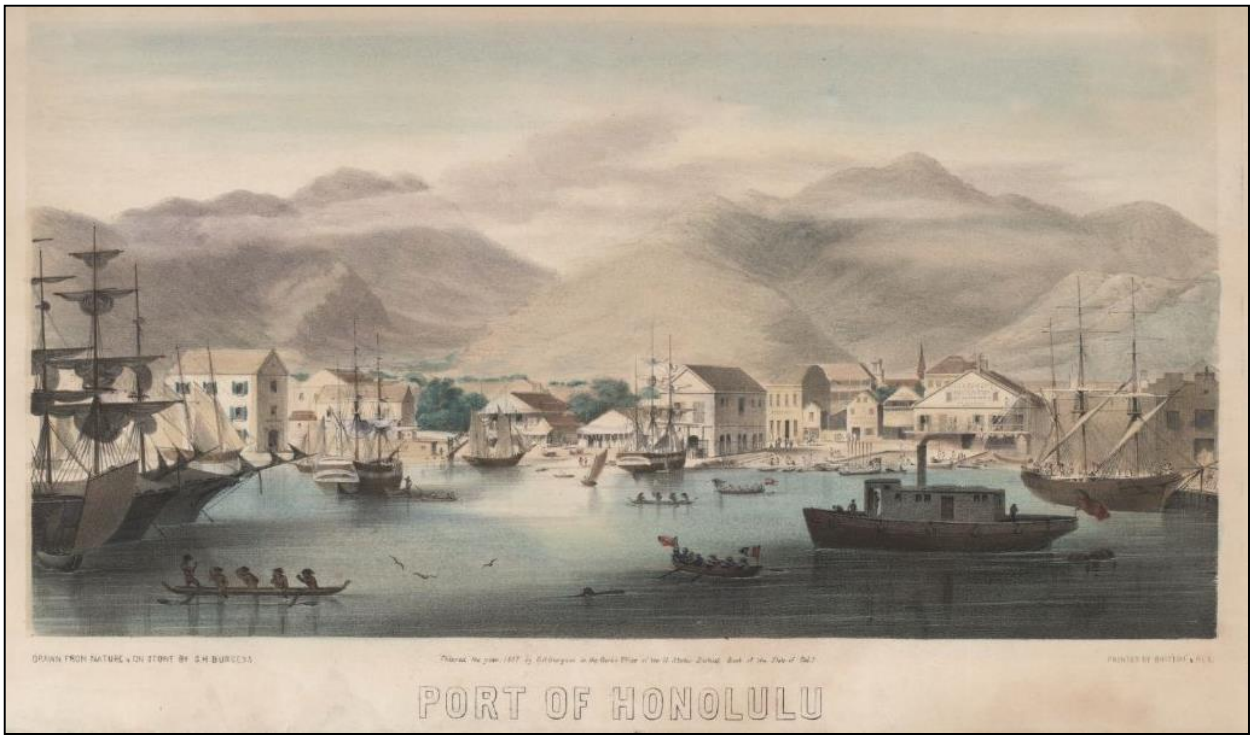

Figure 32: Lithograph by George Henry Burgess, Port of Honolulu 1857. (UC Berkeley Bancroft Library, Robert B. Honeyman Jr. Collection)

6.3.2. Hilo

Hilo Bay, the ancient location of Waiākea village, was partially protected by a natural reef, though when Captain Vancouver surveyed the potential anchorage in 1794 he still found the surf too strong for safe landing, and declared the location marginal at best (Young 2013b). Whalers, missionaries, and merchants became increasingly more active through the years, until finally in 1863 a wooden wharf was built to facilitate ship-to-shore movement. This was replaced in 1865 by an iron-piling wharf, and extended in 1890. It was not until 1908 when the increasing demands of the plantation owners necessitated the construction of a protective breakwater, built over Blonde Reef, a natural reef surveyed by HMS *Blonde* in 1825 (Clark 1985). Construction was completed in 1929.

6.3.3. Lahaina

The location of Lahaina truly has an auspicious origin as the royal capitol of the Hawaiian Kingdom between 1820-1845, during the height of the whaling period in the islands (Clark 1989). Whaling ships frequented Lahaina in large numbers, anchoring in the open roadstead, for its easy access to fresh provisions. The proliferation of grog shops and taverns led Lahaina to be called one of the "breathing holes of hell" (Kirk 2012). There were at least four documented sailors' riots, breaking out amidst the tension between Hawaiian authorities, disapproving missionaries, and drunken sailors (Hawaii Harbors 2016). The disruption caused by whalers ashore reached such a level that the Royal Governor of Maui, Hoapili, constructed the Lahaina

Fort in 1831 to protect the town. Whaling activity in the Pacific began to decline in the1850's, and Lahaina Fort was dismantled in 1854. Only a partial reconstruction of one wall exists today.

6.3.4. Kahului

The harbor of Kahului had a delayed beginning. Originally the area was the site of coastal fishponds and nearby *lo`i* (taro) terraces. In 1790 the shoreline along the *ahupua`a* ("mauka-to-Makai" or "mountain-to-sea" traditional Hawaiian subdivision of land management) of Wailuku (Kahului Bay) was the location of the major battle between Kamehameha's invading army and the Maui defenders during the unification of the Kingdom (Clark 1989). Unlike Honolulu, Kahului on the north shore of Maui, where the island's major harbor is today, was not originally the focus of outside contact. Lahaina, on the west side of Maui, was the nexus for foreign vessels, until agricultural production outstripped whaling efforts in the 1860's and plantation owners sought a port with access to the sugar fields on the fertile middle plains of the island. The first foreign-style building was constructed at Kahului in 1863; the first small landing was built in 1879 (Clark 1989). Though the emerging town of Kahului was burned to the ground in 1900 in order to eradicate an outbreak of the bubonic plague, plantation interests on Maui focused on the development of the harbor (World Port Source 2017). By 1910 and into the 1920's the US Congress and the Army Corps of Engineers had terminals, dock basins, breakwaters, moorings, buoys, and wharves well underway (Welch et al 2004).

Though protected sites for harbors are scarce in Hawai`i, several smaller locations for small boatyards serviced the islands. In addition to Honolulu, by the early 1800s, shipyards with foreign carpenters and blacksmiths had been established in (at least) Kawaihae, and Hanalei (Mills 2000). These played an important role in the Kingdom going through a transition from traditional to foreign-style ship construction. Possibly the largest locally constructed vessel was a brig built on Kaua`i around 1803. Kaumuali`i intended to use the brig to capture Kamehameha under the guise of a foreign merchant vessel, or to flee the islands. After 1805, the brig was not mentioned in any historical text, suggesting that it may have wrecked (Mills 2000).

6.3.5. Wire Rope Landings, Piers and Coastal Infrastructure

The lack of protected landings and safe harbors, combined with the need to service interisland commerce and burgeoning plantations and mills, led to the creation of numerous wire rope landings and beach piers (Dorrance and Morgan 2000; Quentin 1998). Wire rope landings often consisted of a mooring system for vessels in a small "dog hole" style bay (Figure 33). Ships would moor underneath the cable, which led from clifftop to ocean, and cargo could be lowered or offloaded by the overhead winch system directly into the hold. Variations included marine railways built on steep cliffs, operated by wire rope and winch platforms for on/offloading landed cargo (Hawaii Commission to Investigate Private Wharves and Landings 1910). Such vessel moorings were inevitably close to the sharp cliff rocks, and there is considerable correspondence between ship owners and plantation owners regarding the safety of the cable, number of service

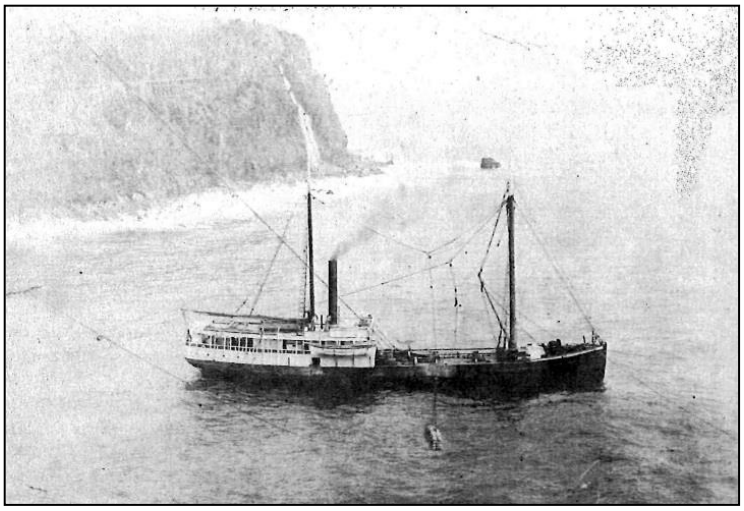

Figure 33: SS *Kaua`i* (RN375) moored and rigged to receive cargo from the overhead cable system, at Hakalau Landing on the Hāmākua coast, 1905. (Hawai`i State Archives)

hours, etc. Heavy chain and permanent iron anchors are still seen today, past elements of these harbor mooring systems. All of these sites put ships perilously close to the shore.

Numerous small piers, both wooden and iron pilings, were built directly from beaches into the back reef environment (Figure 34). Only small steamships and other shallow draft vessels were able to use these landings for passenger and cargo service (Thomas 1983). Equipment on the piers often included narrow gauge rail, steam winches, hoists and derricks, and firefighting gear. Several shallow water archeological surveys have been conducted on the ruins of historic pier and harbor locations in Hawai`i (Van Tilburg 2014, 2015). Many of these former wooden pier landings no longer show any surface trace of their location. Dives and preliminary surveys at these historic landing locations typically reveal anchors, anchor chain, pilings, bottles, loading equipment, derricks, and shore side concrete and wire hawser infrastructure associated with past plantation service.

Increasing vessel traffic also brought with it a greater need for aids to navigation, including range and channel markers, lighthouses and light structures, buoys and other visual aids (Thomas 1983). Seawalls, jetties, groins, and breakwaters are also familiar features of harbor and landing areas. While many of these structures are modern, their use in Hawai`i goes back at least 100 years. For instance, construction of the Kailua pier and its seawall on the island of Hawai`i began in 1900. The stones used here were recycled from ancient Hawaiian royal palace walls and gun-turreted forts (City-Data.com 2017).

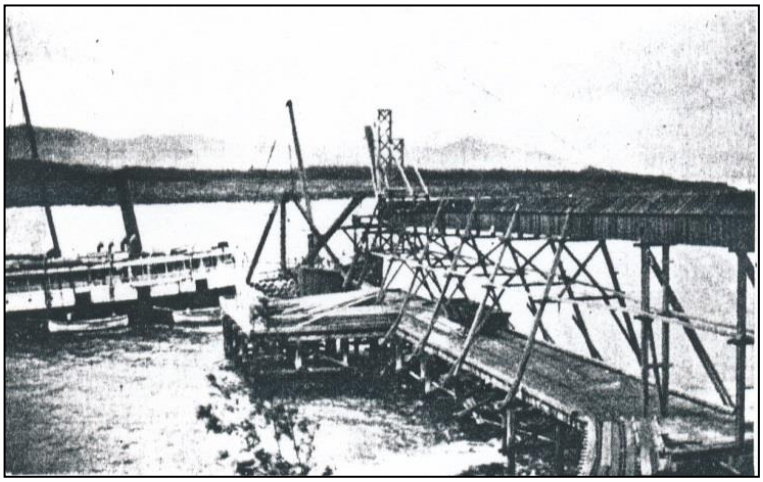

Figure 34: Ahukini Wharf on Hanamaulu Bay, coast of Kaua`i. (Private Wharves and Landings 1910)

The long period of use for these many types of local landings did not slowly transition out of service with the modernization of marine transportation, but came to an abrupt end during a period of duress. On January 28th 1942 the transport *General Royal T. Frank* (RN741), carrying

supplies for the military expansion of Hilo airport, was torpedoed by the Japanese submarine I-71 off the windward coast of Hawai`i Island (von Buol 2012). The transport went down in less than a minute, with the loss of all hands.

The sinking of the *Frank* had lasting consequences for interisland commerce. Every landing (not the ports) on every island was closed down "for the duration." Aircraft and barges took over interisland transport after the war. The sinking of the *Frank* signaled the end of a century of colorful interisland travel. The numerous primitive landings and piers on every island never again saw an interisland steamer anchored offshore as a whale boat propelled by a husky kanaka oarsman brought passengers and cargo to shore. A romantic era was brought to an ignominious end (Dorrance 1994). Appendix 1 provides a list of historic landing sites in Hawai`i.

6.3.6. Implications for the SCR Inventory

Harbors, piers, and landings are the focal points of all marine traffic from beyond the archipelago, between the islands, and from sea to shore. These locations, therefore, have the potential to influence distribution patterns of submerged cultural resources in both near shore and offshore waters. Maritime activities in Hawai`i have always been particularly active and intense, reflecting social, economic, and recreational pursuits (Thomas 1983).

Many near shore landing locations like wharves, quays and piers, served as a transportation focal point between ship and shore and, though subject to impacts from both the terrestrial and marine worlds, may have properties from both land and maritime activities. Maritime and non-maritime artifacts may frequently be mixed. Intrusive or infiltrated objects can occur in deeper water as well. The maintenance of larger harbors usually involves dredging and dumping activities (Blake 1994). As bottom sediments from near shore locations are moved and dumped further offshore, historic materials (out of context) can be deposited in the dredge spoils areas. Dredging and spoils dumping has the potential for both exposing and covering historic resources.

Further information for properties associated with harbors, wharves, and landings in Hawai`i can be found in multiple sources, including archaeological surveys, selected primary and secondary references, and online mapping data (c.f., Thomas 1983; Grace 1974; Hawaii Commission to Investigate Private Wharves and Landings1910; United States Hawaiian Commission 1898; Baldwin 1920; NOAA Office of Coast Survey 2017; and Office of Hawaiian Affairs 2017).

6.3.7. Project Summaries

With the completion of the Hawaiian Railroad in 1882, Māhukona on the island of Hawai`i (entry port for the Hawaiian Kingdom) became the primary transshipment point for all of the surrounding plantations (Van Tilburg 1997). The wreck of the SS *Kaua`i* (RN375), the submerged mooring system, and wharf and infrastructure remains at Māhukona, provide a glimpse of the plantation period which shaped our island society more than 100 years ago (Figure 35). In August 2012, UH MOP student divers, led by NOAA's Maritime Heritage Program staff, spent ten days surveying the wreck site and the industrial harbor. The ship went onto the reef in a late December storm in 1913, a total loss. The initial archaeological study was

completed in 1993 by East Carolina University's Maritime History and Nautical Archaeology Program (now known as the Maritime Studies Program), in collaboration with UH MOP. The 2012 survey provides a snapshot of how these wreck sites and their environment change over time. The survey also served as a training course in the methods of archaeology underwater. The wreck lies within the Hawaiian Islands Humpback Whale National Marine Sanctuary.

Figure 35: The Port of Māhukona, today an access point for ocean recreation. (NOAA ONMS)

In 1999 the UH MOP survey course conducted research at the beach site of the former Waimānalo Plantation landing on the island of O`ahu (Figure 36). Following the Treaty of Reciprocity in 1876, former ranching lands in Waimānalo were converted to sugar cane. Prior to the construction of any roads over the *pali* (cliffs), transportation was by small steamer to Honolulu (Thomas 1983). The beach landing served the nearby sugar mill, completed by plantation-owner John Cummins in 1881. The landing fell into disuse following World War II. The site of the former 180-m (600-ft) wooden pier, with associated steam winches, derrick, cargo and fire-fighting equipment, lies in the shallow waters of the bay.

Project records for both of these surveys are held by NOAA's Maritime Heritage Program and the University of Hawai`i Marine Option Program.

Figure 36: Sunken derrick at the former site of Waimānalo Landing. (NOAA ONMS)

7. Plantations and the Steam Era 1880-1940

Numerous causes contributed to the economic downturn in Pacific whaling in the 1850s and 1860s, including the depletion of whale stocks, the discovery of petroleum, and the maritime depredations during the American Civil War (Kuykendall 1953). The longhorn cattle that had been introduced to the islands by Captain George Vancouver in 1793 provided the basis for expansion of the ranching industry, particularly following the California gold strikes and the development of new markets for Hawaii's products (Whelan 1988; Henke 1929). However, foreign landowners in the islands foresaw a much larger potential for agricultural export: sugar.

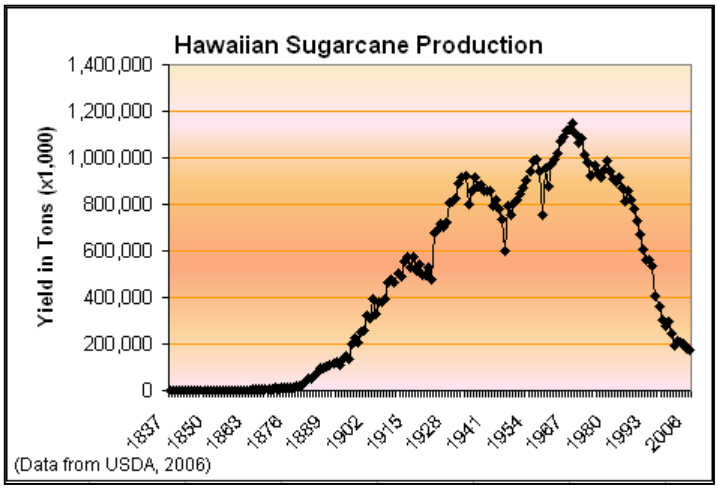

Figure 37: Sugar cane production in the Hawaiian Islands. (United States Department of Agriculture, National Agricultural Statistics Service 2006)

Experimental sugar mills and early small plantations had developed by the 1830s, but better conditions were still needed (Deerr 1949). Plantation economies needed land. The Māhele land redistribution enacted in 1848 had the effect of making many commonly held public lands available for purchase or lease by foreigners, and was crucial to the success of the burgeoning plantation economy (Kent 1993). Market expansion following the gold strikes and Civil War helped, and the removal of import duties to the United States following the passage of the Reciprocity Treaty of 1876 assured large profits to the plantation owners (Kuykendall 1967). This represented a brand new and highly profitable economic system for the islands, altering social, political, and economic realities (Figure 37). The imported labor force necessary for plantation systems would forever shape Hawaii's notably multicultural society.

7.1. Island and Continental Connections

Maritime commerce in Hawai`i, and in particular the popularity of steam navigation, was closely tied to the success of the major plantation owners, the "Big Five" companies as they came to be known in the islands (C. Brewer & Co., Theo H. Davies & Co., H. Hackfeld & Co., Castle & Cooke, Alexander & Baldwin). Following the Reciprocity Treaty, it became clearly profitable to operate and maintain steamship companies locally in Hawaiian waters as planters could make a complete commitment to the necessary interisland services (Thomas 1983).

The transition from sail to steam was gradual, for the early paddle-wheel steam vessels were ill-suited for the open ocean conditions of the islands' channels (Kemble 1942). It was not until the advent of improved designs of propeller-driven (screw) steamships with more efficient high pressure engines during the latter half of the 19th century, and in particular the arrival of the coastal steam schooner designed for servicing small bays and landings, that the transition to suitable and commercially successful steam navigation among the islands was complete (Froning 2007).

7.1.1. Tall Ships and Transpacific Contacts

Even as small interisland steam vessels were making inroads in Hawai`i, large sailing vessels continued to be commercially viable. In the early days of the transition to steam power, steamships simply could not carry enough coal for the long passage between Hawai`i and the continental United States. Later, large sail-driven commercial carriers with bulk cargo continued to prove more economically efficient over the longer Pacific Ocean passages (Gardiner 1993). The tall ships were a common sight for decades as steam engines slowly revolutionized marine transport (Figure 38).

Figure 38: Hawaii's museum ship *Falls of Clyde*, former Matson carrier to the West Coast. (R Schwemmer)

These "down easters" as they were sometimes known (for many had been built in eastern coastal New England, particularly Maine), and in particular the bigger iron and later steel-hulled commercial carriers, were familiar Pacific long-haul vessels, large enough to compete economically in the coal, grain, lumber, guano, salmon, jute, sugar and copra trades during the late 19th century (Gardiner 1993). Only a few of these wind-driven ships of the industrial age remain afloat as museum vessels today (*Star of India*, *Falls of Clyde*, *Balclutha* and others). The remains of many more rest on the bottom of the ocean (Table 9). The design of ferrous ships evolved over time as shipwrights gained experience in iron construction.

7.1.2. Implications for the SCR Inventory

Large sailing commercial carriers in the mid to late 19th century and afterwards were engaged in regional and global Pacific trade, and therefore played a significant role during this period when regional and global commerce shaped the social and economic setting of the Hawaiian Islands.

7.1.3. Associated Inventory Sites

Table 9: Number of ships, barks and barkentines in the inventory

Type	Description	Number
Ships	Large three-masted vessel with square-rigged sails on all masts.	8
Barks	A vessel of at least three masts which is square rigged on all, with the exception of the mizzenmast being fore-and-aft rigged.	17
Barkentines	Large three-masted vessel with square-rigged sails on the foremast only.	5

7.1.4. Project Summaries

Figure 39: Student divers mapping the *Ivanhoe* (RN798) site, Port Allen, Kaua`i 2007. (NOAA ONMS)

In 2005 UH MOP staff dove the wreck site of the *Ivanhoe* (RN798), at Port Allen, Kaua`i, known at that time by only a few local divers on the island. The iron-hulled Chilean-flagged three-masted bark dragged her anchors during a Kona storm at the port on the night of December 25, 1915 and quickly went to pieces. Two lives were lost and three men injured in the wreck. One-half of her cargo of nitrate from Valparaiso, some 600 tons, was lost (*Honolulu Star Advertiser* 1907). In 2007, an East Carolina University maritime field team, with photography assistance from NOAA's Maritime Heritage Program, completed a three-week baseline trilateration survey of the wreck site (Figures 39-40). The wreck is located in the very rough surge zone of the seaward corner where the harbor's breakwater meets the rocky coastline. Access is difficult, and visibility limited. Large portions of the iron hull, frames, keelson, and rounded transom stern are flattened down to the hard bottom coral substrate. Numerous deadeyes and ports, capstan, rigging elements, and other topside artifacts are scattered around wreck site (Van Tilburg 2011).

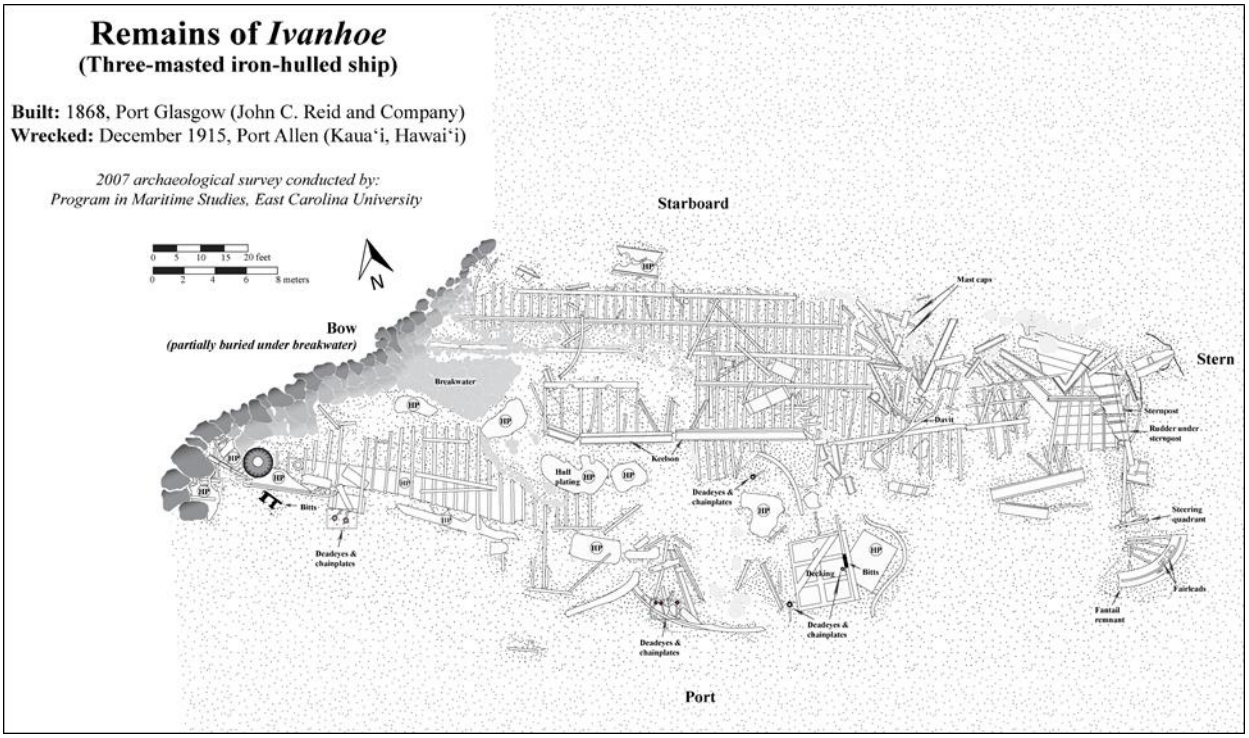

Figure 40: Site map of the bark *Ivanhoe* (RN798) wreck. (Nathan Richards and John Wagner—Program in Maritime Studies, East Carolina University)

7.2. Local Plantation Steamboat Fleet

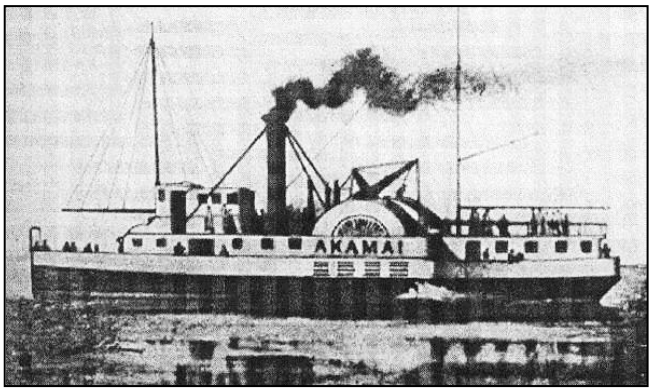

Figure 41: The early sidewheel steamer *Akamai,* wrecked, rebuilt, and (as the schooner *Mahimahi* RN410) lost at Waialua, O`ahu 1894. (Hawai`i State Archives)

Initially, the successful commercial transition to steam propulsion was slow. The first steamer to attempt to operate permanently from local Hawaiian waters, the American twin-screw steamer *Constitution*, arrived at Honolulu on January 24th 1852 (Kemble 1942). The unwieldy vessel made only one round trip to Lahaina, before returning to the continent. The following year the *S.B. Wheeler* (renamed *Akamai*), arrived in the islands. The *Akamai* (RN410) was built in Maine, shipped in parts around Cape Horn, and re-assembled in Benicia, California (Figure 41). The small side-wheeler was unsuited to the rough channel passages between the islands, though, and found better employment as a tug for sailing ships through the narrow channel at Honolulu Harbor from 1854 to 1857 (Thomas 1983).

The economic viability of large plantations increased the need for interisland services, and this fortunately coincided with the evolution of more efficient steam propulsion. By the late 19th century, double compound engines had evolved into triple compound engines, and improved cylindrical Scotch boilers provided higher more efficient steam pressure (Griffiths 2001). Small hard-working steam schooners, single-screw double-masted vessels with cargo holds amidships and bridges aft above passenger staterooms, were adopted as most suitable for island waters. Some maritime historians identify the origin of these steam schooners with the lumber trade in California, while others find their forebears in the Great Lakes (Froning 2007).

7.3. Local Steamship Companies

In response to these increased needs, three local steamship companies soon emerged as corporations: Wilder Steamship Company founded by Samuel G. Wilder, Inter Island Steam Navigation Company founded by Thomas R. Foster, and the Pacific Navigation Company founded by Amos F. Cooke (Kemble 1946). Pacific Navigation experienced costly setbacks due to a number of shipwrecks, and folded in 1888. The other two, Inter Island and Wilder, dominated the island scene, operating in friendly rivalry for more than two decades. Wilder Steamship Company serviced Maui and the windward ports on the island of Hawai`i, while the Inter Island Steam Navigation Company handled the island of Kaua`i and the Kona, Ka`u, and Hāmākua ports on the island of Hawai`i (Thomas 1983). In 1905 the two companies were joined under one management, resulting in a single Inter Island Company fleet of 14 steam vessels: *Maunaloa, Ni`ihau, Mikahala, W.G. Hall, `Iwalani, Keauhou, No`eau* (RN812), *Kinau, Claudine* (RN548), *Maui* (RN428), *Helene* (RN539), *Kai`ulani, Likelike* (RN402), and *Lehua*. The fleet was later enlarged by the purchase of the *Hawai`i* and *Hornet* (RN829) from the Hawaiian Meat Packing Company in 1926 (Thomas 1983). All of these hard working ships, familiar sights

among all of the Hawaiian Islands, formed the backbone of interisland freight and passenger transportation.

In the 1920's and 1930's large steamships brought a new type of visitor to the islands, tourists (Kemble 1959). Hawai`i began to earn a reputation as an exotic vacation hideaway, marketed through radio broadcasts and celebrity vacations, which fitted well with the type of luxury passenger liners plying the sea-lanes between Honolulu and the West Coast. The arrival of steamships gave local residents a break from the agricultural routine and an excuse for boisterous harbor events known as "Boat Days," a celebrated theme on the waterfront (Historic Hawai`i Foundation 2012). Those carefree days came to an end on December 7th 1941.

Inter Island Steam Navigation Company vessels went into active wartime service immediately following the attack on Pearl Harbor (Welty 1946). The corporation grew into a diversified overseas terminal, ship repair and hotel business (also spawning Inter Island Airways, which later became Hawaiian Airlines), but by 1950 the local Hawaiian steamship operation had become unprofitable and was discontinued. The surviving Inter Island vessels were either run aground, dismantled, or sold at auction and scattered around the world (Thomas 1983).

7.3.1. Servicing the Plantations

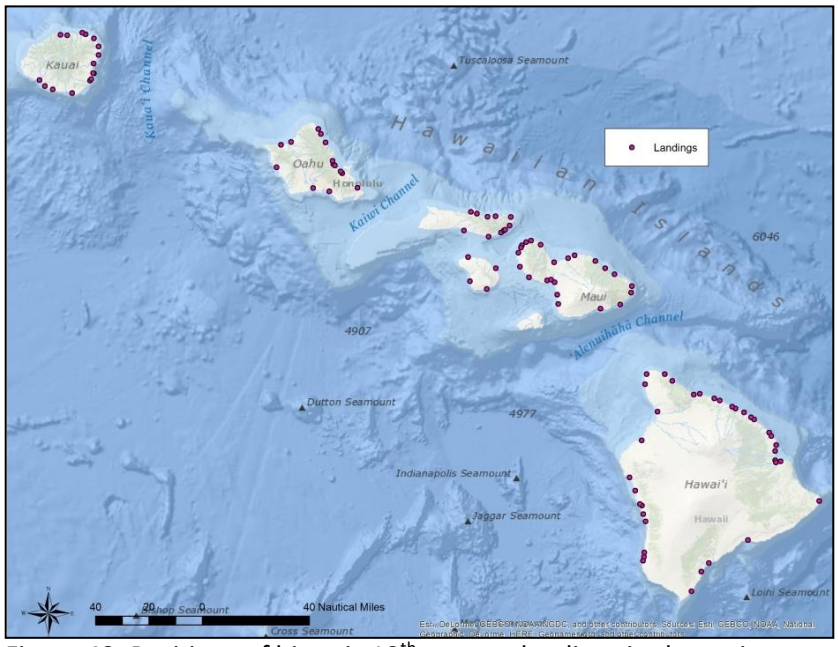

Figure 42: Positions of historic 19th century landings in the main Hawaiian Islands. (NOAA ONMS)

By 1884, some 60 sugar mills were scattered around five main islands, these serviced by dozens of small private landings (Figure 42). Regular service to these many small landings was divided between Wilder Steamship Company and Inter Island Navigation Steamship Company. The local steam fleet, therefore, linked all agricultural exports, passengers, and freight with the larger ports of Honolulu and Hilo. From there larger shipping companies took over. A young William Matson emigrated from Sweden to New York in 1863, and by 1882 he had founded the Matson Navigation Company, providing service Pacific-wide, mainly to-and-from the Hawaiian Islands (Worden 1981).

The list of 105 historic landings (beach, early harbor, wharf, wire rope, etc.) can be found in Appendix A: Historic Landing Locations in the Hawaiian Islands.

With the increasing commercialization during plantation period, these many small landings, along with the few harbors, became central nodes of maritime activity in all aspects of the plantation life over the century between 1840 and 1940, connected by regular steamship service between the islands (Figure 43).

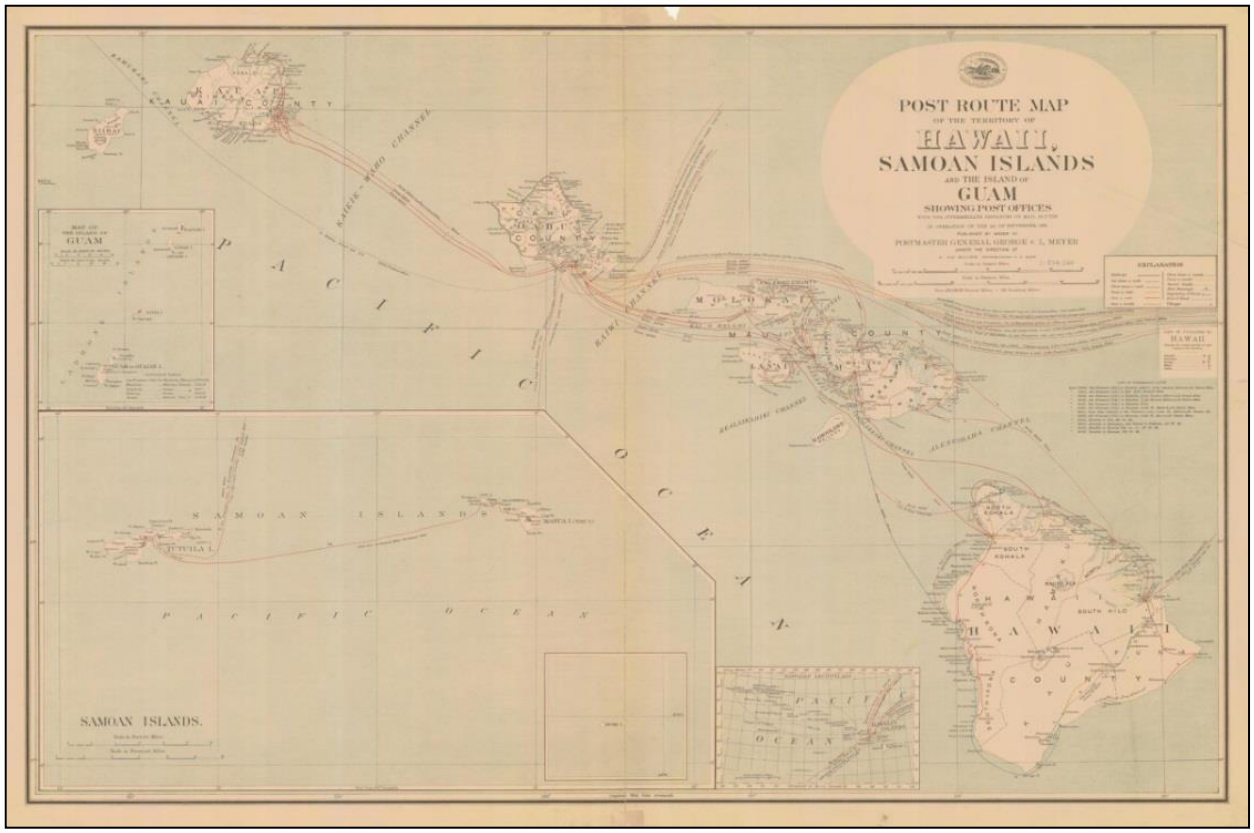

Figure 43: Postal map of the Hawaiian Islands 1908, showing regular steamship landing locations. (NOAA OCS)

7.3.2. Ranching in Hawai`i

The plantation period in Hawai`i, which was approximately 1840-1940, should really be referred to as the plantation *and ranching* period. Both industries arose under similar historical circumstances; both needed large amounts of land; both exported their products to the continent; and both depended on maritime transport for commercial success.

In February 1793, Captain George Vancouver presented long horn bulls and cows (as well as two ewes and a ram) to Kamehameha I, who originally protected them from hunting by *kapu* (prohibition) until 1830. With no natural enemies on the islands, these cattle soon went feral and flourished on the rocky lava slopes and cooler uplands of Hawai`i, O`ahu, Maui, and Kaua`i. By the mid-19th century, there were roughly 35,000 to 40,000 head of cattle (Whelan 1988). There were also some 11,700 horses in the kingdom, the first having been brought to Hawai`i on the vessel *Lelia Byrd* in 1803 (Henke 1929). In 1832 the King invited three *vaqueros* (Spanish cowboys) from Mexico to teach Hawaiians how to rope and work the cattle. The Hawaiian

ranching traditions, then, are distinctive, as their formative influences came from Spanish *vaqueros*, rather than those of the later American West (Whelan 1988). With the increasing market for beef following the California gold rush, the ranching period in Hawai`i was born.

The only obstacle to commercial ranching among the islands was getting the cattle from the neighbor island ranches to Honolulu for transshipment to the continental United States. With the general lack of harbors in the islands, *paniolos* (Hawaiian cowboys) learned to rope and ride cattle directly into the surf, where their horns were lashed to beams extending outboard from the whaleboats. Then the cattle were rowed/towed out to the awaiting steamers, where they were hauled out of the water by nets, and dropped onto the crowded decks (Thomas 1983). Special saddles had to be constructed to withstand the continual salt-water dunking. Steamships specifically designed as cattle boats serviced the ranching industry. Today the cattle are shipped by modern steel containers.

Several notable sailors and captains in the early years realized the opportunities that ranching presented and founded major cattle operations, such as Captain John Palmer Parker at Parker Ranch on Hawai`i, and Captain James Makee at `Ulupalakua Ranch on Maui (Parker Ranch 2017; Ulupalakua Ranch 2017).

7.3.3. Shipwreck Beaches

Figure 44: Navy tanker *YOGN-42* (RN785), a hulk near Shipwreck Beach, Lāna`i. (NOAA ONMS)

The north shore of Lāna`i is unique, for among the many kilometers of coastline surrounding the islands of Hawai`i there is one particular area that possesses by far the greatest share of historic wrecks from the days of sail and steam. The rough and treacherous north shore, particularly within the *ahupua`a* or traditional Hawaiian land divisions of Paoma`i and Mahana, features the wrecks of many interisland steamships (NOAA Office of National Marine Sanctuaries 2009). This area is also known locally as Shipwreck Beach. The six-mile stretch of lava rock and sand today features opportunities for hiking, fishing, and photography. Many people visit the eastern end of Shipwreck Beach to see the hulk of the *YOGN-42* (RN785), a navy fuel barge upright and locked in the reef near Pō`aīwa (Figure 44). However, regarding the many other historic shipwrecks, there is little historical documentation currently available.

In a very real sense, the forces of wind and current have conspired to make Lānai's north shore the ship's graveyard of Hawaii's maritime past. The strong prevailing trade winds blowing east-northeast across Hawai`i are funneled through the gap between the islands of Moloka`i and Maui (NOAA National Marine Sanctuaries 2009). Lānai's north shore lies immediately downwind from this gap. Vessels emerging from the wind shadow in either direction are struck by the sudden gusts and the rough conditions of the channel, and find themselves facing a lee shore.

Any ships cast loose from their moorings at Lahaina, Maui, will drift quickly onto Lānai's reef. These conditions along the Kalohi Channel also allowed 19th century steamship owners to dispose of aging vessels simply by releasing them near Lānai's shore (Thomas 1983). The stripped hulks would beach themselves, rather than remain adrift as navigational hazards. Deposition at Shipwreck Beach reflects a combination of accidental shipwrecks and intentional

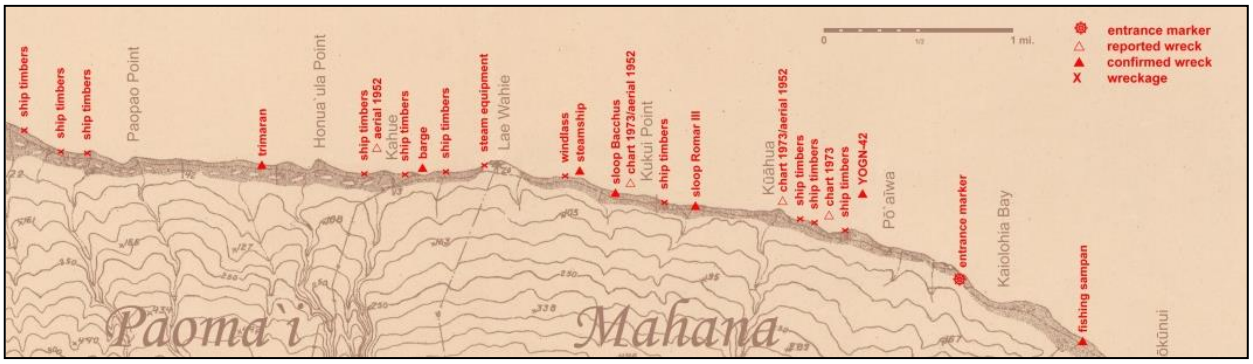

Figure 45: Site map excerpt developed for MAST 2009, Shipwreck beach, Lāna`i. (NOAA ONMS)

groundings (Figure 45).

7.3.4. Implications for the SCR Inventory

The transition to steam from sail changed the character and pattern of maritime activities in Hawaiian waters. Though sail did not vanish overnight, the capacity, speed, and regularity of steam service came to dominate interisland transport (Kemble 1946). Steamship wrecks can be representative of such technological and commercial transition periods as in 19th century Hawai`i (McCarthy 2000). Several submerged steamship wreck sites have been surveyed in the main Hawaiian Islands (Van Tilburg 2014). Whether sailing schooner or steamship, interisland vessels operated in a trade hazardous to both life and property. With the exceptions of Honolulu (O`ahu), Hilo (Hawai`i), and Kahului (Maui), there were no protected wharves where ships could lie in safety in all weather. Open roadsteads and narrow passages between fringing reefs were the usual condition, and often the skillful use of surfboats or elaborate moorings and overhead wire systems were the only way to transport both passengers and products (Quentin 1998). In other words, these landings functioned as a kind of ship trap, and a survey of the hundreds of shipwrecks in Hawaii's past reveals clusters of such wrecks at the landing locations (Gould 2000). The challenge today, as obvious traces of many of these landings have vanished, is to relocate and investigate these sites through research into historical maps, aerial photographs, and underwater surveys (Table 10). The significance of interisland navigation, as well as the landings and shipwrecks, therefore, is closely connected to the plantation economy and plantation culture of the islands of Hawai`i for a large portion of the 19th century (Table 11).

The post-gold rush era saw the Pacific opened fully to global commerce. Manufactured goods and raw commodities moved along the coasts and across the ocean in ships that ranged from wooden-hulled schooners to vessels built of iron and steel, and then steamships that, between the 1850s and 1870, transitioned from wooden hulled paddle wheelers to iron and steel screw steamers driven by propellers (Delgado 2009). In the 20th century, the small steamers gave way to the diesel and then gasoline motor ship (see 7.4.2 Sampan Construction, below).

7.3.5. Associated Inventory Sites

Table 10: Highlighted entries for the plantation period

SCR Record Number	Highlighted entry vessel names	Notes
829	*Hornet*	Sites identified/surveyed by NOAA/UHMOP along Lānai's north shore associated with ranching and cattle
324	*Hamakua*	Steamship exploded and burned off Maui, 1924
798	*Ivanhoe*	Chilean-flagged tall ship lost with cargo of nitrite; surveyed by ECU/NOAA
403	*Likelike*	Steamer lost 1897 near Honoipo, Hawai`i…pending u/w survey
461	*Pele*	Steamer (also called *Surprise*), lost 1895 on Kaua`i; recreational dive site
428	*Maui*	Inter Island steamship lost 1917; partial survey completed
375	*Kaua`i*	Inter Island steamship lost at Māhukona Dec 24, 1913; recreational site; survey completed

Table 11: Number of schooners and auxiliary sail steamers in the inventory

Type	Description	Number in inventory
schooners	Handy vessel for commercial trade between the islands with fore-and-aft rigged sails on two or more masts (usually two). Small schooners proved well adapted to Hawaiian waters, being more maneuverable for windward harbors and landings, and requiring fewer crew to man the sails.	139
steamships	Small screw steamships of the island's fleet (also called auxiliary steam schooners), featuring cargo holds and a limited number of passenger cabins, usually carried two masts for auxiliary fore-and-aft rigged sails, and for handling booms for cargo. Some believe the design originated with steamers built on the Californian coast for operating in the small "dog-hole" ports, playing a key role in the lumber industry in the years following the California gold rush. From there the design spread to Hawai`i with the growth of the sugar industry, where the steam schooner was aptly suited for the small landings of the islands (Froning 2007).	30

7.3.6. Project Summaries

The Marine Option Program at the University of Hawai`i, host of the Graduate Maritime Archaeology and History Program, has documented several submerged steamship wreck sites

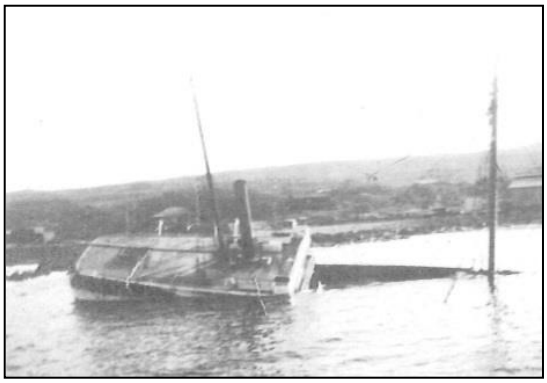

Figure 46: SS *Kaua`i* on Christmas Day 1913, at Māhukona Port. (Hawai`i State Archives)

associated with the plantation period. The SS *Kaua`i* (RN375), lost at Māhukona Port in 1913 and surveyed in 1993 and 2012, has long been a popular dive and snorkeling destination (Figure 46). The wooden-hulled ship went onto the reef while carrying railroad parts and bags of sugar between islands. Both the steamer wreck site (boiler, engine, propeller, scattered plantation railway cargo) and the ruins of the historic Māhukona port itself combine to represent aspects of a major era of Hawaii's economic development, particularly as the days of the commercial sugar industry in Hawai`i have now drawn to a close.

The SS *Maui* (RN428), an iron-hulled steamship wreck located at Kekaha Kai State Park on the North Kona coast of the island of Hawai`i, was also employed in the sugar industry when the vessel broke its keel on the lava reef during a storm in 1917. Site survey took place in 2010. Built in 1898 by Union Iron Works of San Francisco, her triple-expansion engine, boiler, hull plates, and stern section remain scattered atop an underwater lava field (Figure 47).

Figure 47: Cylindrical boiler from the SS *Maui* (RN428) lost 1917. (NOAA ONMS)

The 176-foot long SS *Hornet* (RN829; MAST survey 2009) was built in Aberdeen, Washington in 1906 by Lindstrom Shipbuilding Company. She was purchased by the Hawaiian Meat Company in 1924 and brought to the islands as a replacement for the SS *Bee*, sunk in 1924 near Maui. The *Hornet*, however, was only in the cattle transport service for two years before she was transferred to Inter Island Steam Navigation Company in June, 1926, and put into the lay-up fleet, later run aground at Shipwreck Beach on the north shore of Lāna`i (Figure 48).

Figure 48: Working the shore side of the SS *Hornet* wreck site (RN829) at Shipwreck Beach. (J Kuwabara, UH MOP)

An unidentified steamship wreck (RN900), located on Shipwreck Beach Lāna`i, was included in the MAST 2001 survey conducted by UH MOP student divers. Only the heaviest elements of the steam vessel (cylindrical boiler, double-expansion engine, fuel tanks, propeller and shaft, hawse pipes) defined the shallow water site. The 2001 survey also documented the wrecked navy yard oiler YO-21 (RN783) and the wooden structure of an unidentified schooner.

Project records for all of these surveys are held by NOAA's MHP and UH's Marine Option Program.

7.4. Local Sampan Fishing Fleets

Fishing activities, for commercial, recreational, cultural, or sustenance purposes, are so common in a maritime location like Hawai'i that they are almost synonymous with boating. Fishing vessels include almost every type of boat seen on the water. For the purposes of the submerged cultural resources assessment, the discussion therefore will focus on one specific type of historic fishing vessel possessing a special history in the islands, the Hawaiian sampan.

Originally, the term "sampan" comes from the Chinese language, meaning three (san) boards (ban), and likely describes a small simple skiff. The authoritative *Oxford Companion to Ships and the Sea* defines these craft as "typical small and light boats of oriental waters and rivers. . . . the harbor sampan usually has an awning over the center . . . the coastal sampan [is] fitted with a single mast and junk-type sail" (Dear and Kemp 1976). But the use of this term has always been fairly loose. One source claims that if a water buffalo can go on board athwart ships, then the vessel in question is a junk; but if the animal has to lie down fore and aft…or perhaps could not board at all…then it is probably a sampan (Co-Quan 1962).

7.4.1. Japanese Immigration

Though the term originated in China, the physical origins of the Hawaiian sampan, in fact, are purely Japanese. In 1899 a traditional Japanese fishing craft was brought to Hawai`i from southern Honshu Island on the deck of a steamship by Gorokichi Nakasugi (Bowman 1973). Mr. Nakasugi, a fisherman and shipwright, was soon employed in the *aku* or tuna fishing industry, and the traditional design elements of Japanese fishing vessels transferred to the islands. With continuing labor migration, more Japanese vessels and Japanese fishermen soon found employment in the offshore fishing industry. Kewalo Basin on O`ahu began to see larger amounts of *ahi* (yellowfin tuna) and *aku* (skipjack tuna) unloaded on the docks.

Japanese fishermen opened the commercial tuna industry in Hawai`i in conjunction with the motorization of former sailing sampan vessels and the innovation of modern fish packing plants, for it was the ability to can tuna for a distant market that really made possible the expansion and modernization of the fishing fleet (Nakayama 1987).

7.4.2. Sampan Construction

The sampan brought to Hawai'i in 1899 was a wooden-hulled, square-sailed boat reminiscent of traditional designs that were hundreds of years old. The 1899 sampan possessed elements of the *Yamato-gata* style Japanese fishing vessel, a distinctive and historic Japanese craft built for open-water conditions (Greenhill 1995). The light square sail rig was common on traditional Japanese craft. The wide keel and tall stem and diagonally nailed edge-joined planking and prominent bulkheads were Asian features indicative of maritime traditions hundreds of years old (Brooks 2015). Large-scale Japanese shipbuilders had been encouraged by the Meiji government to reform their construction practices post-1868 and adopt foreign construction techniques in order to build larger vessels, but the older traditions lived on in small beach-built fishing craft of the southern Japanese islands (Greenhill 1995). Nakasugi's sampan had elements of a surviving relic.

Over time, these small square-sail fishing vessels began to change. Gasoline engines were fitted into boats beginning in 1905 and more suitable marine diesels by 1927. Shortly thereafter the prominent deckhouse made its appearance (Gaffney 1979). With its flat work space aft and its high bluff bows for shouldering deep ocean swells, the sampan became perfectly adapted to the rough waters between the islands. These modifications were not planned, but were incorporated on an individual basis by Japanese-trained local Hawaiian shipwrights. Some of these changes were learned while repairing foreign-style vessels from the continental US (Nakashima 1934).

7.4.3. Requisition and End of the Sampan Fleet

By 1940 there were 450 sampans in the territory of Hawai`i, making the commercial fishery third in commercial importance after sugar and pineapple (Gaffney 1979). However, it was not economic tension over jobs, but the growing international tensions between Japan and America in the 1930s that brought increased scrutiny of the fishing fleet in Hawai`i. Military planners feared that Japanese nationals, many of whom were illegal immigrants smuggled on board steamships from Wakayama prefecture, had almost complete control over a wide-roving fishing fleet (Yarnell 1934). Many of the larger powered sampans were over 24 m (80 ft) in length, with ranges as extensive as 2,400 km (1,500 mi). These vessels observed few, if any, regulatory restrictions (Leovy 1934). US law at that time required that only American-made and American-owned vessels be documented and foreign fishing vessels under five net tons operated with impunity. Thanks to certain loopholes in shipping regulations, sampans and other powered wooden vessels were allowed to deduct 75 percent of their machinery spaces from their calculated net tonnage. Thus, long-range sampans could qualify as minor five-ton craft (Leovy 1934). Sampans, therefore, filed no clearances for any destinations, nor did their captains file any paperwork regarding their crews. They were not crossing any boundaries from the territory into foreign waters.

Figure 49: One of the last working sampans in Hawai`i, *Sea Queen* in 1998. (H Van Tilburg)

This vague legal status did not sit well with the general growing apprehension in Pacific relations with Japan. United States Customs officials seized many of these sampans on discovering that Japanese nationals were operating some of the domestic fleet (Young 2013c). The US Navy, facing a critical shortage of boats, then purchased many of these sampans, which were fitted out for harbor salvage and inshore patrol duty. The US Coast Guard operated many of them during the war years. Immediately following the attack on December 7th 1941, several local sampans were mistakenly strafed by American planes as the confused fishermen ran them ashore for safety (War General Staff Journal ND). After 1945 the Japanese tuna fishing industry never recovered its pre-war levels (Chenoweth 1990). Today there are only a handful of these wooden pre-war sampans left in operation (Figure 49). By 1950, only 48 of the 450 island sampans remained afloat (Tomasetti 1997).

The remains of these far ranging vessels which tell the tale of Japanese immigration to the islands and the history of the commercial fishery might be found anywhere within the long Hawaiian island chain, stretching from the main Hawaiian Islands to the northwest-most distant atolls (Table 12).

7.4.4. Implications for the SCR Inventory

Sampans, as culturally hybridized fishing vessels in Hawai`i, reflect multiple maritime related narratives, such as traditional Japanese boat construction, the development of the offshore fishery, and their role as auxiliary and inshore patrol vessels during WWII (Van Tilburg 2007b). Their significance may therefore be complex. Though there is no official state boat for Hawai`i, sampans were so ubiquitous for so many years that they have been informally awarded that status and celebrated, appearing on calendars, placemats, cocktail napkins, Elvis Presley movies, the Hawai`i Maritime Center, and even replicated inside popular restaurants. Sampans were an important popular vessel type for Hawai`i, but they were quickly removed from the offshore tuna fishery and only a few examples are left in existence today.

7.4.5. Associated Inventory Sites

Table 12: Number of sampans and fishing vessels in the inventory

Type	Description	Number in inventory
sampans	Motorized Japanese-designed and built long range fishing vessel.	13
General fishing vessels	Generic category for fishing vessels.	30

7.4.6. Project Summaries

As part of the 1997 MAST course, UH MOP students documented the wreck site of the naval patrol vessel *YP-183* (RN786), formerly known as the sampan vessel *Fuji Maru*, located at Kekaha Kai State Park. The *Fuji Maru* was built by shipwright Seichi Funai in 1930 as a 71-foot long *aku* (tuna) long-range boat for the pole-and-line fishery. Operated by Japanese national Wada Mitsuyoshi between 1936 and 1939, the vessel was initially seized on a US Customs charge, but was released following complaints from the Hawaiian Tuna Packers that the seizure was unfairly hurting their business. *Fuji Maru* was later acquired by the Navy for $9,500 and modified with the addition of armament and white paint (Van Tilburg 1997, 2003). On January 12th 1943, during a Kona storm, the vessel's anchor gear failed and the *YP-183* went aground onto the lava rock, a total loss. The engine, fuel tanks, depth charge rack, and assorted debris were discovered in and around Mahai`ula Bay. Portions of the deck and stack had been lifted onto the 1801 lava flow behind the upper beach berm by the tsunami of 1946.

During the 2010 MAST survey on the island of Hawai`i, course staff led local public charter school students on a one-day terrestrial survey of a sampan coast wreck site at `Anaeho`omalu beach in South Kohala, Hawai`i. Wooden hull wreckage was located along the upper beach berm and the three-cylinder Atlas diesel engine was uncovered in the sand, documented, and

buried. Subsequently, during the 2012 MAST course in the same area, a snorkeling survey of the near shore waters was conducted, but no materials were discovered.

Project records for both of these surveys are held by NOAA's Maritime Heritage Program and the University of Hawai`i Marine Option Program.

7.5. Overthrow of the Islands

The loss of sovereignty of the Hawaiian Kingdom was, and is, an event of singular consequence, rivalling in importance the original Polynesian discovery of the Hawaiian Islands. It cannot be overlooked when seeking to understand the cultural landscape of the Hawaiian Islands. It influences the modern-day context for understanding how culture and history both divide and unite people in Hawai`i today.

By 1890 foreign plantation owners, desiring greater control over their industry, had formed an annexation clique, and entered into discussions of a revolution in the Kingdom (Kuykendall 1967). This included commercial and political leaders such as Lorrin Thurston, Sanford B. Dole, William Wilder, J.B. Castle, H.P. Baldwin, Alexander Young, J.H. Soper, and William R. Castle, some of the most influential foreigners in Hawai`i. Lorrin Thurston, grandson of American missionaries, played a lead role in the annexationist's "Committee of Safety" and in the specific events of the actual overthrow (Russ 1992).

The US Navy had a role to play in the overthrow. Captain G.C. Wiltse, on board USS *Boston*, responded to orders from United States Minister John L. Stevens, who approved of the aims of the annexation clique (Kuykendall 1967). The USS *Boston*, a 3,185 ton, 283-foot long Atlanta class protected cruiser, armed with two 8" and six 6" guns, was in port. One hundred sixty-two blue jackets and marines landed at 5:00 PM on January 16th to protect American lives and property in anticipation of pleas from the annexation group, who were "unable to protect ourselves without aid and, therefore, pray for the protection of the United States forces" (Daws 1968). A few were posted at the US consulate near the waterfront, others marched up Nu`uanu Street to the American Minister's office, and the rest occupied Arion Hall near `Iolani Palace. Then, on January 17, 1893, the Honolulu Rifles, the paramilitary wing of the Committee led by Thurston, garrisoned Ali'iolani Hale across the street from the palace and proclaimed a republic (Russ 1992). Queen Lili`uokalani was forcefully dethroned, surrendered under protest, and placed under house arrest. Sanford B. Dole was named president of the Republic the following day.

President Grover Cleveland ordered former congressman James Blount to conduct an investigation. Blount's report was critical of the illegal overthrow, and charged that navy troops landed under a prearranged agreement to assist in overthrowing the Queen (Kuykendall 1967). Yet, despite Cleveland's stated intentions to restore the sovereignty of the Hawaiian Kingdom, Congress took no action. That position changed following the Spanish-American War in 1898. Hawaii's strategic location for provisions and coal became critical to the movement of troops, livestock, and equipment into the Philippines and the South Pacific (Mahan 1893). As a result of the war with Spain, America acquired control of both Apia Harbor in Guam and Manila in the Philippines. Acquisition of the third great harbor in the Pacific, Pearl Harbor, was on the horizon. The treaty of annexation of the Hawaiian Islands, which had been simmering in

Congress for a number of years, suddenly was brought back to life and was signed by President McKinley on July 7th 1898 (Daws 1968).

The annexation clique of plantation owners and politicians was clearly implicated, but so was the US Government. In 1993, President William Jefferson Clinton signed a resolution apologizing for the US role in the illegal overthrow of the sovereign Kingdom of Hawai`i. That Joint Resolution of the US Congress acknowledged that the overthrow of the Kingdom of Hawai`i occurred with the active participation of citizens of the United States.

7.5.1. Implications for the SCR Inventory

The acknowledged fact that the islands were overthrown does not preclude either Hawaiian or non-Hawaiian resources or sites from gaining value or cultural significance. However, it does add to our understanding of historic events and influences how cultural significance is defined and assigned. Both the physical condition of the property (tangible values) and the cultural connections (intangible values) matter when assessing cultural significance of historic properties. The loss of sovereignty was a serious and devastating blow to the Hawaiian people and the Hawaiian Kingdom, from which there would be no recovery to date.

At the very least, the question of the legal basis for annexation in 1898, and consequently the basis of statehood in 1959 and Federal jurisdiction, upon which the current host of preservation laws pertaining to submerged cultural resources are based, remains an intensely debated issue.

8. US Navy and the World War II Era 1940-1945

The late 19th century has been called the beginning of the Age of New Imperialism, a period when technology, industrialization, and Social Darwinism provided the means and the motives for first-world nations to exploit developing countries to a greater extent than ever before (Hodge 2007). In terms provided by Immanuel Wallerstein's World Systems Theory, it was a time when the periphery came under greater direct control by the core nations (Wallerstein 2004). The Kingdom of Hawai`i was, by all accounts, a modern, progressive, and multicultural royal state. And yet, the islands were small and weak compared to the geopolitical interests of powerful foreigners with modern navies.

8.1. Mahan and the Pacific

This imperialism is perhaps nowhere more evident than in the contemporary writing of Rear Admiral Alfred Thayer Mahan, author of the influential *The Influence of Sea Power upon History*. Drawing upon historical case studies of the great naval powers, Mahan concluded simply that: 1) great nations needed overseas markets and commerce; 2) markets and commerce necessitate control of sea lanes; 3) great nations therefore needed large powerful navies (Mahan 1890). In the context of the technological changes of the 19th century, which included torpedo boats, mines, and small fast commerce raiders, Mahan reassured naval planners that the "big gun" battleship navy was still the ruling paradigm. His 1890 publication has been called the single-most influential book on naval strategy ever published (Shulman 1995).

The expressed need for trade with East Asia and the projection of American power into the Pacific meant that the United States had specific interests in Hawai`i. Mahan addressed these specific interests in an article for the *New York Times* in 1893:

> The United States is by far the greatest, in numbers, interests, and power, of the communities bordering upon the eastern shores of the North Pacific; and the relations of the Hawaiian Islands to her naturally would be, and actually are, more numerous and more important than they can be to any other state…From the foregoing considerations may be inferred the importance of the Hawaiian Islands as a position powerfully influencing the commercial and military control of the Pacific, and especially of the Northern Pacific, in which the United States, geographically, has the strongest right to assert herself. (Mahan 1893)

In Mahan's view, a naval base in Hawai`i, including repair facilities and a coaling station, would not only protect commerce but also guard the Pacific approaches to the planned canal at the isthmus of Panama, the potential for a canal there was essential in Mahan's plan to join the naval defenses of the US east and west coasts. Mahan urged the annexation of Hawai`i as a possession crucial to the protection of the approaches to the Isthmus (Wescott 1999). These strongly-held beliefs demanded a serious commitment to a permanent naval presence in Hawai`i.

Rear Admiral Mahan was not the first to urge the control of Hawai`i for military purposes. In 1875 Henry A. Pierce, American minister to the Kingdom of Hawai`i tied military necessity to the pending Treaty of Reciprocity:

> The acquisition of the Hawaiian Islands by the United States, sooner or later, must become a national necessity, to guard the approaches against hostile attempts on the Pacific States...If reciprocity of commerce is established between the two countries, there cannot be a doubt that the effect will be to hold those islands with hooks of steel in the interests of the United States...Refuse the offered treaty, necessity will drive the islands to seek for more intimate political and commercial relations with the British colonies of [British] Columbia, New Zealand, Feejee, and Australia, and to eventuate in the Hawaiian Islands becoming also a colony of the British Crown. (Kuykendall 1967)

Control of Hawai`i and its strategic location in the middle of the North Pacific, with the potential for a deep water naval base, secure commercial profits from the plantation economy, and control of the sea lanes for the benefit of national commerce, seems to have proven more alluring to commercial and military planners than respect for international sovereignty. The end result was the achievement of Mahan's military vision in the Pacific.

8.2. Pearl Harbor

Prior to the confiscation of the land, the harbor area, known as *Pu`uloa* (Long Hill) to Hawaiians, had been mainly planted with sugarcane and taro, or was grazing land for cattle. Banana trees and pineapple fields were tended by local homesteaders. Hawaiian coastal stone fishponds, *loko i`a*, lined the shores. Fishermen and recreational sailors used the waters of the harbor, and the interior islands were the sites for weekend picnics (Landauer and Landauer 1999). Traditional fishing and gathering rights were soon to be terminated.

Naval planners were confident that, once the channel's shallow bar was cleared, Pearl Harbor, would offer vessels secure anchorage and protection from possible enemy fleets threatening O`ahu's south shore (Taylor 1927). American access to the harbor, though, was not included in the initial Treaty of Reciprocity in 1876. Instead, access in perpetuity to Pearl Harbor, "to establish and maintain there a coaling and repair station for the use of vessels of the U.S. and to that end the U.S may improve the entrance to said harbor," was inserted as an amendment to the Treaty during a Congressional secret session (NHHC 2015b). The amendment became part of the 1887 Bayonet Constitution forced upon the Hawaiian government by the anti-monarchy clique known as the Hawaiian League through the armed intimidation of the Honolulu Rifles, reducing the King's sovereign powers (Kuykendall 1967). While this treaty continued in force until the annexation of Republic of Hawai`i in 1898, no advantage was taken by the US Government of the opportunity to fortify or use Pearl Harbor as a naval base (NHHC 2015b).

8.2.1. Early Surveys

The captain of HMS *Blonde* commissioned the first survey of Pearl Harbor in 1824. This was carried out by Scottish engineer Lieutenant Charles R. Malden, who is credited in some sources for naming the shallow bays "Lochs" (Landauer and Landauer 1999; Daws 1968). The first American survey of Pearl Harbor was not carried out until 1840, when Commander Charles Wilkes' six-ship US Exploring Expedition arrived in Hawai`i (Philbrick 2004). In addition to paying close scrutiny to the government and character of the islands, Wilkes conducted an accurate charting of the inlet of the "harbor of Ewa and the Pearl River," noting that "if the water

upon the bar should be deepened, which I doubt not could be effected, it would afford the best and most capacious harbor in the Pacific" (Landauer and Landauer 1999).

8.2.2. Defense Construction

Figure 50: Submarine Base barracks, 1918, Pearl Harbor. (NHHC photo 117892)

The US Navy started some improvements in 1901, and by 1905 the small gunboat USS *Petrel* PG-2 successfully steamed into the upper part of the lochs (Landauer and Landauer 1999). The harbor still could not provide support to major vessels, though, and President Roosevelt's impressive Great White Fleet, the American battle fleet that circumnavigated the globe from December 1907 to February 1909, anchored at the Waikīkī Roadstead in 1908 (Hart 1965). That year, Congress passed appropriations for $1,000,000 to develop Pearl Harbor as the primary defensive position of the United States in the Pacific. Eventually the Pearl Harbor channel, 10 m (35 ft) deep and 60 m (200 ft) wide and approximately 6 km (4 mi) long, was completed in 1913. A submarine base was first established in 1918 (Figure 50). The Secretary of the Navy officially dedicated the naval station on August 15th 1919 (O'Connell 1991).

Work proceeded at Pearl Harbor and outer island facilities at the pace of government funding and commitment, and by the mid 1930's approximately $42,000,000 had been spent on naval infrastructure (NHHC 2015a). Pearl Harbor would soon boast a navy yard, larger submarine base, hospital, air station, Marine barracks, ammunition depot, railway, tank farm, supply warehouses and dozens of buildings for support activities. Major ammunition depots existed at West Loch in the harbor and Lualualei on O`ahu's leeward shore (Landauer and Landauer 1999). Advisory reports in December 1938 recommended that facilities at Pearl Harbor be capable of supporting 10 patrol plane squadrons (modified to five squadrons due to crowding) and two aircraft carrier groups. In 1939 President Franklin Delano Roosevelt declared a Defensive Sea Area around the entrance to Pearl Harbor (Landauer and Landauer 1999). By 1940 appropriations for the naval base had exceeded $100,000,000 (NHHC 2015a). The Pacific Fleet had a new base (Figure 51).

Figure 51: US fleet anchored at Pearl Harbor after the conclusion of Fleet Problem XXI, May 3rd 1940. (NHHC photo 80-G-411120)

8.3. December 7th 1941 Attack

It can easily be argued that no single attack has ever done more to change the nature of Hawai`i or the Pacific region, or even the character of the modern international world. The surprise attack on Pearl Harbor was executed with unprecedented skill and professionalism (Prange 1981). The consequences of the attack are still difficult to overstate.

The Japanese Pearl Harbor Strike Force of six aircraft carriers and support vessels exhibited excellent training and organization, managing in less than two hours to inflict damage on every major military target on the island of O`ahu (Figures 52-53). The carriers reached a point 350 km (220 mi) north of O`ahu without being detected, launching some 350 aircraft in two separate waves (Clarke 1991). The surprise air attack accomplished two goals: destroy the American Fleet at Pearl Harbor, and eliminate the potential for military aircraft on O`ahu to respond.

The Sunday morning raid lasted one hour and 50 minutes, during which time 188 American Army and Navy aircraft were destroyed (NHHC 2016). All air bases were out of commission for several hours. Only a token air resistance could be mustered. Vessels sunk or severely damaged

at Pearl Harbor included four auxiliary ships, three cruisers, three destroyers, and eight battleships. Japanese losses totaled 29 aircraft and five midget submarines (Clarke 1991). For the United States, this was the worst naval catastrophe in history.

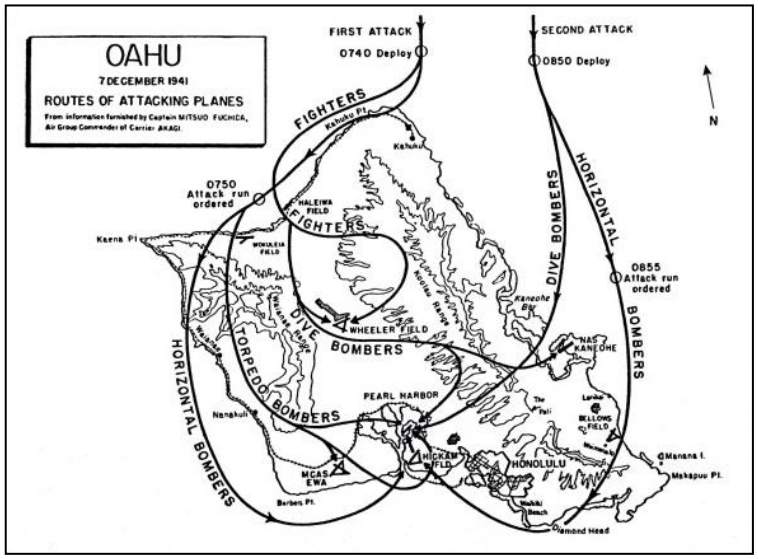

Figure 52: Map showing route of attacking planes, by CAPT Mitsuo Fuchida. (NHHC)

American forces responded valiantly but relatively ineffectively during the attack. Fleet doctrine required all ships to get underway, but with the single momentary exception of USS *Nevada*, this was simply not possible due to substantial damage. After the attack some destroyers and cruisers did put to sea, but these searched to the south, where planners thought an enemy battleship fleet could have threatened the harbor, and did not make contact (Prange 1981).

The outer islands remained almost completely unaware of the attack on O`ahu bases. Radio stations, except for emergency broadcasts, had gone off the air, not wishing to provide a navigational beacon to any other enemy planes (Prange 1981). Waterfront areas on O`ahu's south shore became critical security zones, and all unidentified vessels approaching the island became targets. Six local sampan fishermen were reportedly killed by friendly fire off Barbers Point when they were strafed by American P-40 fighter planes on December 8th (Roehner 2014; Burlingame 1992). At least three "landing parties" were mistakenly confirmed between Barbers Point and Nānākuli, possibly fishermen fleeing for their lives (War General Staff Journal ND). Five days later more sampans were strafed off Kailua and Kohala coasts on O`ahu (Burlingame 1992). Captured local fishermen were listed as prisoners of war and held under guard. Four navy planes of a group of six, off the carrier *Enterprise*, were later shot down by nervous anti-aircraft gunners on Ford Island (Cohen 1981).

Figure 53: Attempting salvage of a burning PBY, Kāne`ohe Naval Air Station, Mōkapu Peninsula. (NHHC photo 97432)

8.3.1. Aftermath in the Islands

By noon on December 7th General Short requested that Governor Poindexter relinquish all civilian control of the islands. He assured the governor that this was "absolutely necessary" in the face of sabotage and impending invasion (Allen 1950). With President Roosevelt's approval, martial law was declared. General Short became the territory's military governor, with a monopoly on all legislative, executive, and judicial power. The writ of *habeas corpus* was suspended. Defenses were hastily erected on the beaches (Figure 54). Within three hours, most of the 1,450 Japanese residents previously designated as "suspicious" by Army Intelligence and FBI agents had been arrested (Allen 1950). They were mainly language school principals, Buddhist and Shinto priests, commercial fishermen, consulate members, and business members of Japanese controlled corporations. On O`ahu these detainees were initially held at the immigration station, and then the larger detainment facilities on Sand Island (Weglyn 1996). In 1943 an internment camp was constructed at Honouliuli (recently designated as Honouliuli National Monument). Detainees were also held on Hawai`i, Kaua`i, and Maui. A total of 17 detainment sites in the Hawaiian Islands were used during the war (Japanese Cultural Center of Hawai`i 2017).

Figure 54: Barbed wire along the beaches at Waikīkī. (US Army Museum Hawai`i photo 3076)

The military ramped up activities following the attack. The navy immediately supplemented minefields with submarine nets outside of major harbors and dedicated aircraft to patrol the island approaches (Chapman 2014). All army and navy installations moved onto a war footing. Military landholdings quickly increased, with the army buying 62,058 acres and leasing some 210,000 more, and the navy acquiring 118,000 acres and expanding Pearl Harbor (Chapman 2014). Military necessity claimed priority at all commercial harbors as well as thousands of tons of cement, concrete block, wood, and sheet metal for the completion of naval bases and airfields already underway.

> Military spending and civilian-led projects resulted in a boom in the islands' economy. With housing in short supply, local residents took in boarders or constructed additional dwellings on their properties. There were also new walk-up apartments, many near streetcar lines in downtown Honolulu and the resort area of Waikīkī. Laundries, barbershops, and hairdressers proliferated—as did bars, dancehalls, pool halls, tattoo parlors, and other venues aimed at a predominantly male workforce. Although prostitution was by the 1930s illegal in the territory, military and civil authorities tacitly permitted brothels within designated areas, notably Chinatown along downtown Honolulu's western edge. Long a presence in the islands, these establishments gained new footing in the immediate prewar years as mainland migrants joined local women to work in the closely monitored sex industry (Chapman 2014).

Wartime conditions changed the character of daily life. For civilians on the home front, barbed wire lined the beaches, gas masks were required safety equipment, and black-out conditions darkened the streets (becoming a "dim-out" after July 1942). The war was not fought in a vacuum, but involved everyone, civilian and military alike. Liberties once taken for granted were curtailed as civil courts closed and protection against illegal detention was suspended, an action later declared unconstitutional by the US Supreme Court (Allen 1950). Unauthorized publication of any type of news media or information was prohibited. All photographers were required to be registered, and film had to be submitted to military censors within 48 hours of being developed (Allen 1950).

Nonetheless, the residents of the Territory of Hawai`i, Japanese and non-Japanese alike, quickly united and joined the US in the larger war effort. Thousands of *Nisei* (second-generation Japanese) joined the 442 Regimental Combat Team and 100th Battalion as soon as they were allowed, and fought heroically in Europe (Crost 1997).

The plantation economy was disrupted and familiar vessels of the local steamship fleet were requisitioned for military use. An executive order gave the War Shipping Administration authority over procuring merchant vessels to meet government requirements (Chapman 2014). The SS *Haleakalā* was assigned to the army and the SS *Kala`e* to the navy, while the SS *Hualālai*, *Wai`ale`ale*, *Humu`ula*, and *Hawai`i* went to the Inter Island Steamship Navigation Company, in service of the War Shipping Administration (Thomas 1983). Some of the commercial piers at Honolulu Harbor were placed under the war department. The "Waterfront News" columns in the local papers, the longtime regular location for all maritime comings and goings, disappeared overnight, never to return.

Hawai`i, the major supply and repair base in the region, was literally the springboard from which the American Fleet could project itself across the Pacific. Some 7,000 naval vessels received repairs at Pearl Harbor during the war. Prior to October 1943 an average of 70 ships per month were serviced at Pearl Harbor. Thereafter, the number increased to 252 per month (Allen 1950). At one point there were 528 ships berthed at the same time at Pearl. Some 200 submarines made the base at Pearl Harbor their home for operations ranging into the Western Pacific. Preparations for major offensives in the Pacific brought periods of intense activity to the islands.

8.3.2. The Hawaiian Sea Frontier

The Hawaiian Islands were only attacked three times: Pearl Harbor on December 7th 1941; Operation K, the Japanese seaplane reconnaissance/bombing attempt of Pearl Harbor on March 4th 1942; and the Battle of Midway June 4-7th 1942. The great naval battles fought across the Pacific during World War II have garnered the majority of attention, but in the main Hawaiian Islands it was the day-to-day home front operations of repair, training, and patrol that were of most immediate concern to island residents. The history of the home front in the islands has usually been overlooked (Allen 1950).

In Hawai`i, local patrols and interisland convoy tasks fell to the Hawaiian Naval Coastal Frontier forces. The Hawaiian Sea Frontier was established by executive order prior to December 7th 1941, but did not actually become effective until September 1942, taking on major tasks including the maintenance of picket ships outside Pearl Harbor and the Port of Honolulu,

escorting interisland shipping, and operation of air-sea rescue facilities (Historical Section, 14th Naval District 1945).

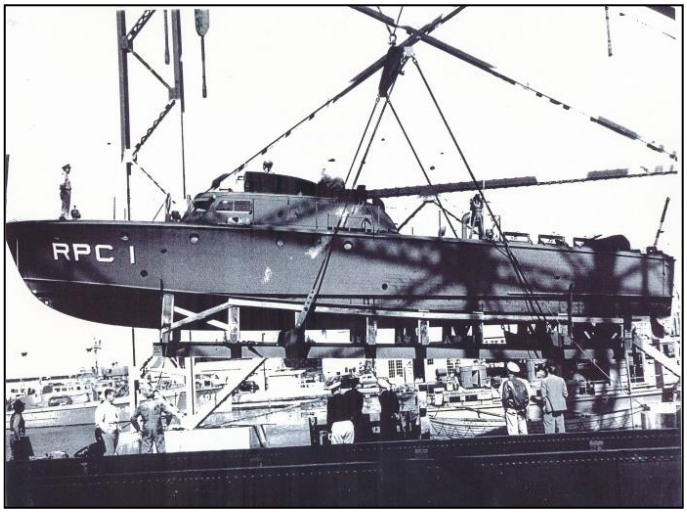

Figure 55: Rescue crash boats became an integral part of station response for downed aircraft in Hawaiian waters. (H Van Tilburg)

The Hawaiian Sea Frontier developed as an offshoot of the 14th Naval District's activities. Boundaries included a coastal zone 800 km (500 mi) from all islands, as well as distant Johnston and Palmyra Islands and Kingman Reef (Historical Section, 14th Naval District 1945). Vessels of the Pacific Fleet were used for offshore patrol, while a variety of confiscated vessels and district craft fulfilled inshore patrol duties (see *YP-277, YP-183* RN786, USS *Kailua* RN729). Many of these vessels carried depth charges at the stern, taking on anti-submarine patrol duties in local waters. Rescue crash boats were ordered by both the Army and Navy (Friedman 1987). These fast 19-m (63-ft) vessels carried both 0.50 cal machine guns and depth charges (Figure 55). Japanese submarines were active briefly following the attack on Pearl Harbor, shelling Hilo Hawai`i, Kahului Maui, and Nāwiliwili Kaua`i in December-January 1942 (see *Neches* RN772). Damage was minor and the submarines did not return to the main Hawaiian Islands (Brown 1989).

Rescue facilities for downed aircraft were established by February 1942. The first rescue organization was a joint Army-Navy office known as Rescue Service Control, located at Hickam Air Force Base (Historical Section, 14th Naval District 1945). Navy captains in charge of rescue vessels taking orders from Army officers in charge of the base presented difficulties, and by August 1943 the Hawaiian Sea Frontier took over all rescue operations, establishing the Joint Operations Center in Āliamanu Crater (Historical Section, 14th Naval District 1945). The Joint Operations Center assumed responsibility for all rescue service throughout the Central Pacific area. Air-Sea rescue organization, by necessity, developed in tandem with the increasing aviation training activities and offensive air strikes in the Pacific.

8.4. Tools for New Tactics: Naval Aviation

In 1910, the Navy Department took charge of an experimental aviation detachment, and very soon Eugene Ely, a Curtiss test pilot, landed a plane on board the modified USS *Birmingham* and later USS *Pennsylvania* in San Francisco Bay in 1911, a momentous event in naval aviation history (Jakab 2011). The aircraft carrier was born. In July 1913, two Curtiss floatplanes were shipped to Hawai`i from San Francisco, and by 1918 the US War Department had secured the majority of Ford Island property for the creation of a landing strip (Landauer and Landauer 1999). In 1925 three navy PN-9 flying boat planes, each with a crew of five, attempted the first cross-Pacific flight to Hawai`i. One was unable to take off from San Pablo Bay, California due

to mechanical troubles; a second was forced to make an ocean landing only 480 km (300 mi) from California. The last PN-9 ran out of fuel 320 km (200 mi) short of the islands, but was then able to "sail" backwards with the prevailing trade winds towards the islands, until being taken under tow to Pearl Harbor (National Naval Aviation Museum 2012). Aircraft from some these very early squadrons lie submerged around the islands today, including open cockpit long range flying patrol boats built by the Keystone Aircraft Company for the US Navy, elements of VP-1 at Ford Island in the 1930s (Figure 56).

Figure 56: Keystone PK-1 flying boat, discovered in 2004 during NOAA/HURL research surveys. (HURL/NOAA ONMS)

8.4.1. Air Bases in Hawai`i

Figure 57: Triangular Ke`ehi Lagoon 1930s seaplane runways are clearly visible near the modern-day HNL reef runway. (Google Earth © 2016 Google Data USGS)

Naval Air Station (NAS) Pearl Harbor was naturally the first planned Naval Air Station, but others soon followed (Department of the Navy 1947). In 1940 the Marine Corps Air Station (MCAS) was established at Ewa on O`ahu, the headquarters for Marine aviation in the Pacific. During the December 7th attack all aircraft at Ewa were destroyed, but the base was quick to recover. By 1942 four runways were operational.

Construction of a small seaplane base at NAS Kāne`ohe on O`ahu began in September 1939 (Department of the Navy 1947). This soon grew into a major air station, housing 18,000 officers and men. Three years of extensive dredging were required, moving some 11 million cubic yards of materials. An airstrip was added to the facility in 1940, with accompanying increases in housing, hangars, fuel storage, etc.

By 1942 the Naval Air Transport Service expanded into the Pan American Airways terminal, and the navy subsequently took over the commercial John Rogers Airport, which then became known as NAS Honolulu (Department of the Navy 1947). Work was begun in February of 1943 with the commencement of dredging operations in Ke`ehi Lagoon. Eventually, three seaplane runways, each 300 m (1,000 ft) wide by 4.8 km (3 mi) long, were completed (Figure 57).

Seaplane ramps, aviation fuel facilities, floating seaplane docks, machine shops, repair facilities, and officer quarters soon followed.

The Naval Air Station at Barber's Point on O`ahu became, during the war, an important technical aviation training school and fortification (Department of the Navy 1947). NAS Barber's Point was originally intended to be an auxiliary airfield of Ford Island, capable only of supporting the land-based operations of two aircraft carrier groups. In the days after December 7th 1941, as it became apparent that Hawai`i would have to accommodate much heavier air traffic, Barber's Point expanded to two main runways with a total capacity for four carrier air groups.

NAS Pu`unene, formerly the Maui Airport, provided target-towing services for the Fleet (Department of the Navy 1947). Plans expanded to include training facilities, bomb and ammunition magazines, and capacity for one aircraft carrier group. By 1943 NAS Pu`unene offered advanced training and staging for fighter, torpedo-bomber, and dive-bomber pilots, and became one of the largest and most important aviation training bases in the United States.

NAS Kahului, also on Maui, served as a maintenance station for the continual influx of visiting carrier air groups (Department of the Navy 1947). Construction began in November 1943. Much of the land was leased from a commercial sugar company. Two runways and associated facilities were completed by 1944. NAS Kahului included a moving target machine gun range, a machine gun school, and a malfunction range. Nearby were piers and shore facilities of Kahului Section Base. Ultimately, Maui became the largest single training ground for naval air groups in the US.

During the war there were a total of nine naval air stations and naval air fields (NAF), and two Marine Corps air stations (MCAS), for a total of 11, five of which were on O`ahu (Table 13).

Table 13: WWII-period Naval Air Stations and fields in the main Hawaiian Islands

Site	Island	Location
Pearl Harbor NAS	O`ahu	Ford Island
Kāne`ohe NAS	O`ahu	Mokapu Peninsula
Honolulu NAS	O`ahu	Honolulu
Barber's Point NAS	O`ahu	Kalaeloa
Pu`unene NAS	Maui	Pu`unene
Kahului NAS	Maui	Kahului
Ewa (MCAS)	O`ahu	Ewa
Bordelon (aka Kanuela) MCAS	Hawai`i	Waimea
Hilo (AAB/NAS)	Hawai`i	Hilo
Homestead (AAF/NAF)	Moloka`i	Central Moloka`i
Mana (AAF/NAF aux)	Kaua`i	Barking Sands

At the time of the attack, the islands of Hawai`i also possessed 15 army air bases and auxiliary fields (AAB and AAF), and one air force base (AFB) for a total of 16, nine of which were located on O`ahu (Addleman 1939…Table 14).

Table 14: WWII-period Army airfields circa 1942

Site	Island	Location
Hickam AFB	O`ahu	Honolulu
Bellows AAF	O`ahu	Waimānalo
Hale`iwa AAF	O`ahu	Hale`iwa
Kahuku AAF/AAB	O`ahu	Kahuku
Kipapa aux AAF	O`ahu	Kipapa
Kualoa AAF/AAB	O`ahu	Kualoa
Luke AAF	O`ahu	Ford Island
Mokulē`ia AAF	O`ahu	Mokulē`ia
Wheeler AAF	O`ahu	Wahiawā
Burns aux AAF	Kaua`i	Port Allen
Mana AAF/NAF	Kaua`i	Barking Sands
Suitter AAF	Hawai`i	`Upolu Point
Morse AAF	Hawai`i	South Point
Hilo AAB/NAS	Hawai`i	Hilo
Putnam aux AAF	O`ahu	Fort Shafter
Homestead AAF/NAF	Moloka`i	Central Moloka`i

8.4.2. Billy Mitchell's Lesson Comes True

Despite the increasing effort of building aviation infrastructure, awareness of the capacity of aircraft to threaten powerful fleets of surface vessels was slow to take hold. Some felt that Pearl Harbor was vulnerable. As early as 1923, air space above Pearl Harbor had been set aside for military use only. That same year Army officer William "Billy" Mitchell had predicted in a 324-page report that the Hawaiian Islands, and in particular the naval base at Pearl Harbor, were open to a Japanese surprise air attack (Clodfelter 2012). Aviation exercises made clear this potential. In 1932 Rear Admiral Harry E. Yarnell staged a simulated air attack on the harbor, this time using the carriers *Lexington* and *Saratoga* (Landauer and Landauer 1999). He based his attack on four assumptions:

- First, a small carrier-centered task force would be more difficult to find than a larger fleet accompanied by a landing force with support ships;
- Second, rain squalls could cover his approach;
- Third, winter clouds form and cling to the Ko`olau mountains east of Pearl Harbor. Attack planes could approach undetected, break out of the cloud banks, and be over Pearl Harbor in clear skies before the defense forces would realize they were even close;
- Fourth, no one would expect, or be ready for, an attack early on a Sunday morning.

Yarnell's success was complete, nine years before the Japanese launched their devastating blow. Though the strength of fleets had been measured in the number of battleships, the Japanese success at Pearl Harbor demonstrated the value of the aircraft carrier as a capital ship and the effectiveness of naval aviation (O'Connell 1991). Nineteenth century thinkers like Rear Admiral

Mahan had envisioned the critical naval contest as one between battleships and big guns, a slug fest of naval surface forces (Gardiner 1992a). Hard-won experience in WWII showed that aircraft carriers and aircraft deserved the lead role at sea.

It would be difficult to overemphasize the overall impact naval aviation would ultimately have on Hawai`i and in the Pacific. Hawai`i evolved very quickly from a few small seaplane bases to six major naval air stations operating during the war, not to mention the aviation training activities conducted from aircraft carriers in Hawaiian waters. Hundreds of young lieutenants and radio operators and engineers were taught the basics in training camps on the continent and then shipped out to the Hawaiian Islands for intensive combat training experience over unfamiliar waters.

8.4.3. Implications for the SCR Inventory

The wrecks of naval aircraft are a specific subset of archaeological resource, not entirely different in nature from many historic period shipwrecks (Figure 58). Even though mass produced in great number, with interchangeable engines and components, submerged aircraft wreck sites are still capable of revealing details of their construction, modifications over time, and even use by the aircrew (Capelotti 2003; Ford 2006). They can exhibit evidence of water ditching and emergency escape, engine failure or combat loss events that led to their demise. Taken as a whole, their patterned distribution speaks to the training ranges and activities among the islands and the aviation infrastructure of air stations and fields, all elements of the World War II Hawai`i landscape.

Figure 58: Many (284) assembly-line manufactured F6F Hellcat navy fighter aircraft were lost in Hawaiian waters. (USN)

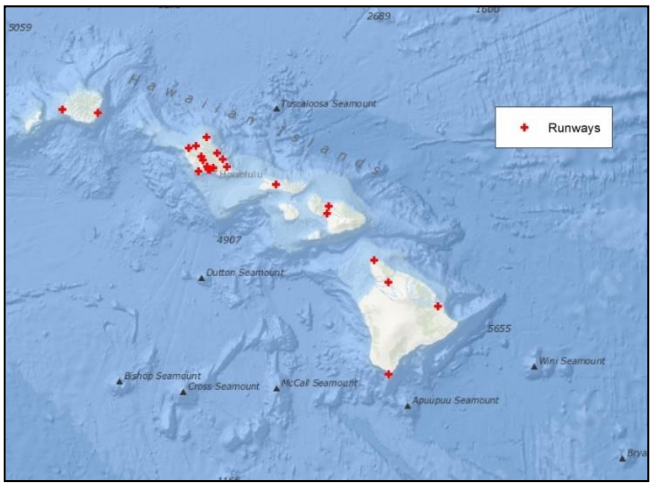

Figure 59: Location of army and navy air fields and stations during the war years. (NOAA ONMS)

The sheer number of naval and army aviation fields during the war (25), the numerous at-sea carrier aviation training exercises, and the number of aircraft lost during these land and sea-based operations, speaks to the intensity of aviation activity in Hawai`i (Figure 59). Naval records for 1922-1952 record at least 1,375 aircraft lost in the waters surrounding the Hawaiian Islands (Van Tilburg 2014). Given the range in years and number of aircraft lost, these submerged sites in Hawai`i may contribute to two major areas for future analysis: 1) the technological evolution of naval aviation from the early flying boats of the 1920s and

1930s through more modern aircraft today; and 2) the importance and the hazards of naval aviation during the attack on O`ahu and throughout the war years in the Pacific. These submerged resources in Hawai`i today are a silent testament to the American national commitment in production and training during World War II (Table 15 and 16).

8.4.4. Associated Inventory Sites

Table 15: Major aircraft types by total number in inventory

Major aircraft types	Status	Total number in inventory
All aircraft	Located/confirmed	47
All aircraft	Reported with position estimates but not yet located	213
All aircraft	In inventory but no position estimate reported	1,115
fighter aircraft	navy and army	561
dive bombers	navy	352
torpedo bombers	navy	191
flying boats	navy and army	36
bi-wing aircraft	1920s-1940s	42

Table 16: Specific aircraft types by total number in inventory

Type	Description	Total number in Inventory
F5-L Felixstowe	biplane flying boat circa WWI	1
T3M Martin	biplane 3-seat torpedo bomber from the 1920s	1
UO1 Vought	bi-wing 2-seat observation plane	2
O2U Corsair	biplane scout and observation aircraft	2
VE-7 Bluebird	early biplane 2-seat trainer	2
PK-1 Keystone	biplane flying boat	7
J2F Duck	single engine amphibious biplane	4
PD-1 Douglas	open-cockpit biplane patrol flying boat	1
HS Curtiss	single engine bi-wing patrol flying boat	1
DT Douglas	early bi-wing torpedo bomber	2
P2Y Consolidated	maritime patrol flying boat	2
SBC-3 Helldiver	2-seat bi-wing scout and dive bomber	4
SOC Seagull	standard floatplane scout	6
SOC3 Seamew	standard floatplane scout	1
SNB Kansan	light transport and light bomber	1
F2A Buffalo	single seat fighter aircraft	6
FM-2 Wildcat	improved F4F Wildcat first line single seat fighter	89
FG-1 Corsair	single seat fighter aircraft	47

Table 16: Types of naval aircraft, continued:

Type	Description	Total number in Inventory
F4F Wildcat	first line single seat fighter	72
F4U Corsair	single seat fighter aircraft	140
TBD Devastator	3 seat torpedo bomber	5
TBM Avenger	3 seat torpedo bomber	131
TBF Avenger	3 seat torpedo bomber	55
OS2U Kingfisher	catapult launched observation floatplane	12
OY-1 Sentinel	liaison and observation aircraft	5
SC Seahawk	scout seaplane	9
F6F Hellcat	carrier based fighter aircraft	284
F7F Tigercat	heavy fighter twin engine aircraft	4
F8F Bearcat	single engine fighter aircraft	5
SBD Dauntless	naval scout and dive bomber aircraft	80
SB2C Helldiver	carrier base dive bomber aircraft	272
P-40 Warhawk	single engine single seat fighter/ground attack aircraft	5
P-47 Thunderbolt	single engine single seat fighter/ground attack aircraft	2
PB2Y Coronado	large flying boat patrol bomber	1
PB4Y Liberator	four engine patrol bomber	7
PBY Catalina	patrol bomber flying boat	24
PBM Mariner	patrol bomber flying boat	11
PV-1 Ventura	twin engine bomber and patrol aircraft	5
PV-2 Harpoon	twin engine bomber and patrol aircraft	2
JRM Martin	large 4-engine flying boat	1
SNJ Texan	single engine advanced trainer	9
JRS Sikorsky	amphibious seaplane	2
JM Marauder	twin engine medium bomber	3

8.4.4. Project Summaries

Due to the large investment in military and aviation infrastructure and strategic location of the islands, Hawai`i played a major role in the development of naval aviation in the Pacific. Of the many naval aircraft lost in Hawai`i, over 30 have been located and assessed to some extent. The majority of these aviation sites have been documented with video and/or still photography, with subsequent efforts made to identify the general type and specific identity of the aircraft, if possible. Recreational divers using open-circuit scuba and closed-circuit rebreather units, searching depths from 0-300 feet, regularly report new aircraft discoveries. HURL, in its manned submersible operations, has encountered a wide variety of deep-water intact aviation sites (Keystone PK-1 biplanes, Dauntless SBD's, Avenger TBM's, Helldiver SB2C's, Martin JRM-1, etc.) and conducted preliminary non-invasive video documentation.

Several more formal surveys have focused in more detail on documenting specific naval aircraft submerged crash sites. In January 2010 a Maui dive shop owner reported the discovery of a plane to Naval History & Heritage Command, which subsequently requested assistance from NOAA's Maritime Heritage Program in conducting a survey of the site (Figure 60). Site dives by NOAA confirmed local researcher's identification of an SB2C-1C Helldiver (RN891). Fortunately, the aircraft number 18400 was still legible, leading to identification of the specific incident. While engaged in a dive-bombing practice attack on Aug. 31st 1944, high-speed maneuvers damaged the tail fin and jammed the rudder controls. With only limited ability to control the aircraft, navy lieutenant William E. Dill and aviation radioman Kenneth Jobe made a successful water landing in Mā`alaea Bay, surviving the crash without injuries (Aviation Branch NHHC 1944). The plane, intact in 15 m (50 ft) of water, is now a recreational dive site. The site map and photo/video data assist in monitoring the federal property.

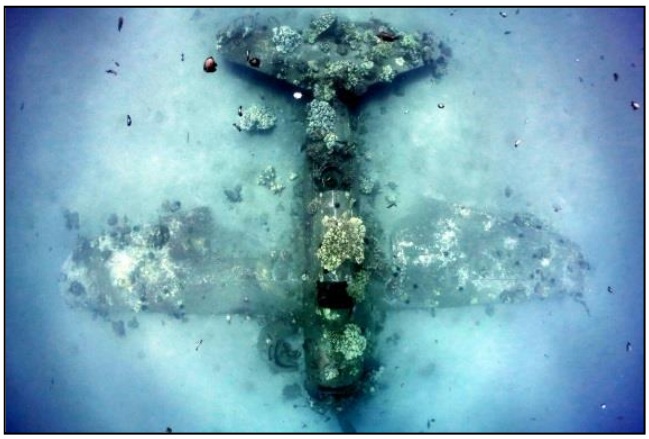

Figure 60: SB2C-1C Helldiver buno 18400 (RN891), ditched in Mā`alaea Bay August 31st, 1944…one of dozens of naval aircraft located. (NOAA ONMS)

Dive boats also frequently visit the F4-U Corsair (RN833), resting 34 m (110 ft) below the surface in O`ahu's Maunalua Bay (Figure 61). The aircraft and location correspond to the naval report of the F4U-1A, serial number 49668, which crashed on April 17th 1945. The pilot was Lt. William Holden of VMF-215 of the USMCR. The plane was being ferried from Homestead field on Moloka`i to the Marine Corp Air Station at Ewa when a ruptured oil line obscured cockpit visibility, causing a water ditch (Aviation Branch NHHC 1945). In 1993 a dive boat operator illegally attached a mooring cable to the aircraft's propeller, damaging the upper engine cowling and airframe. This mooring remained in place until 1999 when it was finally reported by NOAA to the State of Hawaii's Department of Ocean Boating and Recreation officers. A second mooring was attached to the plane in 2005, which was also subsequently reported and removed (Van Tilburg 2003). Documentation of the site over time provides a local case study for recreational impacts to maritime heritage resources.

Figure 61: F4U-1A Corsair buno 49668 (RN833), ditched in Maunalua Bay April 17th 1945. (Keoki Stender www.marinelifephotography.com)

In June 2015, NOAA's Maritime Heritage Program, in collaboration with UH MOP, conducted a MAST field survey of a sunken Catalina PBY-5 (RN834) that was one of America's first aircraft casualties of World War II. The navy seaplane is resting on the bottom of Kāne'ohe Bay, within the

450 m (500-yd) seaward buffer zone of Marine Corps Base Hawai`i. Minutes before the December 7th attack began at Pearl Harbor, Japanese aircraft bombed the nearby US Naval Air Station at Kāne'ohe. Twenty-seven Catalina PBY flying boats on the ground or moored on the bay were destroyed, and six others were damaged. The strike on the seaplane base was a significant loss for the US military, as these long-range patrol bombers could have followed the Japanese planes back to their carriers (Wenger et al 2015). The site was first surveyed using baseline trilateration by East Carolina University in 1994, but low visibility prohibited photo documentation. The 2015 survey had better conditions, re-creating the trilateration site plan map and collecting video and still photography of this heritage property (Figure 62). Survey data for the project are held by NOAA's Maritime Heritage Program.

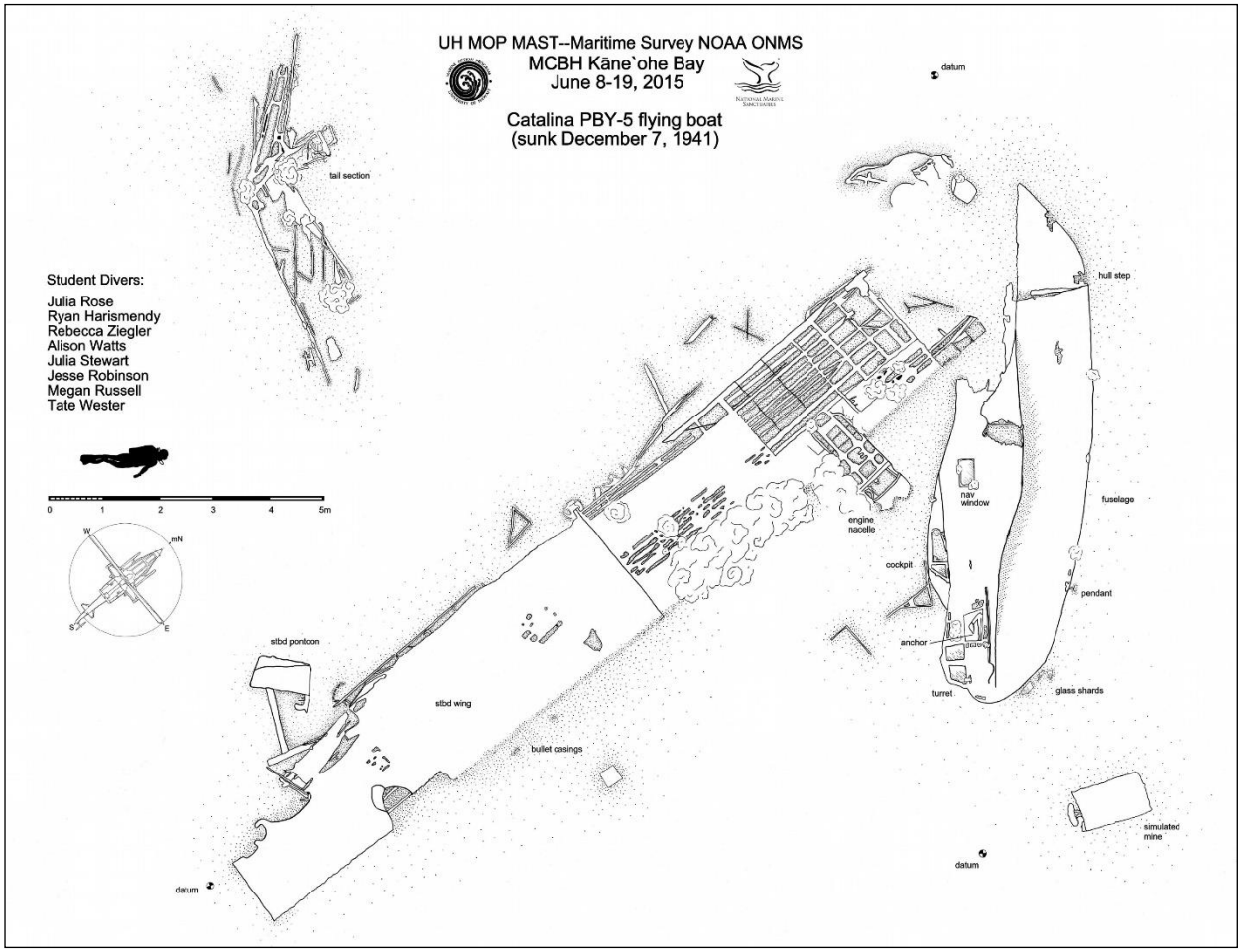

Figure 62: Baseline trilateration plan of the PBY-5 Catalina (RN834) produced by MAST 2015 students in the murky waters of Kāne`ohe Bay. (NOAA ONMS)

8.5. Tools for New Tactics: Amphibious Craft

Military leaders have long recognized that putting armed forces ashore in hostile contested territory has always been one of the basic functions of the navy. For hundreds of years this meant sailors undertaking landings in regular ships boats, without benefit of any special purpose-built craft for amphibious operations (Bartlett 1983). Following the disastrous experience of the

Allied landings at Gallipoli during World War I, the British devised an early flat-bottomed motor landing craft, with the familiar forward-deployed ramp for putting soldiers and equipment directly onto the beach (Speller and Tuck 2001; Friedman 2002). During the 1920's and 1930's the American Navy and Marine Corps revised these early designs into several versions of landing craft as directed by the Navy's Continuing Board for the Development of Landing Craft, established in 1937: LCVPs (Landing Craft Vehicle Personnel), LCUs (Landing Craft Utility), LCMs (Landing Craft Mechanized), LCTs (Landing Craft Tank), and LSMs (Landing Ship Medium) (McGee 2000). Support ships, such as the LST (Landing Ship Tank) and LCI (Landing Craft Infantry) were much larger. In short, the imperative for improving the capacity for landings gave birth to a plethora of highly specialized amphibious platforms. This represented a revolution in naval technological driven by the need to go into harm's way, to take entrenched enemy defensive positions on fiercely-held Pacific islands and atolls beachfronts.

Figure 63: Tracked LVT(A)-1 (note the 37mm gun) churning its way towards the Maui shore 1944. (NARA photo 44972)

Ramped landing craft (LC) delivered soldiers directly onto the shore at the water's edge, but once outside of the landing craft, exposed troops still had to cross the open beach under enemy fire. Tracked amphibious assault vehicles, capable of transporting troops and equipment from ship to shore, and then driving up onto and beyond the beach itself, were developed to support amphibious operations and reduce casualties during landings (Bailey 1986; Friedman 2002). LVT (Landing Vehicle Tracked, also called AMTRACKS for Amphibious Tractors) were first tested in 1935, and underwent a number of substantive design changes prompted by the Continuing Board within the Bureau of Ships. As with landing craft, LVT designs adopted important modifications in order to fulfill specific tasks: LVT-1 through LVT-4 progressed through versions of landing vehicles as specialized personnel carriers. These AMTRACKS protected troops from being exposed to enemy fire on and beyond the beach. Armored AMTRACKS, LVT(A)-1 and the LVT(A)-4, featuring turrets mounting either a 37mm gun or a 75mm howitzer, were designed to provide direct fire support at the beach landing (Figure 63). These were literally amphibious sea-going tanks, and operated in coordination with the LVT personnel carriers (Mesko 1993). Like landing craft, LVTs were loaded and deployed several kilometers out to sea from larger LST amphibious ships, and then formed up in their assembly areas in coordinated waves, prior to starting their final high-speed run through cleared lanes to the beach (Speller and Tuck 2001). The Amphibious Assault Vehicles (AAV) used by the military today are the direct technological descendants of WWII versions of these AMTRACKs.

The allied island-hopping campaign in the Pacific required that remote and heavily-defended enemy-held bases and airfields be captured and held. Amphibious landings during World War II demanded greater coordination of air, sea, and ground forces than ever before, and greater specialized training (Bartlett 1983). Offshore bombardment of beachheads had to be carefully

timed with coordinated waves of amphibious assault vehicles. Logistical support of the landing, removal of submerged obstacles by underwater demolition teams, near shore mine sweeping, amphibious assault waves, subsequent off-loading of material, transport of the wounded, refueling, salvage of disabled craft, etc., represented a new tactic in naval warfare (Dyer 2010). At Guadalcanal, Tarawa, Saipan, Peleliu, Leyte, Iwo Jima, and Okinawa in the Pacific, and then Normandy and North Africa in Europe and the Mediterranean, these massed LCs, LVTs, and amphibious support ships played crucial roles.

8.5.1. Implications for the SCR Inventory

The channels, bays, beaches, hills, and skies above Hawai`i provided training grounds for combined forces amphibious exercises during World War II. These training exercises were large complex multi-day operations involving thousands of personnel, and accidents occurred. The waters off Pearl Harbor and Hawaii's many training beaches possess multiple landing craft and AMTRACK wreck sites, representative of design evolution during the preparation for massive Pacific invasions in the South Pacific (Table 17 and 18). LC and LVT wrecks are also found on land in former combat training areas, and a number of intentionally disposed LC and LVT's, some damaged in the West Loch explosion of May 21st 1944, have been discovered south of the entrance to Pearl Harbor. There are a number of large LST's (Landing Ship Tank) as well, which, after being damaged during the explosions, were also sunk as target assets off of O`ahu. The landing craft and assault vehicles lost during training exercises on Maui may have ordnance associated with the wreck site. All amphibious craft and vehicles represent the significant effort and technological achievement in design, and the importance of the Hawaiian Islands as training grounds for combat in the Pacific.

Figure 64: Bow of *LST-480* (RN771), ramp and doors missing, remains at West Loch, Pearl Harbor. (NOAA ONMS)

On Sunday May 21st 1944, intensive preparations for the invasion of the Marianas Islands were underway. Hanaloa Point at West Loch was the staging area for amphibious ships during World War II. Due to limited facilities at Pearl Harbor, 29 large LSTs were crowded together during these operations, side-tied in rows or "nests." Soldiers from Schofield Barracks were transferring ammunition, and aviation fuel from the LCTs stowed on the decks of the larger ships (Salecker 2014). At 3:08 PM a large explosion ripped through *LST-353*, second from the end of TARE (Berth)-8. The initial explosion originated near the bow of *LCT-963*, stored on the deck of *LST-353*. The exact cause of the initial blast was never determined (Lenihan 1989). One hulk, *LST-480* (RN771), remains in West Loch today (Figure 64). Burning debris showered down around gasoline drums and equipment onto a fleet of twenty-nine waiting tank landing ships. Burning oil on the water set nearby ships ablaze, and hot debris thrown into the air swept through the Loch. The inferno and subsequent detonations of

shipboard ammunition raged for the next 24 hours, sinking six of the LST's, destroying 17 LVTs and killing 163 men. Another 396 were injured (Salecker 2014; Cressman 2000). The disaster, later called a "Second Pearl Harbor," was immediately classified as top secret, and a rigid press blackout kept news of the event quiet until 1960. The planned invasion of Saipan was ultimately delayed by only a day, but the salvage of the sunken ships and clearing of West Loch continued for months and into 1945. Many of the damaged LVTs, LCTs and LSTs were later sunk outside Pearl Harbor (NARA).

8.5.2. Associated Inventory Sites

Table 17: Total numbers by landing craft and AMTRACK types from the inventory

Total number	Highlighted entry types	Notes
27	LVT (AMTRACKs)	Several discovered and surveyed near Maui's training beaches; numerous others located in the Pearl Harbor midden area.
25	Landing Craft	Nineteen LC discovered and surveyed.
10	Landing ships	Four landing ships discovered and surveyed.

Table 18: Types of AMTRACKS and landing craft and landing ships lost among the Hawaiian Islands

Type	Description	Number in Inventory
LVT-1	Early version of personnel carrier AMTRACK	1
LVT-2	Early version of personnel carrier AMTRACK	18
LVT-4	Later version of personnel carrier AMTRACK	1
LVT(A)-1	Armored AMTRACK for fire support	5
LVT(A)-4	Armored AMTRACK for fire support	4
LC	Landing craft (type unknown…generic)	4
LCI	Landing Craft Infantry	1
LCM	Landing Craft Mechanized	9
LCT	Landing Craft Tank	9
LCU	Landing Craft Utility	2
LCVP	Landing Craft Vehicle/Personnel	1
LSM	Landing Ship Medium	1
LST	Landing Ship Tank	8

8.5.3. Project Summaries

Several targeted surveys have focused on documenting the remains of these amphibious craft resources in shallow waters. MAST courses employing UH MOP science divers focused on documenting multiple LVT properties near Maui in 2011 and 2013 (Figure 65). These LVT-4s (personnel carriers) and LVT (A)-4s (armored AMTRACKS with turrets for direct fire support) lie directly in the approach channels for the beach exercises, lost during training for Operation Forager and the invasion of Saipan in June 1944. The LVT's lost near Maui are highly deteriorated. These sites provide local divers and fishermen with small artificial reefs, habitat for reef fish, eels, turtles, corals and other invertebrates.

Figure 65: MAST 2013 divers mapping an LVT(A)-4 wreck site near Maui (RN430). (NOAA ONMS)

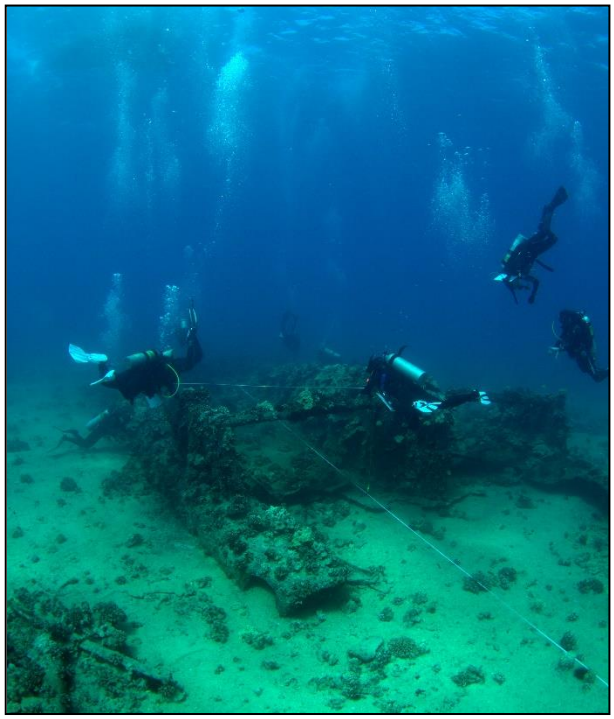

Figure 66: MAST student divers documenting an LSM near O`ahu's south shore. (NOAA ONMS)

In 2014 the MAST course surveyed the inverted stern half of a US Navy LSM (Landing Ship Medium, RN865), sunk in waters off Barber's Point O`ahu (Figure 66). The primary wartime mission of the LSM, a larger faster version of the LCT, was to land fully equipped and manned tanks and other vehicles directly on to enemy shores in the face of strong opposition (Friedman 2002). The Barber's Point LSM appears to have been stripped for intentional scuttling, and may correspond with an LSM used during the filming of the 1965 John Wayne World War II movie "In Harm's Way" (a vessel stand-in for a torpedoed Japanese ship).

Project summaries for these surveys are held by NOAA's Maritime Heritage Program.

Even larger numbers of amphibious ships and craft are found in the deep ocean around the islands. HURL has discovered and documented, in deeper waters south of O`ahu, multiple AMTRACKS apparently disposed following the West Loch explosions in 1944 (hulls damaged), and several larger landing craft (LSMs, LCIs, and LSTs). LST-884 (RN605), manned by an all-Coast Guard crew during the war, was discovered by HURL in November 2014, apparently disposed as a target asset, stripped of its antiaircraft guns. Three "rising sun" insignia

can still be seen on its superstructure, badges from its service at Iwo Jima and the Okinawan Campaign. Survey data for LST-884 and many other deep water amphibious craft is held by HURL. Some of the more recent data remains proprietary, held by the current principal investigators as representatives of the sponsoring agencies for those specific project dives.

Small landing craft in shallower waters (LCVPs, LCUs, and LCMs) have been discovered by recreational divers in many locations throughout the islands. Some of these appear to be stripped for scuttling and may correspond to vessels sunk by Hawaii's artificial reef program, run by the Department of Aquatic Resources in past years (Hawai`i DAR oral communication to authors 2008). Others possess few clues to their origins.

West Loch itself was a site of a joint NPS/NOAA and Navy Mobile Diving and Salvage Unit 1 (MDSU-1) survey project in August 2007. Over the course of the short 4-day project, the team was able to complete a magnetometer and side scan sonar survey of significant portions of West Loch and make a preliminary diving assessment of the historical remains of LST-480 (RN771). Other debris from the explosions in the survey area included small barges, portions of docks, and submerged "camels" or large wooden ship fenders (Van Tilburg and Conlin 2007). The report is on file with NOAA's Maritime Heritage Program.

8.6. Submarine History in Hawai`i

Submarines have a development history quite different from surface naval vessels. For a long period their stealthy nature presented a challenging but unquantifiable threat to military planners, so trial-and-error experimentation went on for years during the 19th century without substantial support (Delgado 2011). It was not until 1900 when Irish engineer John Philip Holland conceived of and successfully implemented the ideal combination of surface diesel engines and submerged battery motors, with self-propelled torpedoes (Friedman 1995). The first submarine formally commissioned (though certainly not the first *employed*) in the US Navy was named USS *Holland* (SS-1).

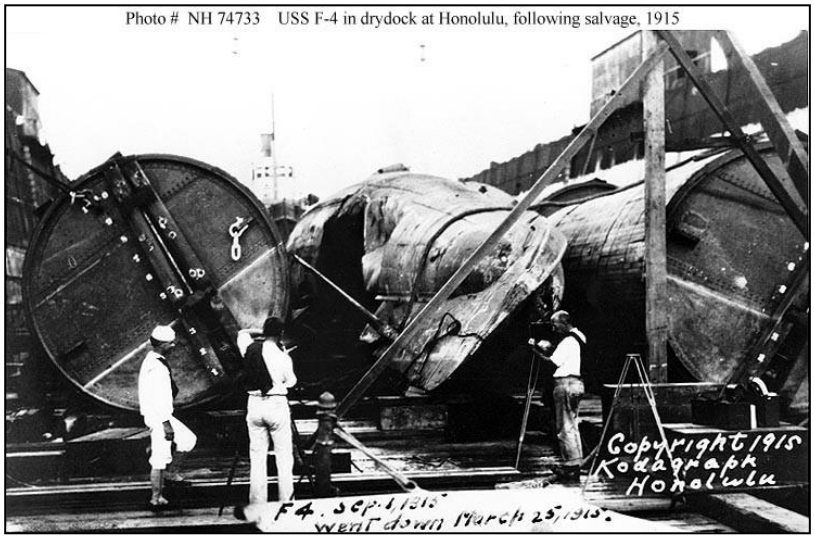

Figure 67: *F-4* (RN314) in dry dock after being recovered from over 92 m (300 ft), September 1st 1915. (NHHC photo 74733)

8.6.1. American Submarines at Pearl Harbor

In 1912, American submarines first arrived at Pearl Harbor. The First Submarine Division, Pacific Torpedo Flotilla, including the *F-4* (Figure 67), had originally been stationed at San

Pedro, California. In Hawai`i submarines *F-1* through *F-4* began operations from an old pier at the site of the initial naval station at Honolulu Harbor, what is now the foot of Richards street (NHHC 2015c). F class submarines were some of the first navy boats to feature bow planes (Friedman 1995). Following the tragic loss of *F-4* with all hands on March 25th 1915, all of these early F class submarines were returned to the West Coast, and operations were temporarily cancelled (Landauer and Landauer 1999).

During normal target practice exercises off Pearl Harbor, the submarine *F-4* (RN314) failed to return from a normal training mission. All of her 21-man crew were killed, the first major US submarine loss. The wreck site was too deep to consider plans to rescue her crew; special submarine rescue and salvage equipment simply did not exist in 1915 (Lockwood and Adamson 1962). Lieutenant Commander Julius A. Furer became the Salvage Master on site and managed to locate the search area by signs of oil and bubbles at the surface (Gore 1971). Sub tenders, rescue vessels and tugs were soon on the scene, locating the sub by wire sweeps of the bottom. On April 12th divers and hard hat gear, along with a decompression chamber, arrived from the New York Navy Yard Diving School and within two days, Chief Petty Officer Frank Crilley descended all the way to the 92 m (300 ft) deep site, a record breaking dive. Crilley would later receive the Medal of Honor from President Calvin Coolidge. *F-4* was brought to the surface on August 29th and placed in dry dock. The accident appeared to be attributable to battery acid leaking from storage jars, through sheet lead protection, and onto the main ballast tank bulkhead (Gore 1971). The *F-4* remains buried beneath the sediments between docks S13 and S14 at Pearl Harbor's submarine base today (Van Tilburg 2003).

K class submarines followed the F class to Hawai`i, operating this time from Kūāhua Island (later a peninsula) in Pearl Harbor from 1915 to 1917 (Friedman 1995). Their tender, the cruiser USS *St. Louis* C-20, also served as a receiving and training ship, as well as a traditional cruiser. These submarines, though, soon returned to bases on the continent, being recalled during America's entry into World War I (NHHC 2015c). The subsequent R-class submarines stationed at Pearl Harbor were some of the first American boats to feature the 53 cm (21in) torpedo tube (Friedman 1995). These were followed by S class boats, influenced by the response to German U-boat actions in the Atlantic during World War I.

S-class boats were our Navy's first ocean-going attack submarines, significantly larger, faster, and more heavily-armed than all their coastal/harbor-defense predecessors (Johnston 2012). The submarine base at Pearl Harbor at this time was still relatively primitive. An old barracks ship, USS *Alton* IX-5 (RN266), provided improvised housing. (Formerly the *Alton* had been the protected cruiser USS *Chicago* CA-14, an "ABCD" ship of the White Squadron.) The old vessel *Alton* was moored where the present-day base's largest pier, S1, is now located. A causeway was provided to the vessel, and the *Alton's* topsides were covered to provide housing for submarine officers, while the lower decks were provided for officers and men stationed at the base itself (NHHC 2015c).

Subsequent classes marked the staged development of submarine designs from coastal defense boats to the large and powerful ocean-going fleet boats of World War II (Alden 1979). From *Dolphin* to *Cachalot* to *Porpoise* to *Salmon* to *Sargo* to *Tambor* to *Mackerel* to *Gato* class, boats increased in size, range, speed, and efficiency (Friedman 1995). *Gato* class submarines, at 95 m (311 ft) in length with a range of 20,370 km (11,000 nautical miles or nm), were the first mass-produced fleet boats of the war period. They carried 24 torpedoes and could maintain patrol for

75 days with a complement of six officers and 54 enlisted men. Seventy-seven were completed between 1940 and 1944. The *Gato* class boats, along with the similar *Balao* and improved longer-ranged *Tench* class submarines that soon followed, made up the majority of the submarine fleet during World War II (Alden 1979).

8.6.2. Japanese Midget Subs

Despite the long history of submarine operations in Hawai`i, notoriety in submarine history goes to the adversaries in World War II. The most famous submarine in Hawaiian waters is the Japanese midget sub, sunk outside of Pearl Harbor December 7th 1941 (Delgado et al 2016). The Japanese Navy was neither the first nor only one to experiment with midget submersibles as potential secret weapons prior to the war; the concept was a familiar one among all combatants. The Japanese, however, did create an extremely capable version during trials in the 1930's, known by the code name *Ko-Hyoteki* or Target Type-A.

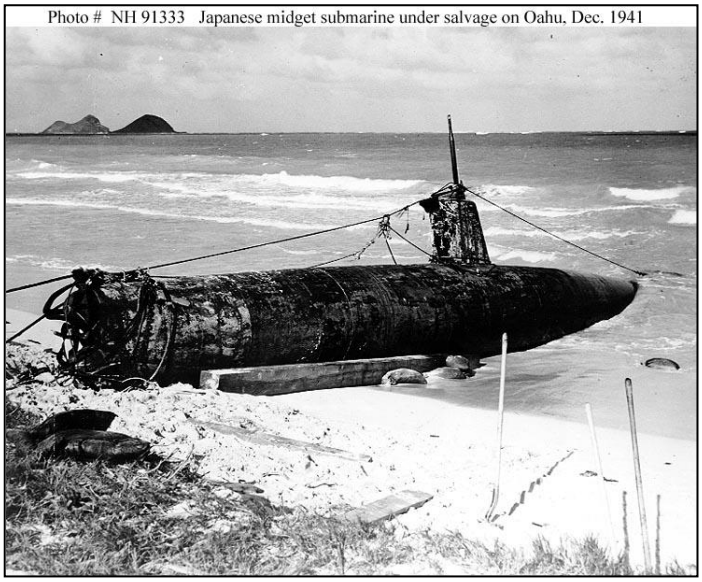

Figure 68: Japanese Type-A submarine aground at Waimanalo Beach, December 8th 1941. (NHHC photo 91333)

Five of the Type-A *Ko-Hyoteki* took part in the surprise attack on December 7th. Japanese C1-type fleet submarines had arrived the previous night outside the harbor to deploy the midget subs of the Special Attack Unit (Burlingame 1992). Following their launch, the five midget subs maintained strict radio silence, so it is not clear today how most of them maneuvered in preparation. It is known that at least one sub and possibly two succeeded in penetrating the channel and harbor defenses (Delgado et al 2016). One was rammed by the USS *Monaghan* in the harbor and sunk before it could release its torpedoes (later recovered and buried in a landfill). Another ran ashore outside the harbor entrance near Ke`ehi Lagoon (found by divers in 1960 and returned to Japan). A third had compass failure and eventually grounded at Waimānalo Beach (Figure 68). The sub was recovered and is now at the National Museum of the Pacific War in Texas. The fourth was sighted shortly before the arrival of the carrier-based aircraft and sunk by the USS *Ward* (Lenihan 1989).

In the early morning hours on December 7th, four navy minesweepers were performing their regular sweeping duties outside the channel, and the USS *Ward* DD-139, a *Wickes* class flush deck "four stacker" destroyer, was on regular patrol (Burlingame 1992). The USS *Antares* towing a 500-ton lighter from Palmyra was making her approach to the harbor entrance. At 6:30 AM a crewman on board the *Ward* spotted an object astern of the ship, and a PBY also on morning patrol began circling the location. What appeared to be a conning tower and periscope was sighted behind the barge being towed by the *Antares*, apparently attempting to follow the

vessel into the channel. The PBY dropped smoke pots to mark the contact, and the *Ward* opened fire with its #1 gun at a range of 90 m (295 ft). The initial shot was high. The PBY then made a depth charge attack, and the *Ward,* also dropping depth charges and crossing the stern of *Antares*, fired a second shot from its #3 gun, which appeared to strike the target directly at the starboard base of the conning tower, but there was no explosion (Outerbridge 1941). Fired from less than 90 meters, it's doubtful that the shell had time to arm itself (Delgado et al 2016). The Type-A sub (RN740) began to descend and moved into the area of the exploding depth charges, leaving behind an oil slick. Unfortunately, the *Ward's* actions were not immediately confirmed as a solid indication of an impending attack, and Pearl Harbor command remained unaware of the impending strike until the first Japanese aircraft arrived at 7:55 AM, over an hour after the midget sub had been sunk (Burlingame 1992).

The fate of the fifth Type-A *Ko-Hyoteki* (RN523-525) has been the subject of speculation for years. Today, a combination of new documentary evidence and field data (site confirmation of design features) strongly suggests that three portions of a Japanese sub that was salvaged and disposed in deep water, and discovered by HURL years later, are in fact separate pieces of the fifth member of the original Pearl Harbor attack force (Delgado et al 2016).

8.6.3. The Captured Japanese Submarine Fleet

A special group of Japanese WWII submarines lies in Hawaiian waters that reflect both the technological achievements of the Imperial Japanese Navy as well as the material and logistical limitations of the Japanese war efforts. In August 1945, during the final weeks of the war, two large *Sentoku*-class submarines *I-400* and *I-401,* along with the Type AM-class *I-14* and two *Sentaka*-class fast attack submarines *I-201* and *I-203*, sortied from their naval base in Japan to strike at the assembled American carrier force at Ulithi Atoll in the South Pacific (Geoghegan 2013). These submarines were advanced designs, far beyond the capabilities of other navies at the time; however, their production was so limited that they had little effect on the outcome of the war.

- *Sentoku class*: These giant 5,223-ton 122 m (400 ft) long submarines (*I-400* RN730/527 and *I-401* RN731/527-528) were capable of carrying, launching and recovering three *Seiran* M6A1 bombers. With an impressive range of 69,450 km (37,500 nm), this advanced platform could literally surface anywhere in the world and conduct an air strike against enemy targets (Sakaida et al 2006). Operational plans originally included a surprise air strike on the critical locks of the Panama Canal, crippling the ability of the Allies to transfer vessels between the Atlantic and Pacific theaters. These were the largest submarines of their day, only being surpassed in the 1960s by Cold War-era designs. Only three *Sentoku*-class submarines were ever launched, and only two were to serve briefly in combat roles, at the aborted Ulithi Atoll strike (Geoghegan 2013).
- *Sentaka class*: This 1,291-ton 79 m (259 ft) long experimental high-speed attack submarine (*I-201* RN531-532) was of advanced design with a range of 10,740 km (5,800 nm). The submarine's true strength was speed, being capable of making almost 36 kph submerged (22 mph), faster than the rated surface speed of 29 kph (18 mph), and almost twice the speed of submerged American submarines. To

achieve this speed, the streamlined *Sentaka* class featured reduced conning tower size, retractable dive planes and retractable deck AA guns. Although 18 were laid down on the ways, only three *Sentaka*-class submarines were completed before the end of the war (Geoghegan 2013).

- *Type AM class*: This large type of aircraft-carrying submarine (*I-14* RN529-530) was capable of launching and recovering two Aichi M6A1 Seiran bombers. Almost as large as the *Sentoku* class at 114 m (373 ft) in length and 3,603 tons, the AM class had an impressive range of 38,900 km (21,000 nm). Seven were ordered by the Japanese military, but only two, *I-13* and *I-14*, were ever completed (*Type AM Submarine* 2017).

With the announcement of the end of hostilities on August 15, 1945, the Ulithi Strike Force was ordered to abandon the attack and return to their base in Japan. The submarines were soon intercepted by US Navy ships and surrendered peacefully. All five submarines were brought to Hawai`i from Japan by US Navy prize crews for study by the military. Following interest expressed by the Soviet allies in examining the new technology, all were subsequently sunk in deep water off the south shore of O`ahu as target assets in 1946 (Kerby 2013).

In 2005 HURL discovered the *I-401*, the giant Japanese aircraft carrier submarine, in deep water off the southwest coast of O`ahu (Figure 69). In 2009 HURL discovered the *I-14* and the *I-201*, and in 2013 a HURL/NOAA project discovered the *I-400*. The *Sentaka*-class *I-203* is now the only one of the fleet of five captured submarines in Hawai`i that has yet to be found, a testament to the capabilities of HURL's undersea program (Kerby 2013). All of these submarines have been the subject of follow-up HURL/NOAA collaborative investigations, and several (*I-400* and *I-401*) have been the subject of documentaries produced by a variety of media companies. Survey records are held by HURL and by NOAA.

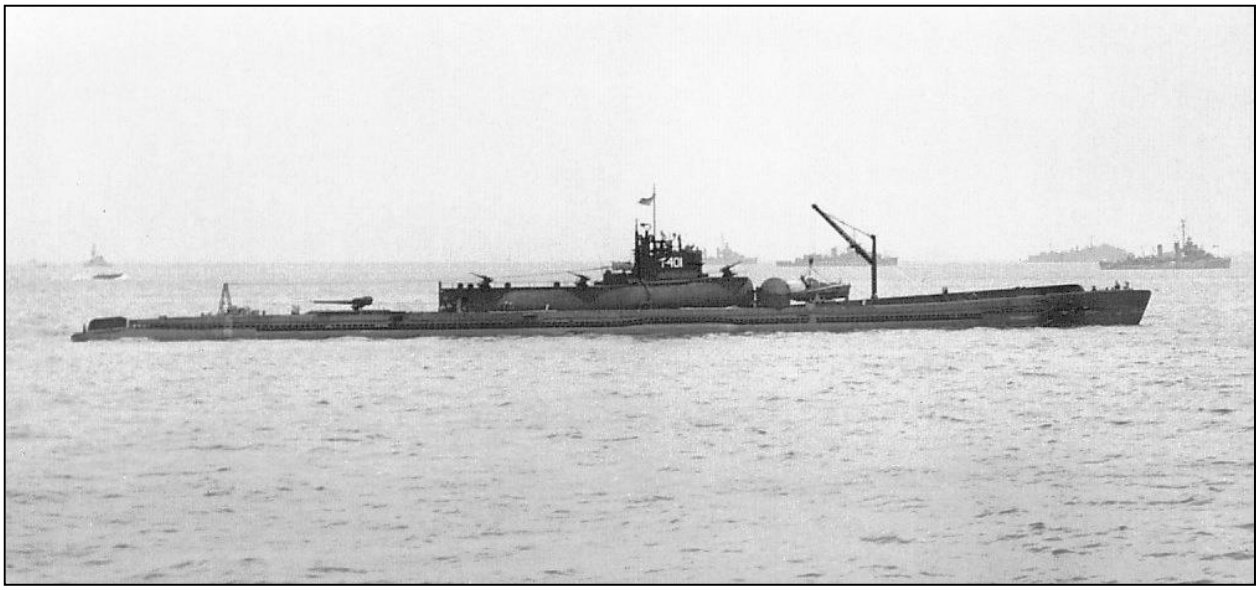

Figure 69: Image of Japanese submarine *I-401*, showing watertight aircraft hangar (forward door open), Seiran aircraft being recovered by retractable crane. (I-400 Class Submarine 2017)

8.6.4. Implications for the SCR Inventory

For the most part, sunken submarines in Hawai`i were decommissioned US Navy boats intentionally disposed as target assets. There are, however, a number of notable exceptions to this, being the Japanese WWII captured subs (above), the midget subs deployed at Pearl Harbor, the Japanese *I-23* (below) and accidental training losses like the *F-4* (above) and the *S-28* (Table 19). In all cases, lost submarines have a special significance as powerful new weapons operating in an extremely hazardous environment (Table 20). Their wrecking event takes place often unseen, their losses remaining a complete mystery, without closure for families of the crew. In archaeological terms of site formation processes, sunken subs as uniform welded cylinders often remain relatively intact, until initial damage or slow deterioration breaches the hull, scouring destabilizes seafloor support, joints open, and interior artifacts fall out in catastrophic collapse (Figure 70).

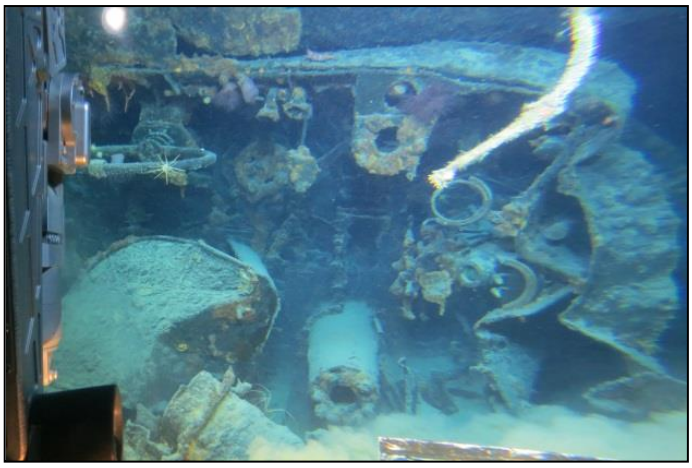

Figure 70: Bridge atop the conning tower (on STBD side) of the *I-400* Japanese submarine. (NOAA ONMS)

8.6.5. Associated Inventory Sites

Table 19: Highlighted submarine entries for the Hawaiian Islands

SCR Record Number	Highlighted entry submarine names	Notes
775	*S-28*	American S-class submarine lost with all hands during training in 1944; pending survey
730	*I-400*	(and 526) Japanese *Sentoku*-class aircraft carrier submarine discovered by HURL
527	*I-401*	(and 528) Japanese *Sentoku*-class aircraft carrier submarine discovered by HURL/NOAA
521	*S-4*	American S-class submarine discovered by HURL; in-service accident in the Atlantic, salvaged, used as submersible training hulk for submariners
314	*F-4*	F-class submarine lost off Pearl Harbor in 1915 with all of her 21-man crew. Subsequently salvaged and reinterred
523	Type A submarine	(and 524-525) "3-piece site" Japanese midget sub surveyed by HURL/NOAA, possibly salvaged from Pearl Harbor and disposed
740	Type A submarine	"Ward sub" Japanese midget sub sunk by USS Ward immediately prior to Pearl harbor attack; surveyed by HURL/NOAA/NPS

Table 20: Types of submarines lost among the Hawaiian Islands and total number in inventory

Nationality	Type	Number in Inventory
American	Gato class	3
	Balao class	4
	Tang class	1
	S class	4
	F class	1
Japanese	Sentoku class	2
	Sentaka class	1
	Type AM	1
	Type A (*Ko-hyoteki*)	2
	Type B1	1
	Kaidai class	1
German	U-43 class	1

8.6.6. Project Summaries

The Japanese submarine (RN740) sunk by the USS *Ward* was located on August 28th 2002 by HURL *Pisces* submersibles following years of focused surveys (see Section 8.8.1. Naval Midden Pearl Harbor below). The midget sub appeared upright and intact, in relatively good condition, with a slight list to port (Figure 71). Both torpedoes were still in their tubes, and no extensive exterior damage was visible except for a shell hole at the base of the conning tower's starboard side, corresponding to the USS *Ward's* report. There was no apparent exit hole on the port side, nor any evidence of explosion (Wiltshire et al 2002). Silt, corrosion, rusticles, and sponges were evident on the outside of the hull. Stern dive planes and rudder were in the "up" and "to starboard" positions. The sub rested on hard substrate at its midsection, where a sandy berm has built up on both sides of the hull. The bow extended unsupported over an area scoured by bottom currents, and scouring was occurring between amidships and the stern rudder as well. The *Pisces* subs conducted non-invasive video survey (Wiltshire et al 2002). HURL and NOAA contacted the US State department, and as advised, protected the site's position as sensitive data (Delgado et al 2016). The specific identity of the crew and the submarine remain unconfirmed.

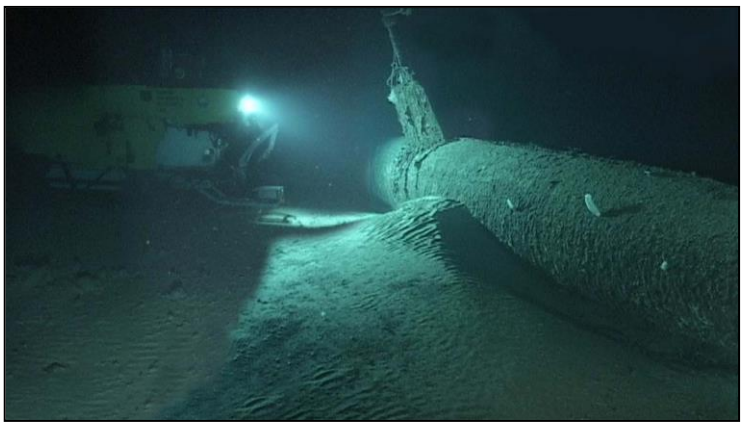

Figure 71: HURL submersible *Pisces V* at the Type-A Japanese sub site (RN740), 2002. (HURL)

In September 2002 NOAA, HURL and NPS agreed upon an initial research design for the Japanese midget sub site, a plan emphasizing long-term management goals. NOAA, HURL and NPS moved forward with a precautionary approach. *In situ* preservation policy was chosen as the preferred alternative concerning preservation efforts at the site (Delgado et al 2016). The precautionary approach minimizes all impacts to a site or property while gathering the data necessary for site preservation.

Ownership of the Japanese submarine was clarified in the February 2004 agreement between the US Department of State and the Government of Japan, stating: the US owned and controlled the midget sub; the site should be respected as a war grave as well as an historic resource; the site should be protected and managed in accordance with international law, US historic preservation laws, and the US Policy for the Protection of Sunken Warships (Delgado et al 2016). Research design and preservation goals must conform to this agreement between the US and Japan. Status as a war grave has special meaning to those familiar with World War II resources and the honor and respect observed for such sites.

Over subsequent years, HURL, NOAA, and NPS have conducted a number of joint-agency monitoring and investigative dives of the midget sub, compiling data on the sub's environment, deterioration status and site formation processes in order to contribute to the collaborative preservation effort and management decisions (Delgado et al 2016).

- 2002 Discovery by HURL
- 2002 Initial archaeological assessment by HURL, NOAA, NPS
- 2002 Media coverage by NOAA, NPS, WHOI
- 2003 Monitoring survey by HURL
- 2003 Corrosion study initiated by NOAA, NPS, ONR
- 2004 Monitoring survey by HURL, NOAA
- 2004 Media coverage for Asahi TV by HURL
- 2005 Corrosion studies and interior survey by NOAA, NPS, NHC
- 2007 Monitoring survey by HURL
- 2009 Monitoring survey by HURL
- 2011 Monitoring and media coverage by HURL, National Geographic
- 2013 Monitoring survey by HURL, NOAA
- 2014 Monitoring survey by HURL, Matthews Foundation
- 2016 Monitoring/media coverage NOAA OER

The results of these surveys and recommendations for the future of the site have been compiled in James P. Delgado et al, *The Lost Submarines of Pearl Harbor* (2016).

In 1938 the American submarine *S-19* (RN522), deemed "in excess of the limits prescribed by the London Naval Treaty of 1930," was scuttled off the south shore of O`ahu (NHHC 1938). In September 2015 an opportunistic deep ROV survey was conducted by NOAA's Office of Ocean Exploration and Research and the ONMS Maritime Heritage Program. An archaeological video

Figure 72: OER's ROV "Deep Discoverer" at the bow tubes of the American submarine *S-19* (RN522). (NOAA OER)

inspection of *S-19* was conducted while biologists documented the deep-water coral habitat of the wreck (Figure 72). The vessel, lying in over 400 m (1,300 ft), provides a view of navy salvage circa 1938: scuttling preparations included removing rudder and stern dive planes, props and shafts, two Nelseco engines, anchor, bow planes and bow plane pivot mechanisms, deck gun, forward capstan, and the conning tower superstructure. Survey data are held by NOAA's Maritime Heritage Program and NOAA's Office of Ocean Exploration and Research.

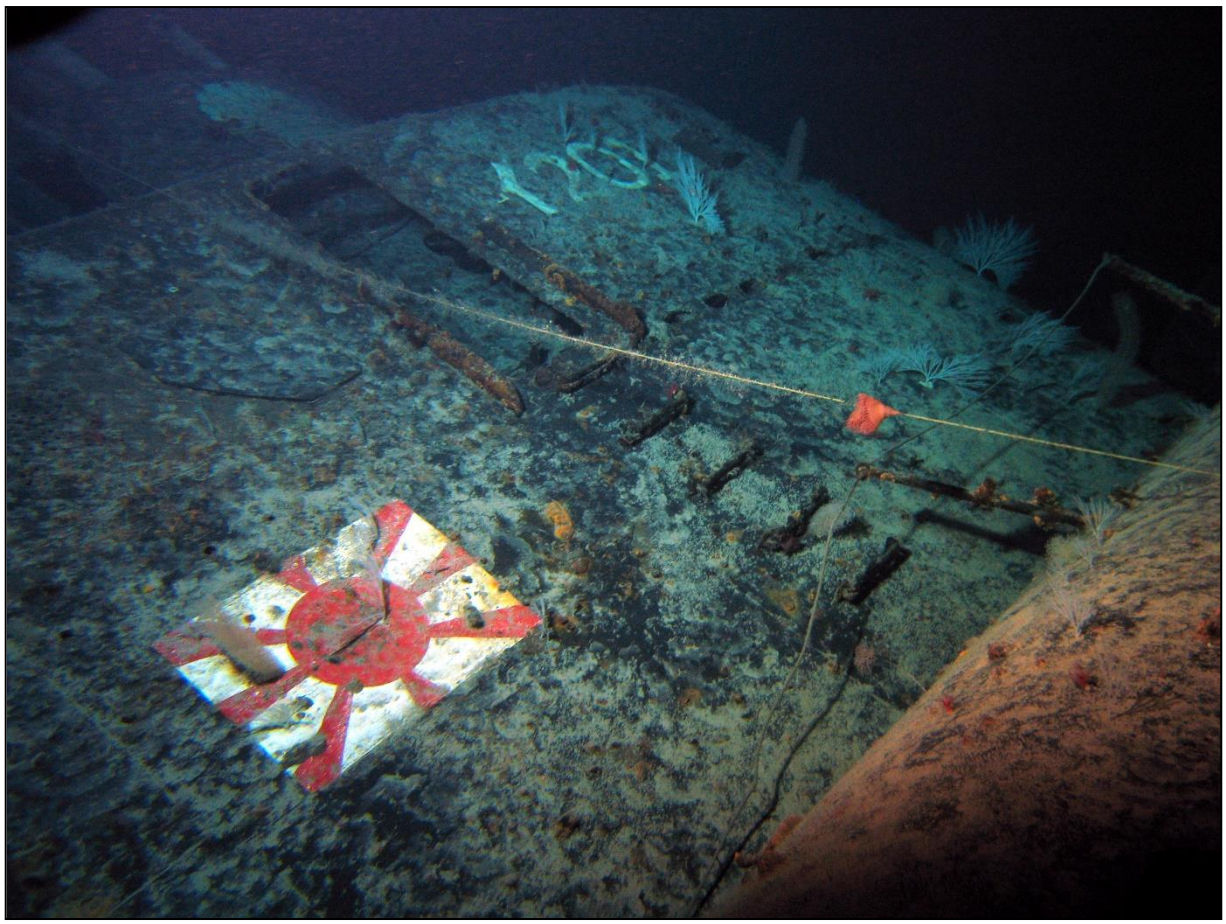

Figure 73: Conning tower of the *I-201* (RN531) experimental fast attack Japanese submarine. (HURL/NOAA ONMS)

Between 2003-2017, both HURL and NOAA ONMS and NOAA OER have combined their efforts and conducted a number of surveys of submerged ships and aircraft (Table 21). A significant number of these have been preliminary non-invasive surveys of sunken submarines, including the *I-400, I-401, I-201* and *I-14* (Figure 73 and Section 8.6.3. above). Further investigation is needed and plans are ongoing for a return to those sites. Survey data are held by HURL, NOAA MHP, and NOAA OER.

Table 21: Collaborative HURL and NOAA surveys in the Hawaiian Islands

SCR Record Number	Site name	Year	Notes
536	*PC-578*	2003	Coastal patrol craft
537	*PC-594*	2003	Coastal patrol craft
561	*Marshall Mars* JRM-1	2004	Navy flying boat
740; 523	Japanese midget subs (2)	2002-2016	Outside Pearl Harbor entrance
NA	Deep Water Database	2008	Side scan survey, O`ahu south shore
529	*I-14*	2009	Type AM aircraft carrying submarine
531	*I-201*	2009	Sentaka experimental fast attack sub
527	*I-401*	2009;	Sentoku class
729	USS *Kailua*	2013	Former *Dickenson*; Auxiliary vessel
730	*I-400*	2013-2014	Sentoku class; with NHK Japan

Many maritime heritage resources in the Hawaiian Islands have been located during the last two decades, however two very important wrecks have not yet been found: the American submarine *S-28* (RN775), lost west of Nānākuli during combat training exercises in July 1944; and the Japanese submarine *I-23* (RN914), which disappeared on combat patrol approximately 16 km (10 mi) south of Pearl Harbor in February 1942. Both were lost with their entire crews. The circumstances surrounding these wartime losses remain a mystery. In 2015 a collaborative survey proposal, featuring the University of Hawaii's IMI-120 towfish (specific bathymetric side scan/magnetometer system) to obtain high resolution seafloor imagery in the areas where the vessels are believed to be located, was submitted to NOAA's Office of Ocean Exploration and Research. The search for these wartime casualties directly addresses specific Maritime Archaeology Program priorities including an emphasis on "high-resolution surveys to locate archaeological targets." Both of these submarines represent major wartime losses. The *S-28* carried out seven wartime patrols and sank the last Japanese ship in the Aleutian Campaign. The *I-23* participated in the Pearl Harbor Strike Force in December 1941, and then returned to Hawai`i and played a role in the attempted second attack on Pearl Harbor known as "Operation K." Locating these submarines could solve the mystery behind their losses, and bring long-sought closure to families of their missing crewmen.

8.7. Training: the War Time Home Front

Hawai`i during World War II served as a major training, staging, and supply base for the entire region (Chapman 2016; Allen 1950). Due to similarity of environments within the Pacific, the Hawaiian Islands were particularly suited for jungle warfare exercises and amphibious operations (Figure 74). O`ahu was the busiest and most used training island, but all of the main islands hosted military exercises (Figure 75). Squadrons of aircraft practiced overhead, while landing craft charged the beaches; ships' guns fired at island target areas, and Underwater Demolition Teams negotiated submerged obstacles. The sights and sounds (and even smells) of the Hawaiian Islands were very different from what

Figure 74: Marines and landing craft training in the Hawaiian Islands, April-May 1944. (NARA photo 109365)

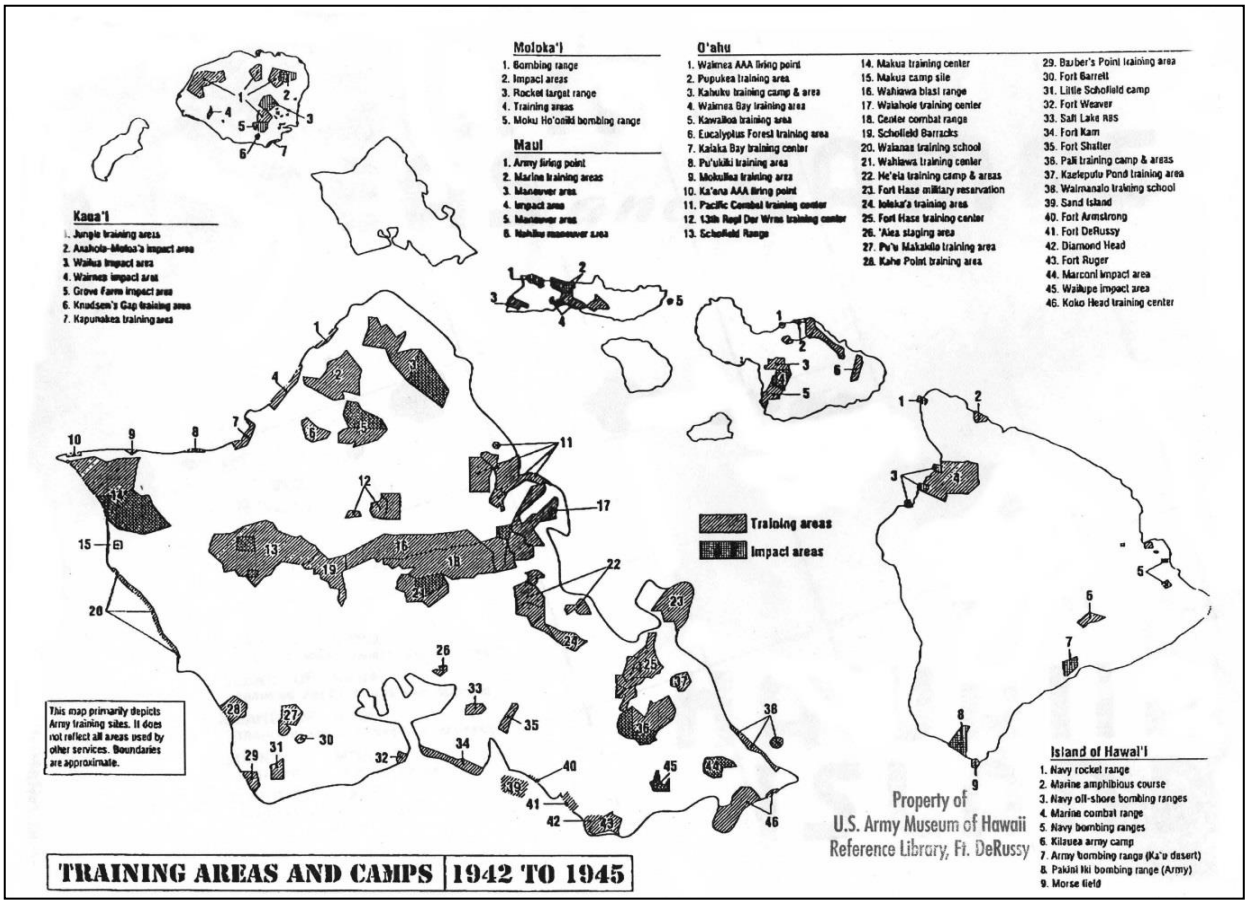

Figure 75: Training and camp areas in the Hawaiian Islands 1942-1945, primarily depicting Army sites…map not to scale. (US Army Museum of Hawai`i)

they are today. Maui serves as an example of the intensity of the combat training home front in Hawai`i. The island during the war was fully engaged as a staging center and training base, and temporary home to the 4th Marine Division ("Maui Marines") at Camp Maui on the slopes of Haleakalā (Chapin 1945a). There were almost 50 different military training areas on Maui, including live-grenade courses, pistol, rifle, and machine-gun ranges, a bazooka area, a mortar and artillery impact area, a seacoast artillery range, an antiaircraft firing area, and combat firing ranges for maneuvering and firing of tanks and halftracks in coordination with the infantry. Maui also featured extensive jungle training areas and simulated village and cave fighting courses. Training was conducted both day and night and bivouacked encampments could be seen all over the island. Camp Tarawa in Waimea on Hawai`i Island hosted both the 2nd and then 5th Marine Divisions (Allen 1950; Chapin 1945b).

8.7.1. Aviation Exercises

Many areas were used for aviation combat training around the islands (Table 22). Kaho`olawe, close to the island of Maui, became known as the most shot-at and bombed island in the world. Formerly a ranch, in 1941 the navy leased the island for one dollar a year, and live ordnance training exercises (air, gunnery, landings, torpedoes etc) continued for decades (Parsons 2004). The navy also used `Īlio Point on the northern end of Moloka`i, and Mokuho`oniki Rock, off Moloka`i's eastern end, as target areas (Allen 1950). Other bombing target areas included Kahuku on O`ahu, Makanalua Peninsula on Moloka`i, and `Opaua Point on Maui (Historical Section 14th Naval District 1945).

Table 22: Partial list of target bombing ranges in the Hawaiian Islands, WWII. (Environment Hawaii newsletter Aug 1992)

Island	Range
Moloka`i	`Īlio Point Bombing range
	Mokuho`oniki bombing range
	Makanalua (Kalaupapa) navy bombing range
Maui	Opana Point navy bombing range
	Kanouou Point
	Kanehena point
	Kane Puu bombing range
O`ahu	Kahuku Point bombing range
Hawai`i	Navy offshore bombing ranges
	Navy bombing ranges
	Army bombing range (Kau desert)
	Pakini Iki bombing range
	Mahihi Maka Nui bombing range
	Kau bombing range
Kaho`olawe	Kaho`olawe Island bombing and gunnery range

Figure 76: Fighter aircraft above Waimānalo Beach. (US Army Museum Hawai`i ND)

Thousands of naval aircraft and new pilots took part in intensive training activities in preparation for combat operations in the Pacific (Figure 76). The training itself, night operations, combat practice in close formation, high-speed evasive maneuvers, high-G dive-bombing practice, often proved hazardous. Records from the Aviation Branch at Naval History & Heritage Command for the years 1922-1952 indicate a total of 1,375 naval aircraft sunk in the vicinity of the Hawaiian Islands during that period (Van Tilburg 2003). The vast majority of these losses (1,124 or 82%) sank between 1942-1945. The last year of World War II alone saw 542 aircraft losses in Hawaiian waters. Many of these submerged aircraft crash sites are also war graves. Often, naval aircraft are found by divers in the vicinity of navy and army air station runways. Locating and identifying these aircraft has become a popular pursuit for local sport and technical divers, particularly as closed-circuit re-breather (CCR) technology has advanced and become more available to the specialized public. Some submerged aircraft, like O`ahu's Corsair (RN833) or Maui's Helldiver (RN891) have become regular destinations for Hawaii's recreational diving industry.

8.7.2. Amphibious Exercises in the Islands

Defense constructions on beaches throughout the islands were designed to simulate enemy-held territories. The Wai`anae Amphibious Training Center, largest of the several amphibious schools among the islands and the main Army amphibious training area, sent infantry forces northward to Mākua Beach, where they assaulted replicas of the Japanese defenses at Tarawa Island. O`ahu's Waimānalo Amphibious Training Center on the windward side included nearby Mānana Island (also known as Rabbit Island), where logs, concrete emplacements, and sandbags represented fixed shore positions defending against invasions from the nearby shore (Dorrance 1994; Addleman 1939).

On Hawai`i Island, terrain near Waimea proved a close match for Saipan, Guam, and Palau, and training areas included the beachfront at Hapuna near Camp Drewes, where marines and army infantry in LVT's landed and where scout and sniper units practiced nighttime surf operations (Chapman 2016). Kaua`i also featured an amphibious training center, "Little Tarawa" located at Port Allen, where units of the 33rd Infantry Division trained in February 1944 prior to shipping out to New Guinea (Winston 1948).

On the Garden Isle, the Maui Amphibious Training Center was a hub of activity. Exercises centered on the protected waters and leeward beaches along the southern coastline from Mā`alaea (known as Buzz's) Harbor to Mākena Landing (Figure 77 below). Training locations

also included Molokini Crater. Ships from Pearl Harbor and Kahului converged on Mā`alaea Bay during coordinated training operations prior to major Pacific engagements, such as the invasion of Tarawa in November 1943, Roi-Namur in January 1944, Saipan in June 1944, and Iwo Jima in February 1945 (Chapman 2016). Barbed wire and beach defenses simulated combat landing conditions (Allen 1950). Underwater Demolition Teams also conducted early training in Hawai`i, at O`ahu's Waimanalo Amphibious Training Base and at the Combat Demolition Training Center on Maui's Ma`alaea Bay, today known as Kama`ole Park (Dyer 2010; Fane and Moore 1995). Ultimately, some forty 100-man teams of combat swimmers, the origins of today's Navy SEALs, were trained in surveying and destroying undersea obstructions, and reconnaissance techniques in shore invasions.

Training for all these components of amphibious assault was designed in several distinct phases.

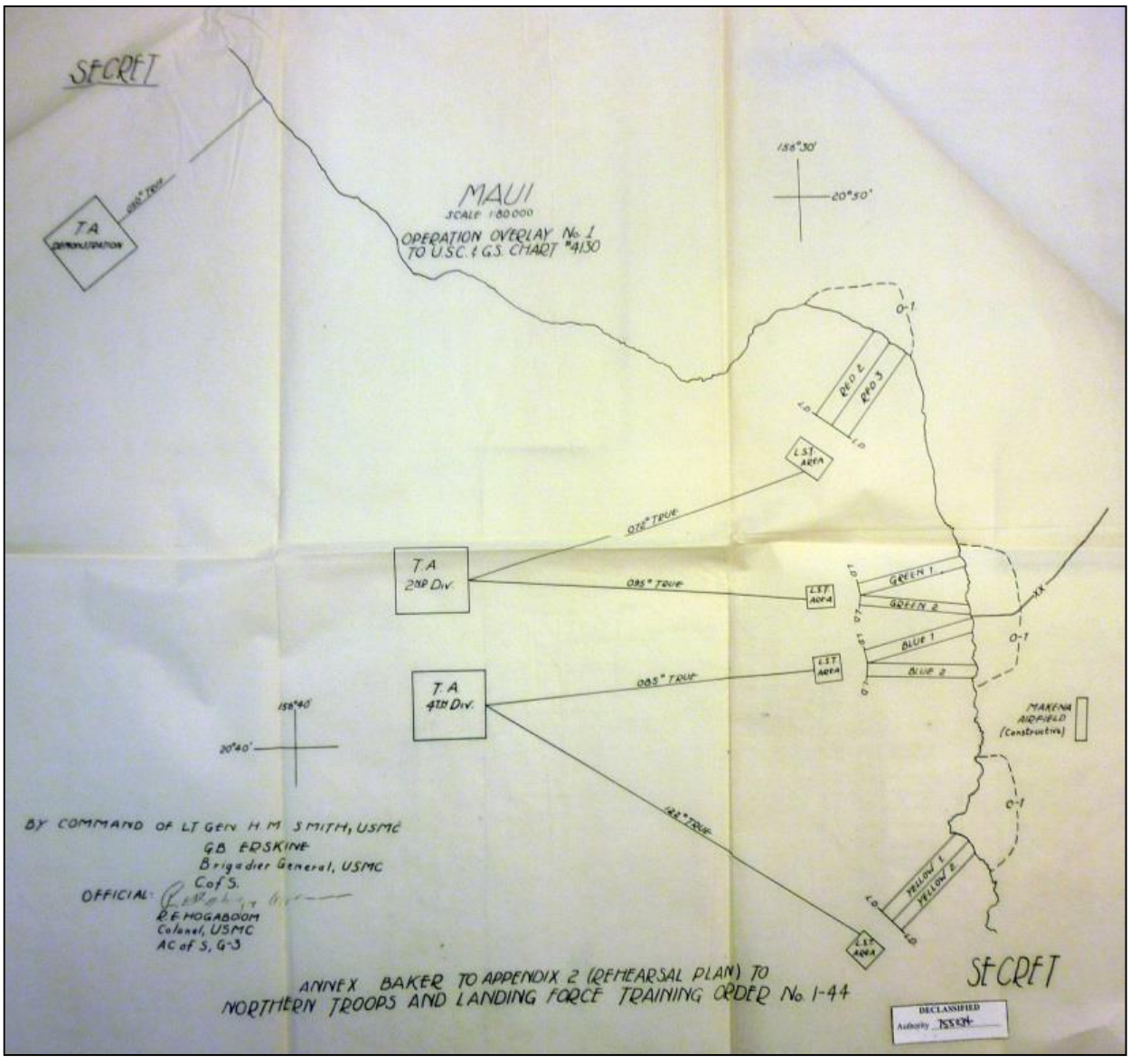

Figure 77: Map accompanying amphibious training orders in 1944, showing LVT assault lanes leading from the LST deployment areas to Maui's southern beaches. (NARA Record Group 127)

> It was recommended that these training centers be located on seacoasts in a temperate climate near to land and air training centers, where safety from submarines existed and terrain suitable for maneuvers on a division scale was available. The planners recommended that the training program should consist of basic, individual and small-unit training of ground forces in the techniques of embarking and debarking from small landing craft and in the training of small boat crews. A second phase of training was planned to include the use of transports and supporting vessels to require actual loading and embarkation on practice operations. The final phase of training was contemplated as a complete rehearsal, or series of rehearsals of the combat operation planned, including the use of all arms expected to be employed…Army Ground Forces was charged with development of doctrine, training of tactical units (to include shore-to-shore and, if facilities permitted, ship-to-shore training), and "all phases of the operations of Army units involved in embarking troops and equipment in small boats from the land, the approach to and loading on a hostile beach, the establishment of a beachhead, and the preparation and initiation of an attack inland." Services of Supply was charged with "the organization, training, supply and equipment of boat operating and maintenance units, the operation of transportation facilities for landing operations, and for the equipment and training of shore parties." Proceeding concurrently with shore-to-shore amphibious training by the Army was ship-to-shore training under control of the Navy (Becker 1946).

Large division-level amphibious exercises involved the combined service forces of thousands of troops, months of planning, and were massively complex in execution (Dyer 2010). In an effort to simulate all aspects of the actual invasion, surface vessels sortied from Pearl Harbor and other ports and conducted off-shore bombardment, while aircraft trained overhead and waves of amphibious craft landed on Hawaiian beaches (Table 23 below). (During the invasion of Saipan, more than 700 LVT's were involved.) Shorelines featured barbed wire and concrete pillboxes placed to replicate enemy islands (Chapman 2016). Invariably, equipment was damaged and lost. During amphibious training prior to Operation Forager (invasion of the Mariana and Palau islands) in 1944 several AMTRACKs were lost (Figure 78). Divers have located submerged LVTs in the vicinity of these training centers on several Hawaiian Islands.

Figure 78: Waves of LVTs training in Mā`alaea Bay, April-May 1944. (NARA photo 304218)

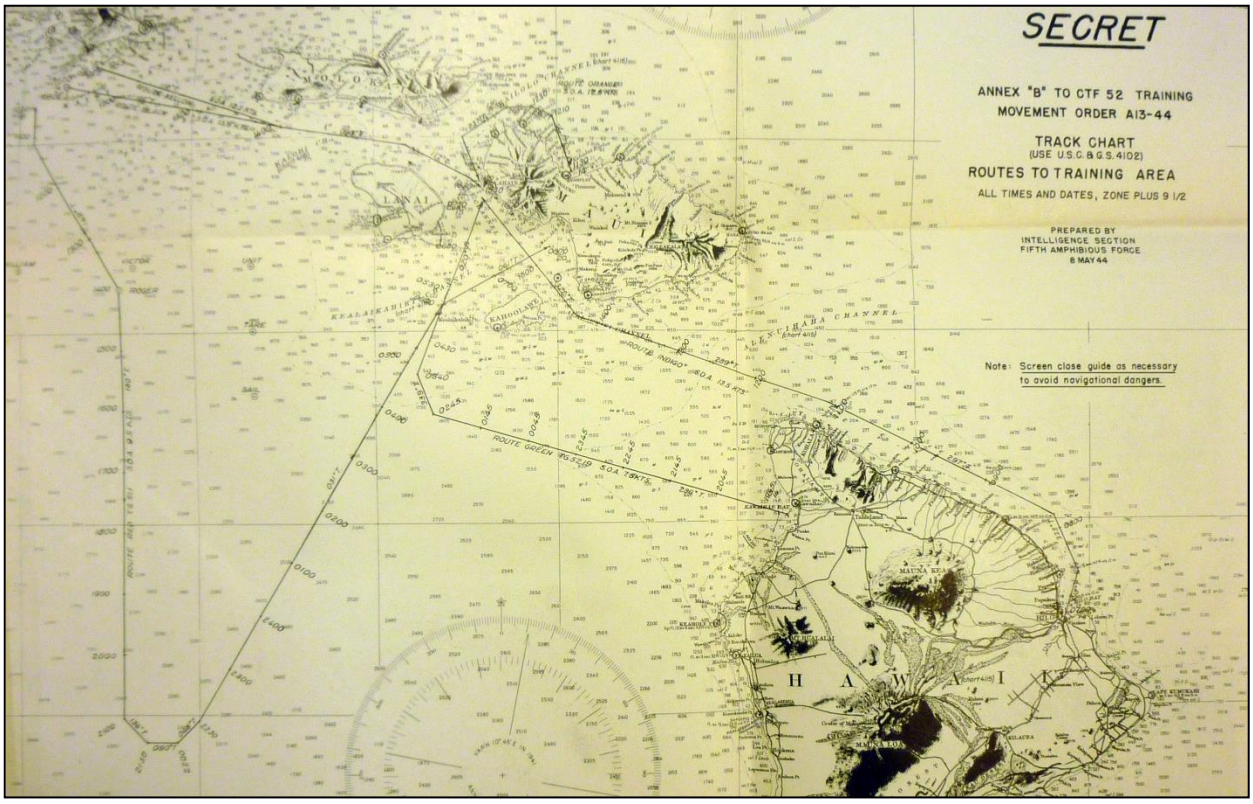

Figure 79: Track chart for navy ships taking part in Operation Forager training exercises, throughout the Hawaiian Islands, May 1944. (NARA Record Group 127)

Table 23: Selected major amphibious training efforts in the Hawaiian Islands (Chapman 2014)

Time period	Units	Training locations	Departure to
July 1943	40th infantry division	O`ahu (Wai`anae and Mākua)	Guadalcanal
	33rd infantry division		New Guinea
	6th infantry division		New Guinea
March 1944	77th infantry division	Maui (Mā`alaea Bay)	Guam
May 1944	4th marine division	Maui (Mā`alaea Bay); Kaho`olawe	Saipan and Tinian
	2nd marine division		
July 1944	81st infantry division		Peleliu
	96th infantry division		Leyte
Oct-Nov 1944	?		?
January 1945	?		Iwo Jima

8.7.3. Losses

Today, the physical legacy of World War II in the Pacific and more generally the US Navy and Armed Forces in Hawai`i can still be found in offshore deep waters and in near-shore waters as well, where sunken aircraft and shipwrecks provide recreational diving opportunities and habitat for marine species. Island monuments to the war years on shore, also part of this cultural landscape, mark the historic locations of amphibious training centers and marine encampments. The deeper waters around the islands also possess this same military legacy in great abundance. The oceans surrounding the Hawaiian Islands maintain a sunken museum of military history in the Pacific.

8.8. Disposing Hulks: Sending Ships to Davy Jones

Many of the submerged cultural resources in the islands are victims of accidents, shipwrecks. Many other resources are intentionally disposed hulks, scuttled commercial vessels, or disposed navy ships used as target assets and sunk by bombs, missiles or torpedoes. Though the wrecking event is often more dramatic in the former rather than the latter, this should not necessarily imply any difference in historical or even archaeological value. Assumptions of diminished archaeological significance of intentionally abandoned and disposed watercraft are generally based on the human tendency to anthropomorphize and personify vessels. Hulks are often written about as if they are some kind of scourge, or a crime against tradition (Richards and Seeb 2015). Intentional disposition or discard is often an act without fanfare, but is it really a story-less event? Because a vessel is intentionally sunk does not mean it is without historical or archaeological value. The Japanese submarines *I-400* and *I-401* are examples of this value despite intentional disposal. The little that is known about their revolutionary design and the events of their capture and loss continue to generate intense public interest in their story.

8.8.1. Naval Midden Pearl Harbor

The long search for the Japanese submarine sunk by the USS *Ward* had a very positive by-product: the discovery of dozens of previously unknown submerged ships, landing craft, aircraft, barges, and other resources (Lenihan 1989; Wiltshire et al 2002). Operation Seamark (Section 8.8.3. below) began to revel the outlines of the material disposal area just south of the entrance to Pearl Harbor, apparently in use for decades. The term “midden” typically means a dumpsite for domestic waste. In the archaeological context, this is usually animal bone, human excrement, shells, sherds, lithic, and other refuse artifacts. For archaeologists a midden allows insight into the diet, settlement pattern and behavior of cultures that are no longer present.

For maritime archaeologists the sunken maritime naval midden resembles a submerged museum of nautical technology and maritime history. The number and variety of shipwrecks, aircraft, submarines, landing craft, and even automobiles scattered over a broad area south of the harbor’s entrance slowly emerged through a combination of multi-beam and side scan surveys, HURL submersible training opportunities, and dedicated maritime archaeology projects. Dedicated surveys to define the rough boundaries of this area were conducted in 2008, documenting a total of 155 separate sonar features, potential maritime properties, in the larger O`ahu south coast offshore area (Kelley 2008).

8.8.2. Implications for the SCR Inventory

The wide variety of scuttled or targeted vessels, despite being intentionally disposed, still represents a specific aspect of military activities in Hawai`i and therefore a specific aspect of the military maritime cultural landscape. The Pearl Harbor midden is a literal cross section of military presence in the islands, possessing everything from floatplanes from the 1920's to vintage turn-of-the-century automobiles to amphibious ships and submarines from World War II. Of the 498 vessels in the database (amphibious, barge, submarine, sail, and powered), 73 (15%) are identified as intentionally disposed. These are widely dispersed south of O`ahu and north of Kaua`i, but the largest concentration of disposed vessels occur near the entrances to Pearl Harbor and Honolulu Harbor (Figure 80). This subset of disposed vessels includes notable ships, such as target vessels from Operation Crossroads nuclear tests at Bikini Atoll (RN774 USS New York, sunk as a target exercise July 8th 1948), and the fleet of captured Japanese submarines (Section 8.6.3. above).

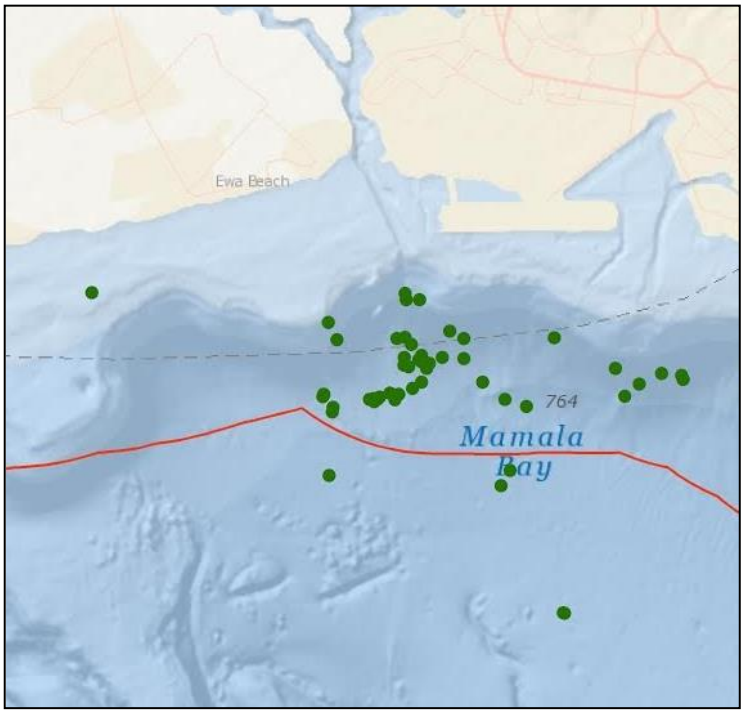

Figure 80: Location of confirmed sites centered on the Pearl Harbor entrance (midden area), south shore of O`ahu. Red line = 3mi boundary. (NOAA ONMS)

8.8.3. Project Summaries

The discovery of the large naval midden of discarded vessels was driven by the focused effort to find just one particular vessel, the *Ko-Hyoteki* ("Target-A") Japanese midget submarine (RN740) sunk by the destroyer USS *Ward*, on December 7th 1941. This search began in 1988 as part of the successful collaboration between the National Park Service and US Navy known as Operation SeaMark (Lenihan 1989). To date, Operation SeaMark has conducted the only large-scale archaeological assessment of the whole battle at Pearl Harbor, including the inner shallow harbor and the Naval Defensive Sea Area outside the harbor's entrance. A side scan sonar team from the Navy's EOD-1, under the command of Lieutenant Hank Chace, was assigned the task of searching for the Japanese sub in the deep water defensive sea area outside the harbor using standardized mine and obstruction procedures (Lenihan 1989). Depths in the selected survey area ranged between 230-330 m (750-1,080 ft). The initial survey area for the Japanese sub was defined by Pearl Harbor survivor/USS *Arizona* Memorial volunteer Ray Emory, NPS Pearl Harbor historian Dan Martinez, and US Navy divers (Lenihan 1989).

Over the next decade numerous side scan sonar surveys were conducted by NPS, the Navy, and several private companies (Delgado et al 2016). These consistently revealed aircraft, landing craft, barges, ships, a plethora of lost and disposed navy material…but no Japanese midget sub. HURL's *Pisces IV* and *Pisces V* manned research submersibles documented many of these sites, since part of their annual training activities were carried out in the Pearl Harbor search area. HURL's senior submersible pilot and director of operations Terry Kerby and dedicated others had a longstanding interest in the hunt for the elusive midget sub, and had even come across portions of a dismantled sub, though it was obvious these were lowered to the seafloor and not sunk by the USS *Ward* (Delgado et al 2016).

In March of 2002 HURL conducted towed side scan sonar survey of areas both within and outside of the Naval Defense Sea Area (NDSA), going beyond the original 1988 survey area for the Japanese midget sub (Figure 81). This survey was completed by Dr. Christopher Kelley as a test of the side scan sonar system for bottom fish habitat characterization (Wiltshire et al 2002). Data produced were equally applicable to the ongoing search for the midget sub, an example of collaboration between natural resource and heritage resource research. Targets from the habitat survey were available to the upcoming HURL submersible test dives. Finally, on August 28th 2002, HURL submersibles discovered the Japanese midget sub sunk by the USS *Ward*. The discovery initiated a long-term preservation and research effort collaboratively hosted by NOAA, NPS, and HURL (Van Tilburg 2007c).

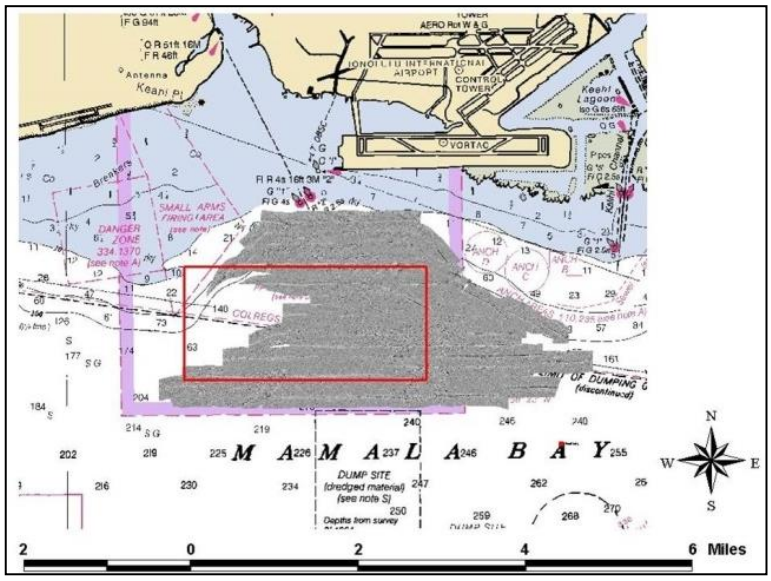

Figure 81: Naval Defense Sea Area (purple) established in 1939; NPS 1988 survey area for the Japanese midget sub (red); and HURL's 2002 side scan coverage (grey). (HURL)

In 2008, in order to better define the boundaries of the naval midden near Pearl Harbor, NOAA's Maritime Heritage Program engaged NOAA OER funding to support HURL in deep ocean side scan survey. The specific goal of this project was to provide NOAA and partner agencies with a working document relevant to maritime heritage resource management in the areas offshore Pearl Harbor and O`ahu's south shore (Kelley 2008). Besides incorporating the battleground for the submarine attack on Pearl Harbor on December 7th 1941 (multiple Japanese midget sub sites), the area features numerous naval aircraft, surface ship and submarine resources sunk or scuttled during the 20th century. HURL conducted ten days of side scan sonar operations for potential maritime heritage targets below the depth of 50 m (165 ft). The database resulting from this survey provided locations, descriptions, and images of known maritime heritage resources and unknown sonar targets for a significant area south of O`ahu. These data have been incorporated into the current inventory.

9. Ongoing Connections to Marine Spaces 1945-2015

Though the large-scale World War II logistical support for military repair and supply and the intensity of combat training operations came to an end in August 1945, military operations in the islands continued on a reduced scale during the Korean War 1950-1953 and the Vietnam War 1955-1975 (Landauer and Landauer 1999). Pearl Harbor expanded to become the center of Navy Region Hawai`i. Crucial changes in modern Hawaiian society, switching from a plantation-based economy to a tourism-based economy, changed the way many residents perceived and used ocean space (Steinberg 2001). The very nature of marine transport changed, as massive container ships replaced break-bulk cargo vessels leading to expanding container terminals reshaping the working waterfront, as towed barges replaced interisland cargo vessels, and as air transportation replaced passenger vessels between the islands. New technologies are also changing the undersea environment, with fiber optic cables crisscrossing the sea floor, and with the military's Pacific Missile Range Facility featuring the world's largest instrumented multi-environment range supporting surface, subsurface, air, and space operations simultaneously (Navy Installations Command 2017). Changing the way marine spaces are accessed means changing impacts to the historic cultural footprint in the ocean.

9.1. Tourism and Recreation Industry

Hawai`i as a recreational tourist destination goes back at least as far as promotional materials in the 1890's with the publication of Harry M. Whitney's *The Tourist's Guide through the Hawaiian Islands*, featuring descriptions of pleasure trips to the volcanoes of the island of Hawai`i (Whitney 1890). Some individuals would associate the beginnings of mass recreational tourism with improvements in marine transportation, when efficient steam propulsion made more frequent Pacific travel possible, and the arrival of steamers from the continental United States meant boat day celebrations at the harbor, impromptu gatherings at the arrival of visitors in Honolulu (Mak 2015). World War II in the Pacific had the lasting effect of introducing thousands of young American servicemen to the region and the islands, instilling a latent desire to return to Hawai`i in the years to come. Following the war, jet air travel became more popular beginning in the late 1950's, and steamship traffic from the continent declined. Nonetheless, the economic benefits of the tourism industry quickly outpaced proceeds from the sugar cane and pineapple plantations, which were declining in the face of rising labor costs and foreign competition. Tourism today represents Hawaii's single largest source of private capital for the state's economy. For example, 2015 experienced a daily average of 214,469 visitors in the islands, spending on average more than $41 million per day. In that year, tourism supported 170,000 jobs, more than any other industry in Hawai`i (Hawaii Tourism Authority 2016).

The emphasis on tourism underscores the importance of water quality and ocean recreation in Hawai`i. The Environmental Protection Agency rates the current overall condition of Hawaiian coastal waters as "good," the highest rating possible (Hawaii Tourism Authority 2016). Ocean recreation activities include surfing, diving, sport fishing, sailing, kayaking, paddling, whale watching, and other recreational uses of marine spaces. New technologies, such as closed-circuit rebreather (CCR) diving or water-propelled jet-packs bring new ways for people to recreate on and in the ocean. Some of these new technologies open access to previously unknown submerged resources, with the consequent increase in potential impacts to historic properties. NOAA ONMS has documented divers removing artifacts from wreck sites at over 60 m (over

200 ft). Recreational diving continues to be a profitable industry for many shops and operators in the islands. The Hawai`i Islands Recreational Scuba Association (HIRSA) is a non-profit group made up of individuals and industry members acting as a trade association for scuba retailers and resorts, supporting and promoting dive tourism, safe diving practices and a healthy marine environment (HIRSA 2016).

Fishing is a very common recreational and sustenance activity in Hawai`i. A quarter of the population participates in some form of recreational fishing at least one time per year (Department of the Navy 2008). In addition, sport fishing is very popular with tourists visiting Hawai`i. Data on recreational fishing in Hawai`i is very limited because no license is required for non-commercial, saltwater fishing. Hawai`i has a well-developed recreational fishing infrastructure with approximately 25 small boat harbors and 20 boat ramps. NOAA National Marine Fisheries Service (NMFS) suggests that the number of boats that participate in recreational fishing in Hawai`i is likely between 5,000-6,000 vessels (NMFS 2007).

9.2. Containerization

In 1956, trucking company owner Malcolm MacLean revolutionized the former more traditional maritime shipping technologies of break-bulk cargo and roll-on roll-off transport by standardizing the shape and size of steel on-deck shipping containers (Gardiner 1992b). Containers revolutionized trade and exchange, making it more convenient to load ships with containers that could come off and onto the deck and onto rail cars or on the back of semis to roll out of the port and to market by rail and highway (Woodman 1997). The powerful intermodal efficiencies realized by MacLean's first containership *Ideal X* stacked with space-efficient, transport efficient boxes, and ultimately his shipping company Sealand, reshaped not only the commercial waterfront but the nature of international capitalism as well (Broeze 2000). Containerization made the transport of resources and finished products so efficient that it allowed the manufacturing process itself to be effectively moved overseas to cheaper labor markets.

In the Hawaiian Islands, where once a fleet of small schooners and then steam vessels carried break-bulk cargoes between numerous small roadsteads and shore landings to Honolulu, the effects of containerization were startling. Many beach and wire rope landings had already vanished due to wartime restrictions and the decline of the plantation economy (Dorrance 1994). With containerization and the revolution in marine transportation, the transformation of the waterfront accelerated. Honolulu Harbor was forced to expand and adapt to space-intensive cargo container operations. The human scale of the historic commercial port areas disappeared, as the center of maritime activity moved away from the town, and the flat empty spaces of Sand Island became the habitat for giant container bridges, stacking cranes, and straddle carriers (Thomas 1983).

Maritime shipping has grown and concentrated, and at the same time experienced a transition to greater economies of scale. Today approximately 90% of all food consumed in the islands arrives via containers from the continental United States (Woody 2015). All commercial activities have concentrated at six main harbors, with Honolulu Harbor being by far the largest and busiest. In 2011 there were 14,073 registered vessels in Hawai`i (State of Hawai`i Data

Book 2011). Inter-island vessels (2,390) transported 3,220,416 cargo tonnage and overseas vessels (884) carried 6,487,553 cargo tonnage into the Port of Honolulu in 2011 (State of Hawai`i Data Book 2011). Passenger cruise ship traffic included 420,649 arrivals and 778,405 departures at Honolulu Harbor in 2011 (State of Hawai‘i Data Book 2011).

9.3. Tug and Barge

Business opportunities expanded with the burgeoning maritime commerce at the turn of the century. In 1900 three brothers, Herbert, William and Jack Young, arrived in Honolulu and soon incorporated as Young Brothers, Limited, a marine outfit providing ocean towing, rescue, and barge service between the islands, as well as salvage or "wrecking" operations (Thomas 1983). The business expanded in the following decades, forming Hawaiian Tug & Barge as a sister company (Uchida 2001). In 1999, the parent company of Foss Maritime acquired Young Brothers and assets of Hawaiian Tug & Barge. In 2013 Hawaiian Tug & Barge was incorporated into the Foss Maritime fleet, while Young Brothers remains a wholly own subsidiary of Foss.

From interisland paddling and outrigger canoes, to brigs and schooners, to the steam mosquito fleet, maritime commerce in Hawai`i is now a matter of pallets and containers being shipped on interisland barges. Maritime transport in Hawai`i has been containerized and expanded to maximize economy and efficiency, and yet (oddly) people themselves are almost entirely excluded from this maritime traffic. Passenger jetfoil ferries between the islands, discussed for years and initiated successfully in the 1970s, ultimately succumbed after only 31 months to competition with the airlines (Thomas 1983).

In August 2007 Austral USA, a division of the world's largest fast-ferry builder Austral, launched the Hawai`i Superferry, an aluminum-hulled, drive on/off passenger and vehicle catamaran for high-speed service among the islands. Due to environmental concerns and differences of opinion on unintended consequences of ferry service between O`ahu and the outer islands, service was suspended in 2009 (Loomis 2015).

Today it is not possible to book interisland passage to all the islands on commercial maritime vessels; the large majority of people move between islands by commercial aircraft only. In 2016 small boat (no vehicles) ferry service was limited to direct routes between Maui and Lāna`i, and between Maui and Moloka`i.

9.4. Navy Region Hawai`i

Compared to the island-wide training centers during World War II, military activities and infrastructure have also undergone considerable consolidation, evolution and transition in efficiency. Whereas 11 naval air stations and fields had been operating in the islands during World War II, there is now only one: NAS Kāne`ohe was reactivated in 1952 as Marine Corps Air Station Kāne`ohe Bay, and now designated Marine Corps Base Hawai`i (MCBH) Kāne`ohe Bay.

Training areas and assets have been concentrated. In 1958 the Pacific Missile Range Facility (PMRF) at Barking Sands on Kaua`i was officially established. The 1,885 acres were formally transferred to the US Navy. In 1967 the Barking Sands Tactical Underwater Range was added to

the facility. PMRF continues to maintain facilities at Barking Sands, Mākaha Ridge, Port Allen, Maunakapu, and an unmanned radar site on the island of Ni`ihau. The mission of the PMRF is to provide integrated range services in a modern, multi-threat, multi-dimensional environment which ensures the safe conduct and evaluation of both training and T&E missions (Navy Installations Command 2017). PMRF has also created a virtual target island by incorporating ocean sensors in an area near Kaua`i into a new offshore firing range. This has replaced Kaho`olawe island as a target range, which was transferred back to the state of Hawai`i in 1994 and has undergone partial clearance of unexploded ordnance on land (Parsons 2004). Today the PMRF is the world's largest instrumented multi-environmental range capable of supported surface, subsurface, air, and space operations simultaneously. There are over 28,000 km^2 (1,100 mi^2) of instrumented underwater range and over 108,000 km^2 (42,000 mi^2) of controlled airspace (Navy Installations Command 2017).

Part of this training includes the intentional disposal of naval vessels as target assets. Beginning in 1971 and continuing every two years, Hawai`i and the US Navy host RIMPAC (Rim of the Pacific Exercise), the largest international maritime warfare exercises in the world. In 2016 RIMPAC engaged 27 nations, 45 ships, five submarines, more than 200 aircraft and 25,000 personnel. Decommissioned naval vessels are regularly sunk during RIMPAC exercises in Hawaiian waters. Two vessels were sunk as target exercises in 2016, USS *Thach* FFG-43 and USS *Crommelin* FFG-37 (Commander Naval Surface Force 2017).

Naval Station Pearl Harbor has maintained its singular strategic role. By 1945 Pearl Harbor had grown into a small city with a network of roads, piers, workshops, buildings, and fire and police stations (Landauer and Landauer 1999). In 1998 the shipyard was re-designated Navy Region Hawai`i. The shipyard is Hawaii's largest industrial plant, and now extends the use of its facilities to commercial vessels (Chamber of Commerce Hawai`i 2017). In 2010 the naval station was joined with Hickam Air Force Base, to form Joint Base Pearl Harbor-Hickam (JBPHH). At that time the workforce for JBPHH totaled approximately 50,000 military and civilian personnel (McAvoy 2010).

The US military today is the second largest industry in the state (Chamber of Commerce Hawai`i 2017). As of 2015, the direct economic impact of the military presence in Hawai`i equaled approximately $7.8 billion dollars or 9.8% of the state's gross state product. Projections are much higher when accounting for indirect impacts of military expenditures, such as small business contracts, related family incomes, housing construction, associated service jobs, etc. Statewide, personnel employed by the military (active duty, civilian, guard and reserve) totaled 73,487 (National Conference of State Legislatures 2017).

Today Hawai`i is home to the US Pacific Fleet, the world's largest fleet command, which operates throughout the Pacific, Southeast Asia and the Indian Ocean. The Pacific Fleet maintains forward presence and regional stability, therefore, over half of the world's surface, more than 260 million km^2 (100 million mi^2). Under the direction of the US Pacific Command and the Chief of Naval Operations, the US Pacific Fleet controls both the 7th Fleet in the Western Pacific (the largest forward-deployed fleet), and the 3rd Fleet on the American West Coast (US Pacific Fleet 2017). Fleet components include all air forces, surface forces, submarine forces, Fleet Marine forces, and the Seabees. Almost 200 surface vessels and submarines make up the mobile forces of the US Pacific Fleet, as well as 1,100 aircraft. There are approximately 130,000 sailors and civilians, throughout the fleet (US Pacific Fleet 2017). National Security Strategy

today dictates that Hawai`i is and will remain a key component in support of the US forward presence in the Pacific, East Asia, Southeast Asia, and South Asia (HHF Planners 2002). The contextual history of the US Navy in Hawai`i remains central to understanding the significance of sunken naval properties, their type and distribution.

NOAA's Maritime Heritage Program recognizes the importance of this naval legacy in the islands and continues to pursue this legacy, through both shallow water and deep-water investigations, in coordination with Naval History & Heritage Command. In June 2015 NOAA and the Department of the Navy (DoN) signed an interagency agreement memorializing this longstanding practice of cooperation as part of the implementation of the Sunken Military Craft Act (SMCA) and 32 CFR Part 767. In particular, Section 1402(a)(3) of the SMCA 32 CFR § 767.5(e) recognizes NOAA's authority to issue permits for activities directed at certain sunken military craft located in national marine sanctuaries and marine national monuments. NOAA will continue to be the lead permitting authority for activities directed at sunken military craft that are also historic resources when they are located in national marine sanctuaries and will serve as the lead in marine national monuments within the sanctuary system. Consistent with the past practice and policy, NOAA will continue to consult and cooperate with DoN on any activities directed at sunken military craft under the jurisdiction of the DoN that may disturb, injure or remove a sunken military craft that are located outside of the sanctuary system as part of its compliance with the NHPA and other applicable standards and requirements of the Federal Archaeology Program. Appendix 3 provides a copy of the NOA/DoN agreement.

9.5. Implications for the SCR Inventory

As with terrestrial archaeological sites, intrusions in the form of materials associated with modern maritime industries and activities, may impose upon the oceanic footprint of older more historic cultural resources and landscapes. Sport diving looters, channel dredges and spoils dump sites, moorings, broken tow cables, lost steel containers, aquaculture pens, anchors, pipelines, submarine cables, offshore energy platform development and military training are all capable of powerfully affecting the marine environment. In this case, modern maritime activities should be interpreted as powerful site formation processes.

10. Conclusions

The oceans surrounding the Hawaiian Islands retain a wide diversity of submerged cultural resources. There are many different types of vessels in the Pacific, but representation within the inventory is not random. In Hawai`i, the variety of vessel types in the inventory reflect specific influential periods and activities, and major historic events. Furthermore, the archaeological record of submerged vessels is biased, heavily influenced by the processes of site formation/deterioration in the subtropical high-energy marine environment. The wooden hulls of voyaging canoes and older sailing vessels are gone, while the iron steam engines and steel hulls of modern landing craft appear over-represented in comparison.

There are many different reasons why vessels sink where they do, many different wrecking processes, but, like vessel types, the distribution of submerged cultural resources in Hawai`i is also not random; wreck sites are not evenly distributed on the ocean floor. Site distribution reflects specific patterns, reflecting the shoreline infrastructure of harbors and landings and passages to-and-from each, or environmental forces where winds, tides, and reefs function like ship traps, or a combination of both where maritime routes converged by necessity in close proximity to rocks and reefs. On some islands natural ship traps provided steamship owners convenient dumping areas for aging hulks, creating shipwreck beaches. Military amphibious training areas, and proximity to aviation operations at navy and army airfields, also heavily influenced the distribution of the submerged military landscape (and continue to do so today). Finally, through site formation processes the distribution of wreck resources is heavily influenced by the environment. Hurricanes and storm waves have swept away many shallow water sites, while even relatively fragile resources like aluminum-skinned aircraft remain intact in the stillness of the deep ocean. Ultimately, the longer-term processes of electrochemical deterioration, seafloor scouring, and biological conversion will continue until almost all traces of these historic properties underwater have been erased.

10.1. Patterns of Submerged Cultural Resources

The submerged cultural resource inventory in Hawai`i, as varied as it is with a plethora of specific types of properties, and as scattered as it is spread among the main eight Hawaiian Islands and channels, the Pleistocene shelves and the isostatic deeps (Section 3.3), is nonetheless an inventory which can be understood in terms of patterned landscapes. The Hawaiian landscapes of navigation and aquaculture, the early post-Cook contact landscapes of whalers and sailing vessels, the plantation era landscape of steamships and landings, and the military landscape of intense activity on, above, and below the sea, all impose their own unique cultural footprint on the marine environment. Understanding this patterned landscape of maritime cultural properties adds deeper interpretations to the assessment and preservation of all of our heritage resources. Appendix 5 provides selected statistics for preliminary inventory analysis.

10.1.1 Hawaiian Settlement

Although the detailed assessment of Native Hawaiian cultural resources is more appropriately covered in *Na `Ikena I Kai (Seaward Viewsheds): Inventory of Terrestrial Properties for Assessment of Marine Viewsheds on the Main Eight Hawaiian Islands* (OCS Study BOEM 2017-

022) and *A Guidance Document for Characterizing Native Hawaiian Cultural Landscapes* (OCS Study BOEM 2017-023) of this project, the nature of some of these resources is included here as part of the significant contextual background. The discovery and settlement of the Hawaiian Islands resulted in the original maritime cultural landscape, one without the artificial distinctions between nature and culture resources, and intimately connected to all spaces above, on, and below the water.

Canoe construction and navigation routes were based on the cultural package of navigation skills inherited and refined from the original Polynesian voyagers (Section 4.2). Fishing and aquaculture achieved advanced levels of sophistication in Hawai`i (Section 4.3). Along with intensive agricultural practices, this allowed the islands and *ahupua`a* (land divisions) to be relatively self-sufficient in terms of food sources. From the brief description of coastal fishponds, it is clear that they were established where the ecosystem resources of fresh-water streams and upland farming met the near shore protected shallow habitat suitable for juvenile fish species (Section 4.3.2). Hawaiians were, and still are, familiar with areas for the production of sea salt, for gathering resources like *limu* (algae), for invertebrates, and for fish both reef and pelagic (Section 4.3.1). Hunting and gathering in the near shore waters was the management responsibility of the *konohiki*, the heads of the land divisions under the *ali`i* or chiefs of the district. The *kapu* (prohibition) system operated for the conservation of marine resources. Maritime transport was oriented towards maintaining this sustainability, not on addressing commercial imbalances by shipping produce and products between islands.

There was a definite patterning to marine activities, and to the maritime cultural landscape. The practices related to these patterned activities, to the original Native Hawaiian cultural landscape, can still be found among the islands today (Maly and Maly 2003).

10.1.2. Early European Voyagers

The foreigners who arrived hundreds of years following the settlement of the islands brought with them entirely different perspectives on navigation and ownership of resources, as well as a completely different package of maritime and military technology (Section 5.1). Though foreign ships contacting Hawai`i were a rarity in the early decades, the repercussions from exposure to these new ideas, technologies, and particularly the diseases which arrived with the European sailors, had immediate and powerful impact (Section 5.3.2).

These European voyages of exploration were infrequent, and so there are very few associated submerged historic properties from this period. The bays and open roadsteads used for early anchorages were often different from the locations of harbors and landings developed much later. The less tangible cultural resources are more important, such as the notes and charts which carried the survey information back to their powerful maritime-oriented home countries (Section 5.3.1). Captains and navigators looked forward into the future, and systematically surveyed anchorages and potential harbors, sounding depths, and seeking provisions for the merchants who would soon sail in their wake (Section 5.3.4). They left their mark by renaming many of the coastal landmarks and bays encountered in their travels. And they left castaways, who became advisors to the Hawaiian rulers and accelerated the changes to come. So, while the physical legacy in terms of submerged cultural resources is slight, a landscape of memory, of named

points, promontories and street names (Vancouver, Portlock, Cook, etc.) still well reflect these early contacts.

10.1.3. Sailing Era of Whaling and Trade

The contacts and surveys of the European explorers opened the door to the commercial pursuits of sandalwood and whales, and the commercialization of society itself. More ships meant more provisions needed at the harbors where foreign vessels arrived, initiating interisland commerce. Harbors expanded, with the first shipyards soon making their appearance. Early harbors like Lahaina and Hilo and particularly Honolulu emerged as focal points for maritime activity. These locations were quickly surrounded by the factors and warehouses of the merchants, along with grog shops and taverns. Commerce and maritime transportation went hand-in-hand, and was oriented towards these burgeoning ports (Section 6.3).

Whaling, more so than any other activity, accelerated maritime change in the islands (Section 6.2.1). Yet, except for the shore-based whaling stations (sites which have yet to be discovered), whaling was an activity that usually took place far from Hawai`i, the islands playing more of a provisioning and transshipment role. In other words, it was not the whaling hunt per se, but the vastly increased vessel and commerce traffic that shaped the cultural landscape of the day.

Increasing activity for provisioning and ship repair and transshipment of cargoes like whale oil meant an increasing number of submerged cultural resources associated with this period, more coastal infrastructure and shipwrecks and abandoned vessels (Section 6.2.2). The subsequent continual development of these historic harbor locations, however (coastal expansion by land fill along with channel dredging and moorings), means that many of the potential sites related to these early years may now be covered by buildings or pavement and inaccessible, or erased from the seafloor by dredging and mooring chains. For instance, coastal expansion and urban development have eliminated all surface traces of the historic origins of Honolulu Harbor (Section 6.3.1). None of the 12 whaling shipwrecks known to have ben lost in the main Hawaiian Islands have been found (Section 6.3.6). Local whaling wreck sites have only been discovered in the remote and uninhabited atolls of the Papahānaumokuākea Marine National Monument to the northwest, in locations never filled or dredged. So the physical cultural footprint may have been significant, but is now difficult or impossible to access.

The legacy of this period now consists mainly of a landscape of memory, the charts and log books and whaling artifacts and exhibits which tell us something about the past. The Whalers Village Museum in Kā`anapali, Maui, exhibits artifacts and provides visitors with some of this information, but its successes are balanced by the loss of the Hawai`i Maritime Center on Honolulu Harbor, once managed by the Bernice P. Bishop Museum, but as of 2017 closed now for over ten years.

10.1.4. Plantation Era and Steam Propulsion

The transition from sail to steam technology in maritime transportation overlaps with Hawaii's plantation period, and in fact it was the establishment of the plantation economy that allowed for the commercial success of steamship companies in the islands (Section 7.3). Plantations were

not centralized but geographically dispersed, and therefore maritime transportation became oriented to servicing numerous small island landings, connecting those locations (105 identified for 19th century) with the larger ports of Kahului, Hilo, and Honolulu (Section 6.3.5). Hawai`i underwent a transition from providing for a transshipment maritime transport economy (whaling) to an agricultural export economy (plantations and ranches).

The large number of shipwrecks associated with this period, many lost at or near the landings they were regularly servicing, reflects the increasing commercialization of the economy, among other factors. Plantation sites were not chosen for the proximity to safe coastal landings, but for the agricultural productivity of the land. Vessels therefore needed to operate in the hazardous windward settings of small bays, cliffs, and shallow beaches (Section 7.3.1). Many landing sites have one or more vessel losses on record. A careful examination of both known (location category 1) and reported (location category 2-4) wreck locations reveals larger (≥5) accumulations of losses in the immediate vicinity of selected 19th century landing locations (Table 24).

Table 24: Selected landings and numbers of vessel losses

Island	Landing	Confirmed wreck number	Reported wreck number
Kaua`i	Hanalei	1	8
	Moloaa	0	7
	Koloa	0	11
O`ahu	Waialua	0	13
	Punaluu		5
	Honolulu	20	31
Maui	Lahaina	3	10
Hawai`i	Hilo	0	15

Infrastructure like buoys, harbor moorings, wharves and piers, marine railways and wire rope systems helped to mediate some of the obstacles (Section 6.3.5). Furthermore, the transition from sail to steam was accompanied by a transition from wooden to iron hulls. While site formation processes erase wooden sailing vessels relatively quickly from Hawaii's high energy marine environment, iron hull plates, boilers, and steam engines, etc., have a much longer archaeological signature (Section 3.6). Increasing commercialization, more frequent maritime traffic, and Hawaii's marine hazards combined to leave a greater accumulation of submerged cultural resources over this 100+ year period than during any previous time in Hawaiian history.

Plantation history and intangible culture is remembered in Hawai`i in a number of venues such as: the Alexander and Baldwin Sugar Museum, the Plantation Village Outdoor Museum on O`ahu, the Hawai`i Plantation Museum on the Big Island, and the Laupāhoehoe Train Museum. However, the local maritime transportation topic is usually absent from most of these venues, and particularly so after the closure of the Hawai`i Maritime Center, the sole museum dedicated to featuring Hawaii's maritime past. Plantation memories are fading. The last sugar mill and plantation, Hawai`i Commercial and Sugar Company, owned by Alexander and Baldwin, closed

in 2016. Likewise, the *Falls of Clyde*, a four-masted iron-hulled sailing tanker built in Glasgow in 1878 and once Hawaii's museum ship from the plantation period, now sits down-rigged and rusting in Honolulu Harbor, closed to the public.

10.1.5. US Navy, Pearl Harbor and World War II

The war years of the mid-20th century witnessed immense changes taking place in the Hawaiian Islands, including the character and orientation of maritime transportation (Section 8.1). Fishing and plantation activities were disrupted, and the declaration of martial law allowed for the shutdown of all private vessels operating from small landings island-wide (Section 7.4.3). While the plantation economy continued in the years after the war, decline and transition was underway. Along with the increased connectivity to the continental United States came the growth of organized united labor, and labor strikes in the islands became more frequent as workers struggled to better their lives under the old plantation system.

It has been said that America's capacity for industrial production played a large part in winning the war, and this can certainly be seen in the large number of ships and aircraft that were deployed, and in the large subset of those that were lost, in the Hawaiian Islands (Section 8.7.3). Many are associated with the various army and naval facilities constructed in Hawai`i prior to and during the war (Section 8.2.2). Their loss is a testimony to the dangers inherent in naval, and in intensive amphibious training activities. Soldiers, sailors, marines, and aircrews lost their livers in Hawai`i before they ever saw combat in the Pacific. Though most histories overlook combat training grounds, the Hawaiian home front during World War II came with its own set of hazards.

The Hawaiian Islands were only attacked by enemy forces three times, and despite the critical losses at Pearl Harbor, all but a few of those ships damaged or sunk on December 7th 1941 were repaired and placed into service before the war was over. Three other specific types of operations account for the patterned distribution of submerged cultural resources associated with the military: naval aviation operations and training (Section 8.4), amphibious operations and training (Section 8.5), and the intentional disposal of obsolete ships and aircraft from Pearl Harbor (Section 8.8).

Some of the confirmed sunken naval aircraft have been found in close association with land based military runways, which may represent something of a pattern, but only 47 of the 1,375 lost aircraft have been located, equal to slightly more than 3%. Surveys for submerged aircraft have not yet been conducted in most areas surrounding the islands. Correlating losses to identified island bombing ranges also suffers from a lack of confirmed/located crash sites, and a lack of clearly identified aviation training ranges (Section 8.7.1). Furthermore, many aircraft were lost during carrier operations in Hawaiian waters, mobile runways far from island landmarks. The pattern for naval aircraft distribution may be very faint, if observable at all.

Vessels lost during amphibious exercises, on the other hand, may exhibit a high degree of patterned distribution. Though Maui is the only island for which survey data exists, AMTRACKs are located in the exact wartime approach channels delineated on the training charts for the exercises (Section 8.7.2). Amphibious training centers and areas have been

identified for other Hawaiian Islands, so the possible pattern may prove helpful in identifying future survey areas for submerged cultural resources.

Numerous naval submerged sites resulted from the intentional disposal of landing craft, patrol boats, landing ships, aircraft, and vehicles in the area seaward of the entrance to Pearl Harbor, the Pearl Harbor midden (Section 8.8.1). For decades larger ships and submarines were stripped, towed further off O`ahu's south shore, and used as target assets. The legacy of this naval training in Hawai`i, which saw such intensity during World War II, continues today with the RIMPAC, the largest international maritime exercise in the world. RIMPAC 2016 involved 26 nations, 45 ships, 5 submarines, more than 200 aircraft and 25,000 personnel. Examination of the positions of known disposed vessels suggests three general areas: 1) the large Pearl Harbor midden centered 5 km (3 mi) south of the entrance to the harbor; 2) a broad area of deep ocean 16-24 km (10-15 mi) south of Barber's Point; and 3) the current area for RIMPAC exercises centered 88 km (55 mi) north of Kaua`i Island (Commander Naval Surface Force 2017).

Unlike the legacy of historic sail and plantation steamships, appreciation for the intangible cultural legacy of World War II in Hawai`i seems to be increasing, celebrated by the USS *Arizona* visitor's center, USS *Bowfin* Submarine Museum, Pacific Aviation Museum, USS *Utah* memorial, USS *Oklahoma* memorial, Fort DeRussy Army Museum, USS *Missouri* museum ship, and other heritage venues. December 7th continues to be a very significant day of annual remembrance, marked by ceremonies at Pearl Harbor, and books and movies continue to offer new perspectives on the attack and the War in the Pacific. The history of World War II is a direct contributor for Hawaii's heritage tourism industry.

10.1.6. Contemporary Maritime Transportation

The transition to a tourism-based economy, which finds its roots in the 19th century, was greatly enhanced post-WWII with the decline of the plantation economy and then growth of American leisure time, disposable income, and the advent of jet travel (Mak 2015; Thomas 1983). The landings and harbors of the old plantation maritime transportation system fell into disuse, and intermodal commerce, along with air travel, has taken their place.

Submerged resource sites during this contemporary period are based on an almost wholly different set of vessels and activities, including the intensification of tourism and recreational fishing (Section 9.1). Containerized transport, along with tug and barge interisland service, have brought specialized vessels to local waterways (Section 9.3). The high-tech facilities at PMRF, with its state-of-the-art virtual training ranges, have drastically changed the nature of naval training exercises in Hawai`i (Section 9.4). Technology also makes possible the exploration of the ocean in increasingly systematic, scientific, and noninvasive ways, advancements that expand our understanding and appreciation of this still largely unexplored realm (NOAA 2014).

10.2. The Dynamic Maritime Cultural Landscape

The maritime cultural landscape of any location is not something that is static or wholly defined by a list of identified objects. It is the broad imprint of human behavior on the marine

environment as expressed in both tangible and intangible resources (MPAFAC 2011). For the purposes of this inventory, it is the sum total of submerged cultural resources associated with specific historic periods and maritime activities. In Hawai`i this maritime cultural landscape has changed over time, sometimes stable over long periods, sometimes in transition for a century or more, and sometimes being altered very quickly under duress of wartime conditions.

This cultural landscape originates with the discovery and settlement of the islands. Patterns and traditions of this original cultural landscape persist today in the maintenance of *ko`a* and *loko i`a,* in the knowledge of traditional fishing and gathering, in the practice of non-instrument navigation and voyaging and canoe construction, and in successful efforts to revitalize traditional marine resource management systems (Maly and Maly 2003; Finney 1994).

The arrival of foreign voyagers beginning in the 18th century had immense socio-economic consequences for Hawai`i and the Pacific. Sandalwood and whaling voyages quickly depleted their targeted resources, but the impacts to indigenous populations from colonization and disease would prove much more permanent (Dye 1994; Pirie 1978). In contrast, foreign vessels of this period were based on canvas and wood, essentially "organic" vessels that leave little trace of their demise after hundreds of years submerged in the islands' dynamic marine environment (Pearson 1987). The maritime landscape seemed little altered. Only the tall ships, iron-hulled merchant vessels from the latter days of commercial sail, remain to be explored.

The greater transition in shipwrecks in the islands, therefore, seems to have occurred during the subsequent plantation period in the 19th century, with the increase in maritime traffic and the innovation of steam engines and boilers, components with much more permanence underwater. Plantations also made possible investments in shoreline infrastructure including wharves, moorings and wire rope landings, traces of which still remain. The days of small steamers working the rugged coastlines of the islands reigned for almost a century.

Compared to this plantation transition to steam, the submerged military cultural footprint was formed very quickly. The development of Pearl Harbor and naval activities were already on the increase during the early decades of the 20th century, but the ultimate results of intensive training exercises and the mass fabrication of amphibious craft and particularly aircraft (1,375 naval aircraft lost in Hawaiian waters) between 1942-1945 alone make this submerged military landscape appear seemingly overnight. In numbers alone, military resources far exceed any other type of submerged property in Hawaiian waters. Aircraft and landing craft may be the most likely type of historic property encountered by divers today.

Hawaii's maritime story is complex, dynamic, and on-going. The many shipwrecks and sunken aircraft and other types of cultural resources left on the seafloor offers a unique perspective on that story. They are the physical legacy of Hawaii's past. Analysis of the many types of submerged cultural resources in the Hawaiian Islands, combined with historical and cultural background, allows for a clearer understanding of important major events and important historical periods that have shaped the islands into what they are today.

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Appendix 1. Historic Plantation Landings in Hawai`i

The following summarized description of historic recorded landing locations (beach, early harbor, wire rope, etc.) is drawn from: Charles Baldwin 1920 *Geography of the Hawaiian Islands*; Mifflin Thomas 1983 *Schooner from Windward*; 1898 *Report of the Hawaiian Commission (Harbors and Coasts)* 1898 (CEG Jackson surveyor); 1910 *Private Wharves and Landings in Hawaii*; and checked against landings depicted on the 1908 Post Route Map of the Hawaiian Islands. Positions are estimates from NOAA Office of Coastal Survey and Google Earth plots.

Island	Landing	Notes	Est. latitude	Est. longitude
NI`IHAU	Kii	Landing on the beach.	21.97646	-160.05974
KAUA`I	Nawiliwili (1)	One of two landings. West side belonging to the government.	21.95057	-159.35696
	Nawiliwili (2)	One of two landings; one on the north side owned by W.H. Rice.	21.9595	-159.34897
	Ahukini	Government landing at Hanamaulu Bay, owned and operated by the Lihue Sugar Company.	21.99287	-159.33251
	Kapaa (Kealia)	Private landing of Makee Sugar Company, with a pier.	22.09829	-159.30369
	Anahola	Open roadstead, no wharf; public.	22.14868	-15930372
	Kilauea	Private wharf of Kilauea Sugar Company; projects out into the water, but is not a regular pier; on the land of Kahili.	22.21789	-159.38343
	Hanalei	Public landing, no wharf; boats land on the beach at the mouth of the river.	22.2121	-159.49881
	Wainiha	Private landing with wharf, derrick and warehouse, owned by the Wainiha Company.	22.21533	-159.54148
	Koloa	A private wharf owned by the Koloa Sugar Company, derrick on wharf.	21.87819	-159.46845
	Eleele (Port Allen)	A private wharf. Port of entry for the Island of Kauai.	21.90022	-159.58991
	Makaweli	A private wharf built by the Hawaiian Sugar Company.	21.91985	-159.63759
	Waimea	A pier owned by the government.	21.95309	-159.67066
	Hanamaulu	Two landings on the north and south sides, owned by Lihue plantation. Built on sidings over the shore out into the sea. Breakwater on the south side.	21.99486	-159.33698
	Kalihiwai	Boats land on the beach; public.	22.22717	-159.40585
	Wailua	Boats land on the beach; public.	22.04964	-159.33386
	Moloaa	Open roadstead, no wharf; public.	22.19421	-159.33301
O`AHU	Honolulu	All wharves government owned, with the exception of one private wharf, property of Allen and Robinson.	21.30849	-157.86663
	Waianae	A pier owned by the government.	21.44809	-158.19478
	Waialua	Boats land on beach; public.	21.59593	-158.10486
	Kahuku	Boats land on beach; public.	21.67041	-157.93504
	Punaluu	Small private pier.	21.59218	-157.89062
	Waimanalo	Private landing owned by plantation.	21.33035	-157.69081
	Kaneohe	Public landing on beach.	21.41435	-157.78669
	Laie	Pier owned by Kahuku plantation.	21.63293	-157.91942
	Heeia	Pier owned by plantation.	21.42519	-157.79695
	Kaalaea	Public landings on the beach.	21.46672	-157.84213
	Kahaluu	Public landings on the beach.	21.45843	-157.83127
	Waikane	Public landing on the beach.	21.48547	-157.84666
	Mokuleia	A wharf and several small landings, all private.	21.57952	-158.16813
	Pearl Harbor	Several small private landings.	21.32824	-157.96761

Island	Landing	Notes	Est. latitude	Est. longitude
MAUI	Kahului	Private landing, pier running out into the water.	20.89563	-156.46725
	Keanae	Government landing, boats come alongside.	20.86182	-156.14868
	Nahiku	Public landing; no wharf.	20.8276	-156.09143
	Kipahulu (Mokulau)	Private landing; freight is hoisted from the boats by a derrick.	20.65024	-156.05479
	Kaupo (Nuu)	Small government wharf, boats come alongside.	20.62619	-15617838
	Makena	Government wharf. Cattle and ranch products from Kula.	20.65379	-156.44148
	Hamoa (Mokae)	Government wharf.	20.71929	-155.98681
	Huelo	Private wharf.	20.90332	-156.21067
	Lahaina	Pier running out into the sea; government wharf.	20.87073	-156.67958
	Olowalu	Private landing, pier running out into the water.	20.80816	-156.62265
	Maalaea	Government wharf, pier, alongside which the boats come.	20.79099	-156.51061
	Honakahau	Land on the beach; public.	21.02311	-156.61046
	Napili	Land on the beach; public.	20.99579	-156.66665
	Hana (Kapueokahi)	Government wharf.	20.75717	-155.98307
	McGregor's landing	Land on the beach; public.	20.79494	-156.48672
	Kihei	Government landing, pier.	20.78082	-156.46324
	Maliko	Private wharf.	20.93633	-156.33959
	Kuau at Paia	Private wharf.	20.91996	-156.37928
	Kahakuloa	Land on the beach; public.	20.99839	-156.55017
	Honokawai	Public landing.	20.95166	-156.69009
	Kaanapali	At Kekaaa, owned by Pioneer Mill Company, with derrick.	20.98272	-156.67411
	Honolua	Private landing owned by Baldwin Ranch; derrick on wooden pier.	21.01316	-156.64186
	Keawakapu	Government landing north of Makena.	20.70779	-156.44724
MOLOKA`I	Kaunakakai	A government wharf; boats land on the beach.	21.08201	-157.02889
	Kamalo	A government wharf.	21.04491	-156.87433
	Pukoo	A government wharf.	21.06911	-156.79801
	Kalaupapa	Government wharf; boats come alongside.	21.18989	-156.98514
	Pelekunu	Boats land among the rocks; public.	21.16198	-156.88089
	Wailau	Boats land on the beach; public.	21.16462	-156.83153
	Halawa	There is a sort of stone place that boats come to, not a regular wharf; public.	21.15977	-156.73637
	Moanui	For the Moanui Sugar Mill, 1870-1900.	21.11019	-156.74421
	Kalawao		21.17947	-156.94769
	Honomuni	Boats land on the beach; public.	21.08176	-156.78061
	Pauwalu	Boats land on the beach; public.	21.08629	-156.77238
LĀNA`I	Manele	Land on the beach; private.	20.74151	-156.88639
	Kahalipalaoa	Land on the beach; private.	20.86121	-156.82976
	Awalua	Land on beach, no wharf; private.	20.92702	-157.00247
	Kaumalapau	Land right up among the rocks; private.	20.78602	-156.99047
HAWAI`I	Honoipu	Government landing, where passengers are landed in row boats; and private landing, where freight is loaded by means of a wire cable.	20.24369	-155.89038
	Kukuihaele	Private landing; freight raised by derrick.	20.12919	-155.56008
	Honokaa	Private landing; freight raised by derrick.	20.10102	-155.46969
	Paauhau	Private landing; freight raised by derrick.	20.08995	-155.4361

Island	Landing	Notes	Est. latitude	Est. longitude
HAWAI`I cont	Koholalele	Private landing of the Hamakua mill. Freight is raised by a derrick from the boats.	20.04178	-155.33688
	Ookala (Kawiki)	Private wharf; wire cable used.	20.01947	-155.28336
	Papaaloa	Private landing owned by Laupahoehoe Sugar Company; wire rope landing and inclined cable railway.	19.97909	-155.22115
	Hakalau	Private landing; freight loaded and unloaded by use of a derrick.	19.90044	-155.12819
	Papeekeo	Private boat landing.	19.82824	-155.08424
	Papaikou	Private wharf.	19.794	-155.08973
	Wainaku	Private landing; freight hoisted by derrick.	19.73858	-155.08987
	Punaluu	Private wharf; terminus of Inter Island Company.	19.135	-155.50399
	Kawaihae	Government wharf.	20.0233	-155.82336
	Mahukona	Private wharf of the Wilder Steamship Company.	20.18408	-155.90069
	Laupahoehoe	Government wharf.	19.99072	-155.23998
	Honoapo (Honuapu)	Pier owned partly by government and Hutchinson Plantation Company.	19.08429	-155.55008
	Hoopuloa	Land on the beach; public, no wharf.	19.19721	-155.90555
	Hookena	Government wharf.	19.37932	-155.89787
	Napoopoo	Government landing, used principally.	19.47331	-155.91959
	Keauhou (Kona)	Government wharf.	19.56145	-155.96259
	Keauhou (Puna)	Private wharf.	19.26972	-155.26016
	Kailua	Government wharf and warehouse.	19.63838	-155.99722
	Kaawaloa	Government landing, used occasionally.	19.48197	-155.93272
	Kukaiau	Private landing owned by Kukaiau mill. Freight is raised by a derrick, swung around on the cars, and pulled to the top of the bluff by cables.	20.05272	-155.35899
	Honaunau	Land on the beach; public.	19.42261	-155.91216
	Kaalualu	Government landing.	18.96826	-155.61198
	Pohoiki	Government wharf.	19.49955	-154.81608
	Hilo	Government wharf.	19.72666	-155.08544
	Hilo	Government wharf.	19.73204	-155.05631
	Honomu	Private boat landing owned by Honomu Sugar Company; wire cable and inclined railway used for loading and unloading fright.	19.88143	-155.11515
	Waipio	Land on the beach; public.	20.12389	-155.59686
	Pololu	Land on the beach among the rocks.	20.20498	-155.73092
	Keokea (Kohala)	Private wharf.	20.24312	-155.77773
	Okoe		19.14777	-155.91261
	Milolii	For Milolii Village.	19.17111	-155.90769
	Kiholo		19.85618	-155.92198

Appendix 2. Sunken Military Craft Act Summary

Agencies: U.S. Navy (within U.S. Department of Defense)

Citation: 10 U.S.C. §§ 113 et seq.

Enacted as: the "Sunken Military Craft Act", on October 28, 2004, as Title XIV of the "Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005"

Where Law Applies: Applies to sunken U.S. military ships and aircraft wherever located around the world. It also applies to sunken foreign craft in U.S. waters that are defined to include the internal waters, territorial sea, and contiguous zone (up to 24 nautical miles off the U.S. coast).

Summary of Law:

On October 28, 2004, President George W. Bush signed the National Defense Authorization Act for Fiscal Year 2005. Title XIV of the Act, generally referred to as the Sunken Military Craft Act (SMCA) (10 U.S.C. § 113 et seq.), preserves the sovereign status of sunken U.S. military vessels and aircraft by codifying both their protected sovereign status and permanent U.S. ownership, regardless of the passage of time. The purpose of the SMCA is to protect sunken military vessels and aircraft and the remains of their crews from unauthorized disturbance. Thousands of U.S. Government warships and military aircraft lie in waters around the world. Recent advances in technology have made these wrecks accessible to looters, treasure hunters, and others who may cause damage. This issue is a growing concern both nationally and internationally because, in addition to war graves, many sunken warships and aircraft contain objects of a sensitive archaeological or historical nature. By providing legal protection for sunken military craft, the SMCA helps reduce the potential for irreversible harm to important historical resources.

The SMCA protects sunken U.S. military ships and aircraft wherever they are located, as well as the graves of their lost military personnel, sensitive archaeological artifacts, and historical information. Its scope is broad, protecting sunken U.S. craft worldwide and sunken foreign craft in U.S. waters defined to include the internal waters, territorial sea, and contiguous zone (up to 24 nautical miles off the U.S. coast).

Source: http://www.history.navy.mil/branches/org12-12.htm (last visited April 9, 2013).

Summary of Legislative History:

The Sunken Military Craft Act was incorporated into the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005, as Title XIV. Introduced as H.R. 4200 on April 22, 2004, the original bill did not contain the SMCA. The bill was then reported, with amendments, by the Committee on Armed Services on May 14, 2004. On May 20, 2004, the Committee on Armed Services filed a supplemental report, which contained the SMCA language. The 108th Congress enacted Public Law 108-375 on October 28, 2004, including the SMCA.

2012 attempted revision to the SMCA
Florida Congressman Connie Mack added an amendment to the 2012 fiscal year defense authorization bill that would amend the SMCA to remove its protections for ships on commercial missions when they sank. It is described as an amendment that-

Would make changes to the language of the Sunken Military Craft Act of H.R. 1540, the National Defense Authorization Act for Fiscal Year 2012. Would clarify the language of the Sunken Military Craft Act to restore its original intent, and would specify that a sunken military craft would be defined as a vessel only when on military noncommercial service when it sank.

Such an amendment would allow salvors such as those in Odyssey Marine Exploration, Inc. v. Unidentified Shipwrecked Vessel, 657 F.3d 1159 (11th Cir. 2011) more leeway in establishing rights over their finds.

The House version of this bill contained an amendment to the National Defense Authorization Act for Fiscal Year 2012:
H.R.1540 National Defense Authorization Act for Fiscal Year 2012 (Engrossed in House)
SEC. 1099N. SUNKEN MILITARY CRAFT.
Section 1408(3) of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (10 U.S.C. 113 note) is amended--

(1) in subparagraph (A), by inserting ', that was' before 'on military noncommercial service'; and
(2) in subparagraph (B), by inserting a comma before 'that was owned or operated'.

However, the Senate removed this amendment in its version and it remained absent from the final version of the bill signed in December 2012.
National Defense Authorization Act for Fiscal Year 2012 (Enrolled Bill - Final as Passed Both House and Senate)

Cases:

- International Aircraft Recovery, L.L.C. v. Unidentified, Wrecked & Abandoned Aircraft, 218 F.3d 1255 (11th Cir. 2000), cert. denied, 531 U.S. 1144 (2001). (See case summary).
  - Not SMCA case but SMCA is codification of cases similar to this case involving government ownership of sunken military craft.
- Odyssey Marine Exploration, Inc. v. Unidentified Shipwrecked Vessel, 657 F.3d 1159 (11th Cir. 2011), cert. denied, 132 S. Ct. 2379 (2012). (See case summary).
  - SMCA is considered part of U.S. law and policy for reciprocal treatment under the Friendship Treaty with Spain; SMCA was not applied as a matter of law to Spanish wreck outside of U.S. waters.
- United States v. Steinmetz, 973 F.2d 212 (3d Cir. 1992), aff'g 763 F. Supp. 1293 (D.N.J. 1991), cert. denied, 113 S. Ct. 1578 (1993). (See case summary).

  - Not SMCA case but SMCA is codification of cases similar to this case involving government ownership of sunken military craft.

Law Articles:

David J. Bederman, Congress Enacts Increased Protections for Sunken Military Craft, 100 Am. J. Int'l L. 649 (2006).

- Article traces the development of the areas of law dealing with sunken military craft. It analyzes the provisions of the SMCA and critiques some of its legal assumptions with regard to developments in this area.

Michael R. Nelson, Finders, Weepers-Losers, Keepers? Florida Court Says U.S. Company Must Return Recovered Treasure to Kingdom of Spain, 16 L. & Bus. Rev. Am. 587, 587-88 (2010).

- Article follows the developments of the Nuestra Senora de las Mercedes shipwreck, commonly referred to as the "Black Swan" (657 F.3d 1159 (11th Cir. 2011); 675 F. Supp. 2d 1126 (M.D. Fla. 2009)).

Rand R. Pixa, In Defense of Perpetual Title to Sovereign Wrecks (2004), available at http://www.history.navy.mil/branches/org12-7m.htm.

- Article describes U.S. and international law relating to the salvage of ship and aircraft wrecks.

Other Relevant Sources:

U.S. Navy, Naval History & Heritage Command, Underwater Archaeology:

- Protection for Sunken Military Vessels and Aircraft
- Talking Points on the Sunken Military Craft Act

Appendix 3. NOAA/Department of Navy Interagency Agreement

Interagency Agreement between the National Oceanic and Atmospheric Administration of the United States Department of Commerce and the United States Department of Navy on Cooperation under the Sunken Military Craft Act

Article I –Purpose, Scope, and Authority

A. This Interagency Agreement (IA) is entered into by the United States Department of Commerce's National Oceanic and Atmospheric Administration (hereinafter NOAA), and the United States Department of the Navy (hereinafter DON). Throughout this IA, these departments may be referred to as "the Participants".

B. The longstanding practice and policy has been for the Participants to consult and cooperate on the protection of sunken military craft. The prohibitions found in Sections 1402(a) and (b) of the Sunken Military Craft Act (SMCA) do not apply to actions taken by, or at the direction of NOAA or as otherwise authorized by law. Accordingly, the purpose of this IA is to set forth the practices and policies for cooperation between the Participants under regulations at 32 CFR Part 767 that implement the SMCA.

C. The scope of this IA includes:

- any sunken military craft as defined under the SMCA that is under the jurisdiction of the DON and located within a national marine sanctuary or national marine monument that is part of the National Marine Sanctuary System (NMSS) (e.g. Papahanaumokuakea Marine National Monument); and
- NOAA activities directed at any sunken military craft under the jurisdiction of the DON that are located outside of a national marine sanctuary or a marine national monument.

D. Authority for participation in this IA is provided, *inter alia*, by the SMCA, the National Historic Preservation Act (NHPA) (54 U.S.C. §§ 300101 *et seq.*), the National Marine Sanctuaries Act (NMSA) (16 U.S.C. §§ 1431 et seq), the Antiquities Act of 1906 (Antiquities Act) (16 U.S.C. §§ 431 – 433), and the Archaeological Resources Protection Act (ARPA) (16 U.S.C. §§ 470aa-470mm).

Article II – Background and Objectives

A. NOAA and DON have been consulting and cooperating on sunken military craft, such as the USS *Monitor*, for over forty years under several authorities, including the NMSA, DON permitting authority under the NHPA, and U.S. property law. On January 6, 2014, DON published a proposed rule to in part implement the SMCA. Once it is finalized, the rule is expected to be codified at 32 CFR Part 767.

B. This IA is intended to memorialize this longstanding practice and policy of cooperation as part of the implementation of the SMCA and 32 CFR Part 767. In particular, Section 1402(a)(3) of the SMCA 32 CFR § 767.5(e) recognizes NOAA's authority to issue permits for activities directed at certain sunken military craft located in national marine sanctuaries and marine national monuments.

Article III – Cooperation on sunken military craft

A. Cooperation on sunken military craft located in national marine sanctuaries and monuments.

1. Consistent with past practice and policy, NOAA will continue to be the lead permitting authority for activities directed at sunken military craft that are also historic resources when they are located in national marine sanctuaries and will serve as the lead for the marine national monument Co-Trustees for monuments within the NMSS.
2. NOAA will consult and cooperate with the DON prior to issuing any NOAA permit or conducting any other undertaking by NOAA that may disturb, injure, or remove a sunken military craft as part of its compliance with the NHPA and any other applicable standards and requirements of the Federal archaeology program.
3. A DON permit under the SMCA may be required for an activity within a national marine sanctuary or marine national monument if the Participants agree that either the activity or the sunken military craft is not addressed by the NOAA permitting regulations governing the sanctuary or monument. Examples might include activity directed at sunken military craft that were recently lost, non-historic, or located in sanctuaries or monuments in which there are no regulations governing historic resources. DON and NOAA agree that the Participants should not issue duplicative or overlapping permits, nor will they require an applicant to submit duplicative permit application information to both Participants.
4. NOAA will continue to notify DON regarding NOAA activities that are directed at but do not disturb sunken military craft, such as non-intrusive research and monitoring activities that are of mutual interest, prior to the conduct of any such activities.
5. When DON plans or proposes to carry out activities that may disturb, injure or remove a sunken military craft in a national marine sanctuary or marine national monument in the NMSS, DON will consult and cooperate with NOAA prior to the conduct of any such activities. DON activities in national marine sanctuaries and monuments may be subject to regulations for each sanctuary and monument.
6. Nothing in this IA is intended to supersede existing regulations, plans and policies regarding the conduct of military activities in national marine sanctuaries and marine national monuments, in particular immediate rescue and salvage operations conducted to preserve life, property or national security on ships or aircraft that may hereafter be lost in national marine sanctuaries or marine national monuments.

B. Cooperation on sunken military craft located outside of the NMSS.

1. Consistent with the past practice and policy, NOAA will continue to consult and cooperate with DON on any activities directed at sunken military craft under the jurisdiction of the DON that may disturb, injure or remove a sunken military craft that are located outside of the NMSS

as part of its compliance with the NHPA and other applicable standards and requirements of the Federal archaeology program.
2. NOAA will continue to consult and cooperate with DON in advance regarding any NOAA activities that are directed at but do not disturb sunken military craft, such as non-intrusive research and monitoring where such NOAA activities are expected to be of mutual interest.
3. As provided in Section 303 of the NMSA (16 U.S.C. 1433), NOAA will consult with DON on any proposed establishment or modification of a national marine sanctuary that would affect the management of sunken military craft under the jurisdiction of the DON.
4. DON, at the request of a foreign government and in consultation with the Secretary of State, has responsibility for applying and enforcing the SMCA and administering its implementing regulations (e.g., for permitting activities related to sunken military craft) with regard to foreign sunken military craft located within U.S. internal waters, the 12 nm U.S. territorial sea and the 24 nm U.S. contiguous zone. NOAA, in consultation with the Department of State (DOS), is to continue to notify, consult and cooperate with foreign governments, agencies and institutions in regard to NOAA conducting surveys and research that may impact foreign sunken military craft located inside and outside of national marine sanctuaries and marine national monuments. Consistent with past practice, if such an arrangement is a non-binding Memorandum of Understanding (MOU), the consultation with DOS may be limited to ensuring that the MOU is not an "international agreement" subject to the C-175 process under the Case-Zablocki Act. In those instances where a legally binding "international agreement" is desired, DOS may elect to take the lead in negotiating the international agreement as well as the interagency process necessary to comply with the C-175 process.

Article IV – Effective Date

This Interagency Agreement takes effect on the later of the day after the last Participant signs the document, or the date that the Final Rule under the revised 32 CFR 767 comes into effect.

SIGNATURES

The Participants have signed this IA on the date(s) set forth below.

FOR THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION:
Signature: _____
Name and Title: FOR DANIEL BASTA, DIRECTOR, NOAA OFFICE OF NATIONAL MARINE SANCTUARIES
Date: 6/10/2015

FOR THE DEPARTMENT OF NAVY:
Signature: _____
Name and Title: SAMUEL J. COX, DIRECTOR, NAVAL HISTORY AND HERITAGE COMMAND
Date: 9 JUN 15

Appendix 4. Summary Inventory List of SCRs in Hawai`i

Alphabetical listing by vessel name/aircraft designation. Excerpt data fields include: record number, vessel name, vessel type, year of loss (if known), federal waters 3-200 (Hawaii OCS), nearest island, location category, and site investigation.

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
641	4 Door Sedan (4)	vehicle		YES	Oahu	1 confirm	YES
652	4 Door Sedan (5)	vehicle		YES	Oahu	1 confirm	YES
630	4-Door Sedan (1)	vehicle		YES	Oahu	1 confirm	YES
632	4-Door Sedan (2)	vehicle		YES	Oahu	1 confirm	YES
635	4-Door Sedan (3)	vehicle		YES	Oahu	1 confirm	YES
757	A.H. Howland	ship	1852	NO	Oahu	2 good	NO
563	A-20A Havoc (40-126)	aircraft	1941	YES	Oahu	1 confirm	YES
735	Active	schooner	1876	NO	Oahu	2 good	NO
260	Ada	schooner	1909	YES	Hawaii	4 poor	NO
261	Adelante	fishing vessel	1967	NO	Hawaii	2 good	NO
1350	Adventure V	unknown	1993	YES	Hawaii	4 poor	NO
262	Aea Kai	fishing vessel	1963	NO	Oahu	4 poor	NO
826	Aeolus	schooner	1914	YES	Oahu	4 poor	NO
1351	Aerial	fishing vessel	1997	NO	Maui	3 fair	NO
263	Ahi	yacht	1929	NO	Oahu	3 fair	NO
264	Ahukini	tugboat	1957	NO	Oahu	4 poor	NO
1352	Aikani III	passenger carrier	1979	NO	Hawaii	2 good	NO
721	Aircraft Cockpit	aircraft		NO	Oahu	1 confirm	YES
569	Aircraft Oahu-1	aircraft		YES	Oahu	1 confirm	YES
722	Aircraft Wing (1)	aircraft		NO	Oahu	1 confirm	YES
723	Aircraft Wing (2)	aircraft		NO	Oahu	1 confirm	YES
724	Aircraft Wing (3)	aircraft		NO	Oahu	1 confirm	YES
725	Aircraft Wings (4)	aircraft		NO	Oahu	1 confirm	YES
265	Ale Ale Kai VI	passenger carrier	1964	NO	Molokai	3 fair	NO
824	Alexander Black	bark	1910	NO	Maui	3 fair	NO
266	Alton	cruiser	1936	NO	Hawaii	4 poor	NO
1353	Alton	schooner	1899	NO	Hawaii	3 fair	NO
1354	Amsuco	tugboat	1915	NO	Hawaii	4 poor	NO
909	anchor	anchor		NO	Oahu	2 good	NO
1406	anchor	anchor		NO	Oahu	2 good	YES
1407	anchor	anchor		NO	Hawaii	1 confirm	YES
2497	anchor	anchor		NO	Oahu	1 confirm	NO
1405	anchors	anchor		NO	Oahu	1 confirm	YES
267	Andrea F. Luckenbach	freighter	1951	NO	Kauai	1 confirm	NO
268	Ann	brigantine	1845	NO	Kauai	2 good	NO
269	Annie	schooner	1879	NO	Kauai	3 fair	NO
270	Annie E.	schooner	1920	NO	Oahu	4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
271	Annie Laurie	schooner	1866	NO	Kauai	2 good	NO
273	Arcade	passenger carrier	1942	NO	Oahu	3 fair	NO
274	Arizona, USS	battleship	1941	NO	Oahu	1 confirm	YES
850	Arthur (British)	brigantine	1796	NO	Oahu	3 fair	NO
1355	Asiatic Prince	steam screw	1928	YES	Kauai	4 poor	NO
1356	Asylum	sailboat	1976	NO	Hawaii	4 poor	NO
638	Automobile (1)	vehicle		YES	Oahu	1 confirm	YES
643	Automobile (2)	vehicle		YES	Oahu	1 confirm	YES
648	Automobile (3)	vehicle		YES	Oahu	1 confirm	YES
650	Automobile (4)	vehicle		YES	Oahu	1 confirm	YES
653	Automobile (5)	vehicle		YES	Oahu	1 confirm	YES
654	Automobile (6)	vehicle		YES	Oahu	1 confirm	YES
258	Awa	fishing vessel	1958	YES	Molokai	3 fair	NO
624	Axel and Wheels	vehicle		NO	Oahu	1 confirm	YES
275	B. H. Ramsdell	schooner	1879	NO	Kauai	2 good	NO
276	Baltimore, USS ex	cruiser	1944	YES	Oahu	4 poor	NO
1357	Banyan	sailboat	1978	NO	Hawaii	4 poor	NO
277	Barbero, USS ex	submarine	1964	YES	Oahu	4 poor	NO
329	Barge Kahala-1	barge		NO	Oahu	1 confirm	YES
330	Barge Kahala-2	barge		NO	Oahu	1 confirm	YES
758	Barge Kahala-3	barge		NO	Oahu	1 confirm	YES
882	Barge Kaiser-1	barge		NO	Oahu	1 confirm	YES
870	barge Kaneohe-1	barge		NO	Oahu	1 confirm	NO
875	Barge Kaneohe-2	barge		NO	Oahu	1 confirm	YES
898	Barge Lanai	barge		NO	Lanai	1 confirm	NO
871	barge Maili-1	barge		NO	Oahu	1 confirm	NO
534	Barge Oahu-1	barge		NO	Oahu	1 confirm	YES
538	Barge Oahu-2	barge		NO	Oahu	1 confirm	YES
540	Barge Oahu-3	barge		NO	Oahu	1 confirm	YES
542	Barge Oahu-4	barge		NO	Oahu	1 confirm	YES
550	Barge Oahu-5	barge		NO	Oahu	1 confirm	YES
872	barge Oahu-6	barge		NO	Oahu	1 confirm	NO
1398	Bashaw, USS	submarine	1972	YES	Oahu	4 poor	NO
1358	Battan	sailboat	1948	NO	Hawaii	4 poor	NO
838	Beachcraft twin-engine	aircraft	1986	NO	Oahu	1 confirm	NO
278	Bee	steam screw	1924	NO	Maui	4 poor	NO
279	Bellatrix	fishing vessel	1959	NO	Molokai	4 poor	NO
280	Benito Juarez	passenger carrier	1918	YES	Molokai	4 poor	NO
732	Bennington, USS ex	barge	1924	YES	Oahu	1 confirm	YES
282	Betty D.	passenger carrier	1938	NO	Molokai	2 good	NO
283	Bettylou	tugboat	1933	NO	Oahu	2 good	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
902	bi-plane	aircraft		NO	Oahu	2 good	YES
284	Blanche and Ella	schooner	1901	NO	Oahu	3 fair	NO
285	Bluegill, USS ex	submarine	1983	YES	Maui	3 fair	NO
1359	Bonaire Star	passenger carrier	1979	YES	Hawaii	3 fair	NO
286	Brothers	fishing vessel	1954	YES	Oahu	3 fair	NO
788	Bruce	schooner	1867	NO	Maui	3 fair	NO
1508	BT-1	aircraft	1941	YES		4 poor	NO
662	Buick Coupe	vehicle		YES	Oahu	1 confirm	YES
287	C. O. Whitmore	bark	1891	NO	Hawaii	2 good	NO
288	C. R. Bishop	steam screw	1894	NO	Kauai	3 fair	NO
637	Cadillac Victoria Coupe	vehicle		YES	Oahu	1 confirm	YES
289	Carbonero, USS ex	submarine	1975	NO	Oahu	3 fair	NO
290	Carol Dawn	fishing vessel	1964	NO	Lanai	4 poor	NO
291	Carolina	yacht	1954	NO	Oahu	2 good	NO
849	Caroline (British)	bark	1850	NO	Oahu	3 fair	NO
292	Caroline Mills	schooner	1878	NO	Hawaii	2 good	NO
736	Carrier Dove	schooner	1921	NO	Molokai	3 fair	NO
895	Cartheginian II	bark	2005	NO	Maui	1 confirm	NO
294	Caucus	dredge	1929	NO	Oahu	1 confirm	YES
551	Cessna 152	aircraft	1979	NO	Oahu	1 confirm	YES
295	Chahao, USS ex	tugboat	1996	NO	Oahu	4 poor	NO
296	Chance	schooner	1855	NO	Kauai	2 good	NO
789	Charles Drew	brigantine	1850	NO	Oahu	4 poor	NO
649	Chevy 4 Door Sedan	vehicle		YES	Oahu	1 confirm	YES
661	Chevy Sedan Deluxe	vehicle		YES	Oahu	1 confirm	YES
658	Chevy Stovebolt 6 Pickup	vehicle		YES	Oahu	1 confirm	YES
603	Chittenden County (LST-561)	landing ship tank	1958	YES	Oahu	1 confirm	YES
298	Claire	fishing vessel	1952	NO	Oahu	2 good	NO
790	Clarion	schooner	1846	NO	Hawaii	2 good	NO
548	Claudine	steam screw	1929	YES	Oahu	1 confirm	NO
726	Corsair Wing (5)	aircraft		NO	Oahu	1 confirm	YES
759	Darter SS-576	submarine	1992	YES	Oahu	4 poor	NO
893	Degaussing Station	anchor		NO	Maui	1 confirm	YES
840	DeHaviland DH 114 Heron	aircraft	2007	NO	Oahu	1 confirm	NO
640	DeSoto Roadster	vehicle		YES	Oahu	1 confirm	YES
299	Dewitt	schooner	1868	NO	Maui	3 fair	NO
906	DH-104 Dove	aircraft		NO	Oahu	3 fair	NO
631	Dodge Opera Coupe	vehicle		YES	Oahu	1 confirm	YES
611	Dodge T207	vehicle		NO	Oahu	1 confirm	YES
300	Dolphin	schooner	1859	NO	Kahoolawe	4 poor	NO
301	Domitila	schooner	1885	YES	Hawaii	4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
302	Dreamcraft	patrol boat	1963	NO	Hawaii	2 good	NO
303	Drymo	bark	1845	NO	Maui	3 fair	NO
1415	DT-2	aircraft	1924	NO	Oahu	4 poor	NO
1417	DT-2	aircraft	1925	YES	Maui	4 poor	NO
1360	Due South	sailboat	1991	NO	Hawaii	4 poor	NO
584	DUWK Duck	amphibious vehicle		NO	Oahu	1 confirm	YES
791	Edward O'Brien	ship	1899	NO	Oahu	3 fair	NO
1361	Ehime Maru	fishing vessel	2001	YES	Oahu	3 fair	NO
304	Eiyo Maru	fishing vessel	1940	NO	Hawaii	2 good	NO
305	Eldora	fishing vessel	1941	NO	Hawaii	2 good	NO
306	Elena L	fishing vessel	1951	NO	Kauai	2 good	NO
307	Ella	bark	1890	NO	Hawaii	2 good	NO
1362	Ella	unknown	1892	NO	Hawaii	4 poor	NO
308	Emma	brigantine	1858	NO	Oahu	3 fair	NO
309	Emma Rooke	schooner	1864	NO	Hawaii	2 good	NO
792	Empire	bark	1901	NO	Hawaii	2 good	YES
719	Eskbank (Estbank)	bark	1878	NO	Oahu	1 confirm	YES
310	Esumi Maru	sampan motorized	1949	NO	Kauai	2 good	NO
311	Eugenia M. Briggs	schooner	1880	NO	Maui	2 good	NO
312	Ewa	sloop	1861	NO	Kauai	3 fair	NO
313	Excel	schooner	1869	YES	Niihau	4 poor	NO
1032	F2A-3 Buffalo	aircraft	1942	NO	Oahu	3 fair	NO
1761	F2A-3 BUFFALO	aircraft	1942	YES		4 poor	NO
1800	F2A-3 BUFFALO	aircraft	1941	YES		4 poor	NO
1801	F2A-3 BUFFALO	aircraft	1941	YES		4 poor	NO
1802	F2A-3 BUFFALO	aircraft	1942	YES		4 poor	NO
2460	F2A-3 BUFFALO	aircraft	1941	YES		4 poor	NO
2461	F2A-3 BUFFALO	aircraft	1941	YES		4 poor	NO
2378	F3A-1 CORSAIR	aircraft	1944	YES		4 poor	NO
2379	F3A-1 CORSAIR	aircraft	1944	YES		4 poor	NO
2380	F3A-1 CORSAIR	aircraft	1944	YES		4 poor	NO
314	F-4, USS ex	submarine	1940	NO	Oahu	1 confirm	YES
1156	F4F-3 Wildcat	aircraft	1942	NO	Hawaii	3 fair	NO
1762	F4F-3 WILDCAT	aircraft	1941	YES		4 poor	NO
1763	F4F-3 WILDCAT	aircraft	1941	YES		4 poor	NO
1764	F4F-3 WILDCAT	aircraft	1941	YES		4 poor	NO
1765	F4F-3 WILDCAT	aircraft	1941	YES		4 poor	NO
1766	F4F-3 WILDCAT	aircraft	1941	YES		4 poor	NO
1767	F4F-3 WILDCAT	aircraft	1941	YES		4 poor	NO
1768	F4F-3 WILDCAT	aircraft	1941	YES		4 poor	NO
1769	F4F-3 WILDCAT	aircraft	1941	YES		4 poor	NO
1774	F4F-3 WILDCAT	aircraft	1941	YES		4 poor	NO

RecNum	Vessel Name	Vessel type	Year Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
1776	F4F-3 WILDCAT	aircraft	1942	YES		4 poor	NO
1777	F4F-3 WILDCAT	aircraft	1942	YES		4 poor	NO
1778	F4F-3 WILDCAT	aircraft	1942	YES		4 poor	NO
1779	F4F-3 WILDCAT	aircraft	1942	YES		4 poor	NO
1860	F4F-3 WILDCAT	aircraft	1942	YES		4 poor	NO
1861	F4F-3 WILDCAT	aircraft	1942	YES		4 poor	NO
2129	F4F-3 WILDCAT	aircraft	1942	YES		4 poor	NO
1439	F4F-3A Wildcat	aircraft	1941	NO	Oahu	3 fair	NO
1739	F4F-3A WILDCAT	aircraft	1941	YES		4 poor	NO
1740	F4F-3A WILDCAT	aircraft	1941	YES		4 poor	NO
1770	F4F-3A WILDCAT	aircraft	1941	YES		4 poor	NO
1771	F4F-3A WILDCAT	aircraft	1941	YES		4 poor	NO
1772	F4F-3A WILDCAT	aircraft	1941	YES		4 poor	NO
1773	F4F-3A WILDCAT	aircraft	1941	YES		4 poor	NO
1775	F4F-3A WILDCAT	aircraft	1941	YES		4 poor	NO
1023	F4F-4 Wildcat	aircraft	1942	YES	Oahu	4 poor	NO
1024	F4F-4 Wildcat	aircraft	1942	NO	Oahu	3 fair	NO
1025	F4F-4 Wildcat	aircraft	1943	YES	Oahu	4 poor	NO
1026	F4F-4 Wildcat	aircraft	1943	YES	Oahu	4 poor	NO
1027	F4F-4 Wildcat	aircraft	1943	YES	Oahu	4 poor	NO
1028	F4F-4 Wildcat	aircraft	1943	YES	Maui	4 poor	NO
1440	F4F-4 Wildcat	aircraft	1942	YES	Lanai	4 poor	NO
1441	F4F-4 Wildcat	aircraft	1944	NO	Oahu	4 poor	NO
1741	F4F-4 WILDCAT	aircraft	1942	YES		4 poor	NO
1742	F4F-4 WILDCAT	aircraft	1942	YES		4 poor	NO
1743	F4F-4 WILDCAT	aircraft	1942	YES		4 poor	NO
1745	F4F-4 WILDCAT	aircraft	1943	YES		4 poor	NO
1746	F4F-4 WILDCAT	aircraft	1943	YES		4 poor	NO
1747	F4F-4 WILDCAT	aircraft	1943	YES		4 poor	NO
1748	F4F-4 WILDCAT	aircraft	1943	YES		4 poor	NO
1749	F4F-4 WILDCAT	aircraft	1944	YES		4 poor	NO
1780	F4F-4 WILDCAT	aircraft	1942	YES		4 poor	NO
1858	F4F-4 WILDCAT	aircraft	1942	YES		4 poor	NO
1859	F4F-4 WILDCAT	aircraft	1942	YES		4 poor	NO
1862	F4F-4 WILDCAT	aircraft	1942	YES		4 poor	NO
1863	F4F-4 WILDCAT	aircraft	1942	YES		4 poor	NO
1864	F4F-4 WILDCAT	aircraft	1942	YES		4 poor	NO
2121	F4F-4 WILDCAT	aircraft	1942	YES		4 poor	NO
2122	F4F-4 WILDCAT	aircraft	1942	YES		4 poor	NO
2123	F4F-4 WILDCAT	aircraft	1942	YES		4 poor	NO
2124	F4F-4 WILDCAT	aircraft	1942	YES		4 poor	NO
2125	F4F-4 WILDCAT	aircraft	1942	YES		4 poor	NO
2126	F4F-4 WILDCAT	aircraft	1942	YES		4 poor	NO
2127	F4F-4 WILDCAT	aircraft	1942	YES		4 poor	NO
2128	F4F-4 WILDCAT	aircraft	1942	YES		4 poor	NO
2131	F4F-4 WILDCAT	aircraft	1942	YES		4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
2132	F4F-4 WILDCAT	aircraft	1943	YES		4 poor	NO
2133	F4F-4 WILDCAT	aircraft	1943	YES		4 poor	NO
2134	F4F-4 WILDCAT	aircraft	1943	YES		4 poor	NO
2135	F4F-4 WILDCAT	aircraft	1943	YES		4 poor	NO
2136	F4F-4 WILDCAT	aircraft	1943	YES		4 poor	NO
2137	F4F-4 WILDCAT	aircraft	1943	YES		4 poor	NO
2138	F4F-4 WILDCAT	aircraft	1943	YES		4 poor	NO
2139	F4F-4 WILDCAT	aircraft	1943	YES		4 poor	NO
2140	F4F-4 WILDCAT	aircraft	1943	YES		4 poor	NO
2143	F4F-4 WILDCAT	aircraft	1943	YES		4 poor	NO
2150	F4F-4 WILDCAT	aircraft	1944	YES		4 poor	NO
2170	F4F-4 WILDCAT	aircraft	1944	YES		4 poor	NO
2466	F4F-4 WILDCAT	aircraft	1942	YES		4 poor	NO
2468	F4F-4 WILDCAT	aircraft	1942	YES		4 poor	NO
2130	F4F-7 WILDCAT	aircraft	1942	YES		4 poor	NO
2467	F4F-F WILDCAT	aircraft	1942	YES		4 poor	NO
1153	F4U Corsair	aircraft	1946	NO	Oahu	3 fair	NO
568	F4U-1 Corsair	aircraft		NO	Oahu	1 confirm	YES
833	F4U-1 Corsair	aircraft	1945	NO	Oahu	1 confirm	YES
835	F4U-1 Corsair	aircraft	1945	NO	Oahu	3 fair	YES
996	F4U-1 Corsair	aircraft	1943	NO	Lanai	4 poor	NO
997	F4U-1 Corsair	aircraft	1943	NO	Oahu	2 good	NO
998	F4U-1 Corsair	aircraft	1944	NO	Oahu	3 fair	NO
999	F4U-1 Corsair	aircraft	1944	NO	Oahu	3 fair	NO
1000	F4U-1 Corsair	aircraft	1944	NO	Oahu	3 fair	NO
1001	F4U-1 Corsair	aircraft	1944	NO	Oahu	3 fair	NO
1002	F4U-1 Corsair	aircraft	1944	YES	Oahu	4 poor	NO
1003	F4U-1 Corsair	aircraft	1944	YES	Oahu	4 poor	NO
1004	F4U-1 Corsair	aircraft	1944	NO	Oahu	4 poor	NO
1005	F4U-1 Corsair	aircraft	1944	NO	Oahu	4 poor	NO
1006	F4U-1 Corsair	aircraft	1944	YES	Oahu	4 poor	NO
1008	F4U-1 Corsair	aircraft	1944	YES	Oahu	4 poor	NO
1011	F4U-1 Corsair	aircraft	1945	YES	Oahu	4 poor	NO
1015	F4U-1 Corsair	aircraft	1944	NO	Oahu	3 fair	NO
1154	F4U-1 Corsair	aircraft	1943	YES	Oahu	4 poor	NO
1155	F4U-1 Corsair	aircraft	1943	YES	Oahu	4 poor	NO
1435	F4U-1 Corsair	aircraft	1943	NO	Oahu	3 fair	NO
1436	F4U-1 Corsair	aircraft	1945	NO	Oahu	4 poor	NO
1694	F4U-1 CORSAIR	aircraft	1943	YES		4 poor	NO
1695	F4U-1 CORSAIR	aircraft	1944	YES		4 poor	NO
1696	F4U-1 CORSAIR	aircraft	1944	YES		4 poor	NO
1702	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
1703	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
1704	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
1705	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
1706	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
1708	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
1709	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
1714	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
1715	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
1716	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
1717	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
1718	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
1719	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
1720	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2354	F4U-1 CORSAIR	aircraft	1943	YES		4 poor	NO
2355	F4U-1 CORSAIR	aircraft	1943	YES		4 poor	NO
2356	F4U-1 CORSAIR	aircraft	1943	YES		4 poor	NO
2357	F4U-1 CORSAIR	aircraft	1943	YES		4 poor	NO
2358	F4U-1 CORSAIR	aircraft	1943	YES		4 poor	NO
2359	F4U-1 CORSAIR	aircraft	1943	YES		4 poor	NO
2360	F4U-1 CORSAIR	aircraft	1943	YES		4 poor	NO
2361	F4U-1 CORSAIR	aircraft	1943	YES		4 poor	NO
2362	F4U-1 CORSAIR	aircraft	1943	YES		4 poor	NO
2363	F4U-1 CORSAIR	aircraft	1943	YES		4 poor	NO
2364	F4U-1 CORSAIR	aircraft	1943	YES		4 poor	NO
2365	F4U-1 CORSAIR	aircraft	1943	YES		4 poor	NO
2366	F4U-1 CORSAIR	aircraft	1943	YES		4 poor	NO
2367	F4U-1 CORSAIR	aircraft	1943	YES		4 poor	NO
2368	F4U-1 CORSAIR	aircraft	1943	YES		4 poor	NO
2369	F4U-1 CORSAIR	aircraft	1943	YES		4 poor	NO
2370	F4U-1 CORSAIR	aircraft	1943	YES		4 poor	NO
2371	F4U-1 CORSAIR	aircraft	1943	YES		4 poor	NO
2374	F4U-1 CORSAIR	aircraft	1944	YES		4 poor	NO
2375	F4U-1 CORSAIR	aircraft	1944	YES		4 poor	NO
2376	F4U-1 CORSAIR	aircraft	1944	YES		4 poor	NO
2381	F4U-1 CORSAIR	aircraft	1944	YES		4 poor	NO
2382	F4U-1 CORSAIR	aircraft	1944	YES		4 poor	NO
2385	F4U-1 CORSAIR	aircraft	1944	YES		4 poor	NO
2398	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2399	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2404	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2405	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2409	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2411	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2413	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2414	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2420	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2423	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2424	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2431	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2432	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
2438	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2452	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2453	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2455	F4U-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2464	F4U-1 CORSAIR	aircraft	1943	YES		4 poor	NO
1713	F4U-1C CORSAIR	aircraft	1945	YES		4 poor	NO
1007	F4U-1D Corsair	aircraft	1944	YES	Oahu	4 poor	NO
1009	F4U-1D Corsair	aircraft	1945	YES	Maui	4 poor	NO
1010	F4U-1D Corsair	aircraft	1945	YES	Maui	4 poor	NO
1697	F4U-1D CORSAIR	aircraft	1944	YES		4 poor	NO
1698	F4U-1D CORSAIR	aircraft	1944	YES		4 poor	NO
1699	F4U-1D CORSAIR	aircraft	1944	YES		4 poor	NO
1700	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
1701	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
1707	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
1710	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
1711	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
1712	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
1723	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
1726	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
2384	F4U-1D CORSAIR	aircraft	1944	YES		4 poor	NO
2386	F4U-1D CORSAIR	aircraft	1944	YES		4 poor	NO
2387	F4U-1D CORSAIR	aircraft	1944	YES		4 poor	NO
2393	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
2395	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
2400	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
2401	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
2402	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
2408	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
2410	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
2412	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
2415	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
2416	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
2419	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
2425	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
2426	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
2450	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
2456	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
2457	F4U-1D CORSAIR	aircraft	1945	YES		4 poor	NO
2372	F4U-2 CORSAIR	aircraft	1944	YES		4 poor	NO
1012	F4U-4 Corsair	aircraft	1945	NO	Oahu	4 poor	NO
1149	F4U-4 Corsair	aircraft	1948	NO	Oahu	4 poor	NO
1150	F4U-4 Corsair	aircraft	1948	NO	Oahu	4 poor	NO
1151	F4U-4 Corsair	aircraft	1948	YES	Oahu	4 poor	NO
1437	F4U-4 Corsair	aircraft	1945	NO	Oahu	2 good	NO
1721	F4U-4 CORSAIR	aircraft	1945	YES		4 poor	NO
1722	F4U-4 CORSAIR	aircraft	1945	YES		4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
1724	F4U-4 CORSAIR	aircraft	1945	YES		4 poor	NO
1725	F4U-4 CORSAIR	aircraft	1945	YES		4 poor	NO
1727	F4U-4 CORSAIR	aircraft	1945	YES		4 poor	NO
2435	F4U-4 CORSAIR	aircraft	1945	YES		4 poor	NO
2436	F4U-4 CORSAIR	aircraft	1945	YES		4 poor	NO
2437	F4U-4 CORSAIR	aircraft	1945	YES		4 poor	NO
2439	F4U-4 CORSAIR	aircraft	1945	YES		4 poor	NO
2441	F4U-4 CORSAIR	aircraft	1945	YES		4 poor	NO
2442	F4U-4 CORSAIR	aircraft	1945	YES		4 poor	NO
2445	F4U-4 CORSAIR	aircraft	1945	YES		4 poor	NO
2446	F4U-4 CORSAIR	aircraft	1945	YES		4 poor	NO
2448	F4U-4 CORSAIR	aircraft	1945	YES		4 poor	NO
2449	F4U-4 CORSAIR	aircraft	1945	YES		4 poor	NO
2451	F4U-4 CORSAIR	aircraft	1945	YES		4 poor	NO
2458	F4U-4 CORSAIR	aircraft	1952	YES		4 poor	NO
1148	F4U-5N Corsair	aircraft	1950	YES	Molokai	4 poor	NO
1152	F4U-5N Corsair	aircraft	1950	YES	Oahu	4 poor	NO
1478	F-5L	aircraft	1924	YES	Maui	4 poor	NO
866	F6F Hellcat	aircraft		NO	Maui	1 confirm	YES
1592	F6F HELLCAT	aircraft	1944	YES		4 poor	NO
1637	F6F HELLCAT	aircraft	1945	YES		4 poor	NO
1143	F6F-1 Hellcat	aircraft	1948	YES	Oahu	4 poor	NO
937	F6F-3 Hellcat	aircraft	1943	NO	Oahu	4 poor	NO
938	F6F-3 Hellcat	aircraft	1943	NO	Oahu	4 poor	NO
939	F6F-3 Hellcat	aircraft	1943	YES	Oahu	4 poor	NO
940	F6F-3 Hellcat	aircraft	1943	NO	Oahu	4 poor	NO
941	F6F-3 Hellcat	aircraft	1943	NO	Maui	4 poor	NO
942	F6F-3 Hellcat	aircraft	1944	NO	Maui	4 poor	NO
943	F6F-3 Hellcat	aircraft	1944	YES	Maui	4 poor	NO
944	F6F-3 Hellcat	aircraft	1944	YES	Maui	4 poor	NO
945	F6F-3 Hellcat	aircraft	1944	YES	Oahu	4 poor	NO
946	F6F-3 Hellcat	aircraft	1944	YES	Oahu	4 poor	NO
947	F6F-3 Hellcat	aircraft	1944	YES	Oahu	4 poor	NO
948	F6F-3 Hellcat	aircraft	1944	YES	Niihau	4 poor	NO
949	F6F-3 Hellcat	aircraft	1944	YES	Niihau	4 poor	NO
950	F6F-3 Hellcat	aircraft	1944	YES	Oahu	4 poor	NO
951	F6F-3 Hellcat	aircraft	1944	YES	Oahu	4 poor	NO
952	F6F-3 Hellcat	aircraft	1944	YES	Oahu	4 poor	NO
953	F6F-3 Hellcat	aircraft	1944	YES	Kahoolawe	4 poor	NO
954	F6F-3 Hellcat	aircraft	1944	YES	Kahoolawe	4 poor	NO
955	F6F-3 Hellcat	aircraft	1944	YES	Maui	4 poor	NO
956	F6F-3 Hellcat	aircraft	1944	YES	Maui	4 poor	NO
957	F6F-3 Hellcat	aircraft	1944	YES	Oahu	4 poor	NO
958	F6F-3 Hellcat	aircraft	1944	YES	Oahu	4 poor	NO
959	F6F-3 Hellcat	aircraft	1944	YES	Maui	4 poor	NO
960	F6F-3 Hellcat	aircraft	1944	YES	Hawaii	4 poor	NO
961	F6F-3 Hellcat	aircraft	1944	YES	Maui	4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
962	F6F-3 Hellcat	aircraft	1944	NO	Maui	4 poor	NO
963	F6F-3 Hellcat	aircraft	1944	YES	Oahu	4 poor	NO
964	F6F-3 Hellcat	aircraft	1944	NO	Maui	3 fair	NO
967	F6F-3 Hellcat	aircraft	1944	YES	Oahu	4 poor	NO
968	F6F-3 Hellcat	aircraft	1945	YES	Maui	4 poor	NO
980	F6F-3 Hellcat	aircraft	1945	NO	Oahu	2 good	NO
981	F6F-3 Hellcat	aircraft	1945	YES	Oahu	4 poor	NO
1160	F6F-3 Hellcat	aircraft	1943	NO	Oahu	3 fair	NO
1161	F6F-3 Hellcat	aircraft	1944	YES	Kahoolawe	4 poor	NO
1425	F6F-3 Hellcat	aircraft	1943	NO	Oahu	4 poor	NO
1426	F6F-3 Hellcat	aircraft	1943	NO	Oahu	4 poor	NO
1427	F6F-3 Hellcat	aircraft	1944	YES	Oahu	4 poor	NO
1428	F6F-3 Hellcat	aircraft	1944	NO	Oahu	4 poor	NO
1429	F6F-3 Hellcat	aircraft	1944	YES	Lanai	4 poor	NO
1430	F6F-3 Hellcat	aircraft	1945	NO	Oahu	4 poor	NO
1467	F6F-3 Hellcat	aircraft	1943	NO	Maui	4 poor	NO
1468	F6F-3 Hellcat	aircraft	1943	NO	Maui	4 poor	NO
1469	F6F-3 Hellcat	aircraft	1943	YES	Niihau	4 poor	NO
1470	F6F-3 Hellcat	aircraft	1943	YES	Niihau	4 poor	NO
1471	F6F-3 Hellcat	aircraft	1944	YES	Oahu	4 poor	NO
1511	F6F-3 HELLCAT	aircraft	1943	YES		4 poor	NO
1512	F6F-3 HELLCAT	aircraft	1943	YES		4 poor	NO
1513	F6F-3 HELLCAT	aircraft	1943	YES		4 poor	NO
1514	F6F-3 HELLCAT	aircraft	1943	YES		4 poor	NO
1515	F6F-3 HELLCAT	aircraft	1943	YES		4 poor	NO
1516	F6F-3 HELLCAT	aircraft	1943	YES		4 poor	NO
1517	F6F-3 HELLCAT	aircraft	1943	YES		4 poor	NO
1518	F6F-3 HELLCAT	aircraft	1943	YES		4 poor	NO
1519	F6F-3 HELLCAT	aircraft	1943	YES		4 poor	NO
1520	F6F-3 HELLCAT	aircraft	1943	YES		4 poor	NO
1521	F6F-3 HELLCAT	aircraft	1943	YES		4 poor	NO
1522	F6F-3 HELLCAT	aircraft	1943	YES		4 poor	NO
1523	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1524	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1525	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1526	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1527	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1528	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1529	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1530	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1531	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1532	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1533	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1534	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1535	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1536	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1537	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
1538	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1539	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1540	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1541	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1542	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1543	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1544	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1545	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1546	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1547	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1548	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1549	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1551	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1552	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1553	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1554	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1555	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1560	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1561	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1562	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1563	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1564	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1565	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1569	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1573	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1574	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1575	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1576	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1577	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1578	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1579	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1580	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1582	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1584	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1586	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1587	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1591	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
1615	F6F-3 HELLCAT	aircraft	1945	YES		4 poor	NO
1616	F6F-3 HELLCAT	aircraft	1945	YES		4 poor	NO
1619	F6F-3 HELLCAT	aircraft	1945	YES		4 poor	NO
1623	F6F-3 HELLCAT	aircraft	1945	YES		4 poor	NO
1624	F6F-3 HELLCAT	aircraft	1945	YES		4 poor	NO
1627	F6F-3 HELLCAT	aircraft	1945	YES		4 poor	NO
1628	F6F-3 HELLCAT	aircraft	1945	YES		4 poor	NO
1640	F6F-3 HELLCAT	aircraft	1945	YES		4 poor	NO
1644	F6F-3 HELLCAT	aircraft	1945	YES		4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
1668	F6F-3 HELLCAT	aircraft	1945	YES		4 poor	NO
1686	F6F-3 HELLCAT	aircraft	1945	YES		4 poor	NO
2465	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
2478	F6F-3 HELLCAT	aircraft	1943	YES		4 poor	NO
2480	F6F-3 HELLCAT	aircraft	1943	YES		4 poor	NO
2481	F6F-3 HELLCAT	aircraft	1943	YES		4 poor	NO
2482	F6F-3 HELLCAT	aircraft	1943	YES		4 poor	NO
2483	F6F-3 HELLCAT	aircraft	1943	YES		4 poor	NO
2484	F6F-3 HELLCAT	aircraft	1943	YES		4 poor	NO
2485	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
2486	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
2487	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
2488	F6F-3 HELLCAT	aircraft	1943	YES		4 poor	NO
2489	F6F-3 HELLCAT	aircraft	1943	YES		4 poor	NO
2490	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
2491	F6F-3 HELLCAT	aircraft	1944	YES		4 poor	NO
556	F6F-3 Hellcat	aircraft	1943	NO	Oahu	1 confirm	YES
1556	F6F-3N HELLCAT	aircraft	1944	YES		4 poor	NO
1567	F6F-3N HELLCAT	aircraft	1944	YES		4 poor	NO
1568	F6F-3N HELLCAT	aircraft	1944	YES		4 poor	NO
1570	F6F-3N HELLCAT	aircraft	1944	YES		4 poor	NO
1571	F6F-3N HELLCAT	aircraft	1944	YES		4 poor	NO
1572	F6F-3N HELLCAT	aircraft	1944	YES		4 poor	NO
1632	F6F-3N HELLCAT	aircraft	1945	YES		4 poor	NO
1638	F6F-3N HELLCAT	aircraft	1945	YES		4 poor	NO
1646	F6F-3P HELLCAT	aircraft	1945	YES		4 poor	NO
965	F6F-5 Hellcat	aircraft	1944	YES	Hawaii	4 poor	NO
966	F6F-5 Hellcat	aircraft	1944	YES	Hawaii	4 poor	NO
969	F6F-5 Hellcat	aircraft	1945	NO	Molokai	4 poor	NO
970	F6F-5 Hellcat	aircraft	1945	YES	Hawaii	3 fair	NO
971	F6F-5 Hellcat	aircraft	1945	YES	Oahu	4 poor	NO
972	F6F-5 Hellcat	aircraft	1945	NO	Hawaii	4 poor	NO
973	F6F-5 Hellcat	aircraft	1945	YES	Maui	4 poor	NO
974	F6F-5 Hellcat	aircraft	1945	YES	Maui	3 fair	NO
975	F6F-5 Hellcat	aircraft	1945	YES	Hawaii	3 fair	NO
977	F6F-5 Hellcat	aircraft	1945	YES	Maui	4 poor	NO
983	F6F-5 Hellcat	aircraft	1945	NO	Oahu	2 good	NO
984	F6F-5 Hellcat	aircraft	1945	YES	Oahu	4 poor	NO
985	F6F-5 Hellcat	aircraft	1945	YES	Oahu	4 poor	NO
988	F6F-5 Hellcat	aircraft	1945	YES	Maui	4 poor	NO
990	F6F-5 Hellcat	aircraft	1945	NO	Oahu	4 poor	NO
991	F6F-5 Hellcat	aircraft	1945	YES	Oahu	4 poor	NO
992	F6F-5 Hellcat	aircraft	1945	YES	Oahu	4 poor	NO
993	F6F-5 Hellcat	aircraft	1945	YES	Oahu	4 poor	NO
994	F6F-5 Hellcat	aircraft	1945	NO	Maui	4 poor	NO
995	F6F-5 Hellcat	aircraft	1945	NO	Oahu	3 fair	NO
1137	F6F-5 Hellcat	aircraft	1946	YES	Oahu	4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
1138	F6F-5 Hellcat	aircraft	1947	YES	Oahu	4 poor	NO
1432	F6F-5 Hellcat	aircraft	1945	NO	Oahu	4 poor	NO
1433	F6F-5 Hellcat	aircraft	1945	YES	Hawaii	4 poor	NO
1434	F6F-5 Hellcat	aircraft	1945	NO	Lanai	4 poor	NO
1475	F6F-5 HELLCAT	aircraft	1948	NO	Oahu	4 poor	NO
1550	F6F-5 HELLCAT	aircraft	1944	YES		4 poor	NO
1557	F6F-5 HELLCAT	aircraft	1944	YES		4 poor	NO
1585	F6F-5 HELLCAT	aircraft	1944	YES		4 poor	NO
1588	F6F-5 HELLCAT	aircraft	1944	YES		4 poor	NO
1589	F6F-5 HELLCAT	aircraft	1944	YES		4 poor	NO
1590	F6F-5 HELLCAT	aircraft	1944	YES		4 poor	NO
1596	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1597	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1598	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1599	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1600	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1601	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1602	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1603	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1604	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1605	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1606	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1607	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1608	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1609	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1610	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1613	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1614	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1617	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1625	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1629	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1630	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1631	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1633	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1634	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1635	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1639	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1641	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1642	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1643	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1645	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1647	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1653	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1654	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1655	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1656	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1657	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
1658	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1660	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1663	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1665	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1666	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1667	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1669	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1670	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1671	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1673	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1674	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1675	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1676	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1677	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1678	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1679	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1680	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1683	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1684	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1685	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1687	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1688	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1690	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1691	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1692	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1693	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
1908	F6F-5 HELLCAT	aircraft	1944	YES		4 poor	NO
2492	F6F-5 HELLCAT	aircraft	1945	YES		4 poor	NO
986	F6F-5E Hellcat	aircraft	1945	NO	Oahu	2 good	NO
987	F6F-5E Hellcat	aircraft	1945	NO	Oahu	2 good	NO
1620	F6F-5E HELLCAT	aircraft	1945	YES		4 poor	NO
1621	F6F-5E HELLCAT	aircraft	1945	YES		4 poor	NO
1622	F6F-5E HELLCAT	aircraft	1945	YES		4 poor	NO
1648	F6F-5E HELLCAT	aircraft	1945	YES		4 poor	NO
1659	F6F-5E HELLCAT	aircraft	1945	YES		4 poor	NO
1626	F6F-5F HELLCAT	aircraft	1945	YES		4 poor	NO
976	F6F-5N Hellcat	aircraft	1945	NO	Hawaii	3 fair	NO
978	F6F-5N Hellcat	aircraft	1945	NO	Oahu	2 good	NO
979	F6F-5N Hellcat	aircraft	1945	YES	Hawaii	3 fair	NO
982	F6F-5N Hellcat	aircraft	1945	YES	Oahu	4 poor	NO
989	F6F-5N Hellcat	aircraft	1945	YES	Oahu	4 poor	NO
1431	F6F-5N Hellcat	aircraft	1945	YES	Oahu	4 poor	NO
1474	F6F-5N HELLCAT	aircraft	1948	YES	Oahu	4 poor	NO
1476	F6F-5N HELLCAT	aircraft	1951	YES	Oahu	3 fair	NO
1558	F6F-5N HELLCAT	aircraft	1944	YES		4 poor	NO
1559	F6F-5N HELLCAT	aircraft	1944	YES		4 poor	NO
1566	F6F-5N HELLCAT	aircraft	1944	YES		4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
1581	F6F-5N HELLCAT	aircraft	1944	YES		4 poor	NO
1583	F6F-5N HELLCAT	aircraft	1944	YES		4 poor	NO
1593	F6F-5N HELLCAT	aircraft	1944	YES		4 poor	NO
1594	F6F-5N HELLCAT	aircraft	1945	YES		4 poor	NO
1595	F6F-5N HELLCAT	aircraft	1945	YES		4 poor	NO
1611	F6F-5N HELLCAT	aircraft	1945	YES		4 poor	NO
1612	F6F-5N HELLCAT	aircraft	1945	YES		4 poor	NO
1618	F6F-5N HELLCAT	aircraft	1945	YES		4 poor	NO
1636	F6F-5N HELLCAT	aircraft	1945	YES		4 poor	NO
1649	F6F-5N HELLCAT	aircraft	1945	YES		4 poor	NO
1650	F6F-5N HELLCAT	aircraft	1945	YES		4 poor	NO
1651	F6F-5N HELLCAT	aircraft	1945	YES		4 poor	NO
1652	F6F-5N HELLCAT	aircraft	1945	YES		4 poor	NO
1661	F6F-5N HELLCAT	aircraft	1945	YES		4 poor	NO
1662	F6F-5N HELLCAT	aircraft	1945	YES		4 poor	NO
1664	F6F-5N HELLCAT	aircraft	1945	YES		4 poor	NO
1672	F6F-5N HELLCAT	aircraft	1945	YES		4 poor	NO
1681	F6F-5N HELLCAT	aircraft	1945	YES		4 poor	NO
1682	F6F-5N HELLCAT	aircraft	1945	YES		4 poor	NO
1689	F6F-5N HELLCAT	aircraft	1945	YES		4 poor	NO
557	F6F-5N Hellcat	aircraft	1951	YES	Oahu	1 confirm	YES
1135	F7F-3N Tigercat	aircraft	1948	NO	Oahu	4 poor	NO
1136	F7F-3N Tigercat	aircraft	1948	NO	Oahu	4 poor	NO
2459	F7F-3N TIGERCAT	aircraft	1948	YES		4 poor	NO
1134	F7F-4N Tigercat	aircraft	1949	NO	Oahu	3 fair	NO
1145	F8F-1 Bearcat	aircraft	1946	NO	Oahu	3 fair	NO
1146	F8F-1 Bearcat	aircraft	1946	NO	Oahu	3 fair	NO
1147	F8F-1 Bearcat	aircraft	1947	YES	Oahu	4 poor	NO
1728	F8F-1 BEARCAT	aircraft	1945	YES		4 poor	NO
1729	F8F-1 BEARCAT	aircraft	1945	YES		4 poor	NO
315	Fairy Queen	schooner	1878	NO	Kauai	3 fair	NO
316	Fanny	schooner	1878	NO	Hawaii	3 fair	NO
760	Fessenden	destroyer	1967	YES	Oahu	4 poor	NO
1018	FG-1 Corsair	aircraft	1945	YES	Hawaii	4 poor	NO
1438	FG-1 Corsair	aircraft	1945	YES	Hawaii	4 poor	NO
1730	FG-1 CORSAIR	aircraft	1945	YES		4 poor	NO
1734	FG-1 CORSAIR	aircraft	1945	YES		4 poor	NO
1736	FG-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2373	FG-1 CORSAIR	aircraft	1944	YES		4 poor	NO
2377	FG-1 CORSAIR	aircraft	1944	YES		4 poor	NO
2383	FG-1 CORSAIR	aircraft	1944	YES		4 poor	NO
2389	FG-1 CORSAIR	aircraft	1944	YES		4 poor	NO
2396	FG-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2397	FG-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2406	FG-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2417	FG-1 CORSAIR	aircraft	1945	YES		4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
2421	FG-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2428	FG-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2429	FG-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2430	FG-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2433	FG-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2434	FG-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2440	FG-1 CORSAIR	aircraft	1945	YES		4 poor	NO
2447	FG-1 CORSAIR	aircraft	1945	YES		4 poor	NO
1014	FG-1A Corsair	aircraft	1944	NO	Oahu	3 fair	NO
1016	FG-1A Corsair	aircraft	1944	YES	Oahu	4 poor	NO
1017	FG-1A Corsair	aircraft	1945	YES	Hawaii	4 poor	NO
1019	FG-1A Corsair	aircraft	1945	YES	Maui	4 poor	NO
1020	FG-1A Corsair	aircraft	1945	NO	Molokai	3 fair	NO
1021	FG-1A Corsair	aircraft	1945	YES	Oahu	4 poor	NO
1077	FG-1A Corsair	aircraft	1944	YES	Oahu	4 poor	NO
1733	FG-1A CORSAIR	aircraft	1945	YES		4 poor	NO
2388	FG-1A CORSAIR	aircraft	1944	YES		4 poor	NO
2390	FG-1A CORSAIR	aircraft	1945	YES		4 poor	NO
2391	FG-1A CORSAIR	aircraft	1945	YES		4 poor	NO
2394	FG-1A CORSAIR	aircraft	1945	YES		4 poor	NO
2403	FG-1A CORSAIR	aircraft	1945	YES		4 poor	NO
2407	FG-1A CORSAIR	aircraft	1945	YES		4 poor	NO
2418	FG-1A CORSAIR	aircraft	1945	YES		4 poor	NO
2422	FG-1A CORSAIR	aircraft	1945	YES		4 poor	NO
1022	FG-1D Corsair	aircraft	1945	YES	Oahu	4 poor	NO
1731	FG-1D CORSAIR	aircraft	1945	YES		4 poor	NO
1732	FG-1D CORSAIR	aircraft	1945	YES		4 poor	NO
1735	FG-1D CORSAIR	aircraft	1945	YES		4 poor	NO
1737	FG-1D CORSAIR	aircraft	1945	YES		4 poor	NO
1738	FG-1D CORSAIR	aircraft	1945	YES		4 poor	NO
2392	FG-1D CORSAIR	aircraft	1945	YES		4 poor	NO
2427	FG-1D CORSAIR	aircraft	1945	YES		4 poor	NO
2443	FG-1D CORSAIR	aircraft	1945	YES		4 poor	NO
2454	FG-1D CORSAIR	aircraft	1945	YES		4 poor	NO
317	Flibberty Gibbett	schooner	1861	NO	Hawaii	4 poor	NO
318	Florence	ship	1902	NO	Oahu	4 poor	NO
2141	FM-1 WILDCAT	aircraft	1943	YES		4 poor	NO
2142	FM-1 WILDCAT	aircraft	1943	YES		4 poor	NO
2144	FM-1 WILDCAT	aircraft	1943	YES		4 poor	NO
2145	FM-1 WILDCAT	aircraft	1943	YES		4 poor	NO
2147	FM-1 WILDCAT	aircraft	1944	YES		4 poor	NO
901	FM-2 Wildcat	aircraft	1944	NO	Maui	2 good	NO
1029	FM-2 Wildcat	aircraft	1945	NO	Hawaii	3 fair	NO
1030	FM-2 Wildcat	aircraft	1945	YES	Oahu	4 poor	NO
1031	FM-2 Wildcat	aircraft	1945	YES	Oahu	4 poor	NO
1412	FM-2 Wildcat	aircraft	1944	NO	Oahu	4 poor	NO
1413	FM-2 Wildcat	aircraft	1944	NO	Oahu	4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
1491	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
1492	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
1493	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
1494	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
1495	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
1496	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
1497	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
1498	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
1499	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
1500	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
1501	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
1750	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
1751	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
1752	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
1753	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
1754	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
1755	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
1756	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
1757	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
1758	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
1759	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
1760	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2146	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2148	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2149	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2151	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2152	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2153	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2154	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2155	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2156	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2157	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2158	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2159	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2160	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2161	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2162	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2163	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2164	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2165	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2166	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2167	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2168	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2169	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2171	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2172	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
2173	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2174	FM-2 WILDCAT	aircraft	1944	YES		4 poor	NO
2175	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2176	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2177	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2178	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2179	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2180	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2181	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2182	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2183	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2184	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2185	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2186	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2187	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2188	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2189	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2190	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2191	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2192	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2193	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2194	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2195	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2196	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2197	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2198	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2199	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2200	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2201	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2202	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2203	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2204	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2205	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2206	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2207	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2208	FM-2 WILDCAT	aircraft	1945	YES		4 poor	NO
2495	Ford Island Barge	barge		NO	Oahu	1 confirm	NO
665	Ford Mod A Ford	vehicle		YES	Oahu	1 confirm	YES
655	Ford Model A Pickup	vehicle		YES	Oahu	1 confirm	YES
660	Ford Model T Pickup	vehicle		YES	Oahu	1 confirm	YES
657	Ford Model T Roadster	vehicle		YES	Oahu	1 confirm	YES
319	Fort George	bark	1908	YES	Hawaii	4 poor	NO
320	Fortunio	brigantine	1851	NO	Oahu	2 good	NO
839	Friendship	fishing vessel	1994	NO	Oahu	1 confirm	YES
607	FWD Truck (1)	vehicle		NO	Oahu	1 confirm	YES
608	FWD Truck (2)	vehicle		NO	Oahu	1 confirm	YES

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
612	FWD Truck (3)	vehicle		NO	Oahu	1 confirm	YES
614	FWD Truck (4)	vehicle		NO	Oahu	1 confirm	YES
793	G.N. Wilcox	bark	1894	NO	Molokai	2 good	NO
741	General Royal T. Frank	steam screw	1942	YES	Maui	4 poor	NO
1815	GH-2 NIGHTINGALE	aircraft	1944	YES		4 poor	NO
322	Giovanni Apiana	schooner	1882	NO	Hawaii	4 poor	NO
794	Gloucester	ship	1831	NO	Oahu	3 fair	NO
795	Golden Gate	schooner	1901	NO	Lanai	2 good	NO
323	Haaheo O Hawaii	brigantine	1824	NO	Kauai	1 confirm	YES
796	Hae Hawaii	sloop	1879	NO	Oahu	3 fair	NO
1363	Halalua	unknown	1986	NO	Hawaii	4 poor	NO
324	Hamakua	steam screw	1917	NO	Kahoolawe	3 fair	NO
325	Hannah	schooner	1865	NO	Kauai	3 fair	NO
1364	Haole	motor vessel	1968	NO	Hawaii	4 poor	NO
1365	Hapuku	sailboat	1951	NO	Hawaii	4 poor	NO
326	Harieta	brigantine	1839	NO	Maui	3 fair	NO
327	Hattie	schooner	1876	NO	Kauai	2 good	NO
328	Hawaii	schooner	1845	NO	Maui	4 poor	NO
1366	Hawaii Number 1	sailboat	1953	NO	Hawaii	4 poor	NO
1367	Hele Ahuana	unknown	1989	NO		3 fair	NO
332	Helena II	sampan	1958	NO	Maui	2 good	NO
539	Helene	steam screw	1929	YES	Oahu	1 confirm	YES
797	Helga (British)	barkentine	1910	NO	Oahu	3 fair	NO
333	Helvetius	ship	1834	NO	Oahu	3 fair	NO
334	Henry	schooner	1862	NO	Maui	2 good	NO
335	Hesperian	brigantine	1885	NO	Maui	3 fair	NO
336	Hilo	bark	1894	NO	Hawaii	3 fair	NO
337	Hipahipa	schooner	1849	NO	Molokai	4 poor	NO
1368	Hoegh Merchant	freighter	1941	YES	Oahu	3 fair	NO
338	Hokulele	schooner	1862	YES	Oahu	4 poor	NO
339	Holokahana	fishing vessel	1953	NO	Niihau	2 good	NO
2498	Honey Badger	fishing vessel	2015	NO	Oahu	1 confirm	NO
717	Marine Railway	other	1915	YES	Oahu	1 confirm	YES
829	Hornet	steam screw	1927	NO	Lanai	1 confirm	YES
1414	HS-2L	aircraft	1922	NO	Oahu	4 poor	NO
530	I-14 (bow)	submarine	1946	YES	Oahu	1 confirm	YES
529	I-14 (main body)	submarine	1946	YES	Oahu	1 confirm	YES
532	I-201 (bow)	submarine	1946	YES	Oahu	1 confirm	YES
531	I-201 (main body)	submarine	1946	YES	Oahu	1 confirm	YES
914	I-23	submarine	1942	NO	Oahu	4 poor	NO
526	I-400 (hangar, AA guns)	submarine	1946	YES	Oahu	1 confirm	YES
730	I-400 (main body)	submarine	1946	YES	Oahu	1 confirm	YES
527	I-401 (bow)	submarine	1946	YES	Oahu	1 confirm	YES
528	I-401 (hangar, AA guns)	submarine	1946	YES	Oahu	1 confirm	YES
731	I-401 (main body)	submarine	1945	YES	Oahu	1 confirm	YES

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
1369	I-70	submarine	1941	YES	Maui	3 fair	NO
663	Indiana Flatbed Truck	vehicle		YES	Oahu	1 confirm	YES
761	Ingraham	destroyer escort	1967	YES	Oahu	4 poor	NO
342	Iolani	bark	1900	NO	Hawaii	4 poor	NO
343	Iolani	schooner	1838	NO	Oahu	4 poor	NO
344	Iolani	schooner	1877	NO	Maui	4 poor	NO
345	Isabella	schooner	1873	NO	Kauai	3 fair	NO
346	Islander	fishing vessel	1947	NO	Maui	2 good	NO
798	Ivanhoe	bark	1915	NO	Kauai	1 confirm	YES
347	Iwa	motor vessel	1942	YES	Oahu	4 poor	NO
348	Iwa	steam screw	1899	NO	Oahu	2 good	NO
349	J. A. Cummins	steam screw	1928	NO	Oahu	3 fair	NO
1817	J2F-2 DUCK	aircraft	1943	YES		4 poor	NO
1818	J2F-2 DUCK	aircraft	1943	YES		4 poor	NO
1464	J2F-5 Duck	aircraft	1944	NO	Oahu	4 poor	NO
1816	J2F-5 DUCK	aircraft	1942	YES		4 poor	NO
857	Jacob B. Lancaster	bark	1859	NO	Molokai	4 poor	NO
350	James I. Dowsett	steam screw	1888	YES	Molokai	4 poor	NO
740	Japanese Type A sub	submarine	1941	YES	Oahu	1 confirm	YES
615	Jeep	vehicle		NO	Oahu	1 confirm	YES
352	Jefferson	ship	1842	NO	Kauai	3 fair	NO
799	Jenny Pitts	bark	1881	NO	Hawaii	3 fair	NO
353	Jessie Fremont	schooner	1916	NO	Oahu	4 poor	NO
1445	JM-1 Marauder	aircraft	1944	NO	Kauai	4 poor	NO
1041	JM-1 Maurauder	aircraft	1944	YES	Oahu	4 poor	NO
1162	JM-1 Maurauder	aircraft	1945	YES	Hawaii	4 poor	NO
354	John P. West	bark	1892	YES	Oahu	4 poor	NO
852	John Wesley	bark	1854	NO	Kauai	2 good	NO
848	Joseph Perkins	barkentine	1880	NO	Maui	3 fair	NO
1133	JRB-4 Expeditor	aircraft	1946	NO	Oahu	3 fair	NO
1821	JRF-5 GOOSE	aircraft	1944	YES		4 poor	NO
562	JRM-1 Marshall Mars (engines)	aircraft	1950	NO	Oahu	1 confirm	YES
561	JRM-1 Marshall Mars (nose)	aircraft	1950	NO	Oahu	1 confirm	YES
1819	JRS-1	aircraft	1942	YES		4 poor	NO
1820	JRS-1	aircraft	1943	YES		4 poor	NO
355	Juanita	schooner	1879	NO	Oahu	3 fair	NO
1370	June	sailboat	1948	NO	Hawaii	3 fair	NO
1371	K.C. Hine	sailboat	1874	NO	Hawaii	4 poor	NO
356	Ka Moi	schooner	1885	YES	Hawaii	4 poor	NO
357	Ka Pueokahi	schooner	1879	NO	Molokai	3 fair	NO
358	Kaala	steam screw	1898	NO	Oahu	3 fair	NO
359	Kaala	schooner	1883	YES	Oahu	4 poor	NO
360	Kaala	freighter	1932	NO	Molokai	1 confirm	YES
801	Kahalaia	schooner	1841	NO	Kauai	4 poor	NO

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729	Kailua, USS ex	steam screw	1946	YES	Oahu	1 confirm	YES
362	Kaipolia	schooner	1850	NO	Lanai	4 poor	NO
363	Kaipopokai	fishing vessel	1950	NO	Niihau	2 good	NO
364	Kalama	sidewheeler	1856	NO	Kauai	3 fair	NO
365	Kalama	schooner	1880	NO	Oahu	3 fair	NO
366	Kalawao	passenger carrier	1945	NO	Molokai	2 good	NO
367	Kalihiwai	schooner	1862	NO	Kauai	3 fair	NO
368	Kamaaina	sampan	1950	NO	Hawaii	2 good	NO
858	Kamaile	schooner	1880	NO	Oahu	3 fair	NO
369	Kamaka	sampan	1957	NO	Hawaii	3 fair	NO
370	Kamamalu	schooner	1857	YES	Maui	4 poor	NO
912	Kamehameha	brigantine	1829	NO	Maui	4 poor	NO
371	Kamoi - aka Soverign	schooner	1873	NO	Molokai	3 fair	NO
372	Kapiolani	steam screw	1886	NO	Oahu	4 poor	NO
373	Kasuga Maru	sampan	1946	YES	Hawaii	4 poor	NO
374	Kate Lee	schooner	1871	NO	Hawaii	4 poor	NO
802	Katie	sloop	1874	NO	Molokai	4 poor	NO
375	Kauai	steam screw	1913	NO	Hawaii	1 confirm	YES
376	Kauikeaouli	schooner	1906	NO	Kahoolawe	4 poor	NO
377	Kaulilua	schooner	1898	NO	Molokai	2 good	NO
378	Kauukualii	schooner	1851	NO	Kauai	2 good	NO
379	Kawailani	schooner	1909	NO	Oahu	3 fair	NO
380	Keahonui	schooner		NO	Kauai	4 poor	NO
1372	Keala Komo	motor vessel	1972	NO	Hawaii	4 poor	NO
381	Kekauluohi	schooner	1841	NO	Kauai	3 fair	NO
382	Kekauluohi	schooner	1880	NO	Kauai	3 fair	NO
383	Kekauluohi	schooner	1884	NO	Kauai	3 fair	NO
803	Keola	schooner	1840	YES	Kahoolawe	4 poor	NO
804	Keoni Ana	schooner	1862	YES	Kauai	4 poor	NO
384	Kihalani	steam screw	1895	NO	Hawaii	3 fair	NO
385	Kilauea Hou	steam screw	1900	NO	Hawaii	2 good	NO
386	Kilohana	steam screw	1899	NO	Maui	3 fair	NO
387	Kinoole	schooner	1860	NO	Niihau	4 poor	NO
388	Kitsap	schooner	1919	YES	Kauai	4 poor	NO
389	Kitty Cartwright	schooner	1871	NO	Kauai	3 fair	NO
390	Klikitat	bark	1912	NO	Hawaii	2 good	NO
391	Kohala	schooner	1867	NO	Hawaii	2 good	NO
855	Kompila Maru	sampan	1933	YES	Maui	4 poor	NO
1373	Kona Queen	motor vessel	1972	NO	Hawaii	4 poor	NO
1374	Kookie Maru	sailboat	1936	NO	Hawaii	2 good	NO
392	Kuaihelani	sampan	1932	NO	Oahu	4 poor	NO
533	Kualoa	yacht	1963	NO	Oahu	1 confirm	YES
393	Kulamanu	schooner	1884	NO	Hawaii	3 fair	NO
394	Kulamanu	sidewheeler	1881	NO	Oahu	4 poor	NO
1375	Kulani	sailboat	1965	YES	Hawaii	4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
395	Kumano Maru	sampan	1947	NO	Oahu	2 good	NO
1376	Kumu	motor vessel	1968	NO	Hawaii	4 poor	NO
854	La Ninfa	schooner	1899	NO	Oahu	3 fair	NO
396	Lady	schooner	1908	NO	Oahu	3 fair	NO
1377	Lady Aud	fishing vessel	1996	NO	Oahu	4 poor	NO
1378	Lady Lynn	sampan	1978	NO	Hawaii	2 good	NO
397	Laieikawai	schooner	1873	NO	Oahu	2 good	NO
1379	Lanakila	sailboat	1949	NO	Hawaii	3 fair	NO
398	Lavinia	schooner	1906	NO	Oahu	3 fair	NO
885	LC Pearl Channel	landing craft		NO	Oahu	1 confirm	YES
908	LC Pearl Harbor	landing craft		NO	Oahu	1 confirm	YES
904	LC Rabbit Island	landing craft		NO	Oahu	2 good	NO
598	LCI(L)-714	landing craft		YES	Oahu	1 confirm	YES
2499	LCM	landing craft mechanized		NO	Oahu	1 confirm	NO
1404	LCM Ewa Beach	landing craft mechanized		NO	Oahu	1 confirm	YES
883	LCM Pearl Channel-1	landing craft mechanized		NO	Oahu	1 confirm	YES
884	LCM Pearl Channel-2	landing craft mechanized		NO	Oahu	1 confirm	YES
585	LCM-3 Mike Boat (1)	landing craft mechanized		NO	Oahu	1 confirm	YES
586	LCM-3 Mike Boat (2)	landing craft mechanized		NO	Oahu	1 confirm	YES
591	LCM-3 Mike Boat (3)	landing craft mechanized		NO	Oahu	1 confirm	YES
592	LCM-3 Mike Boat (4)	landing craft mechanized		NO	Oahu	1 confirm	YES
594	LCM-3 Mike Boat (5)	landing craft mechanized		NO	Oahu	1 confirm	YES
737	LCM-6 Mike Boat (6)	landing craft mechanized		NO	Oahu	1 confirm	YES
600	LCT (3)	landing craft tank		YES	Oahu	1 confirm	YES
587	LCT-5 (1)	landing craft tank		NO	Oahu	1 confirm	YES
597	LCT-5 (2)	landing craft tank		NO	Oahu	1 confirm	YES
602	LCT-6 (4)	landing craft tank		YES	Oahu	1 confirm	YES
762	LCT-961	landing craft tank		YES	Oahu	4 poor	NO
763	LCT-963	landing craft tank		YES	Oahu	4 poor	NO
764	LCT-983	landing craft tank		YES	Oahu	4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
765	LCT-984	landing craft tank	1944	YES	Kahoolawe	4 poor	NO
766	LCT-988	landing craft tank	1944	NO	Lanai	4 poor	NO
873	LCU Maili-1	landing craft utility		NO	Oahu	1 confirm	YES
874	LCU Maili-2	landing craft utility		NO	Oahu	1 confirm	NO
886	LCVP Pearl Channel	landing craft vehicle/per		NO	Oahu	1 confirm	YES
1380	Legamin	sailboat	1997	NO	Hawaii	4 poor	NO
399	Lehua	schooner	1850	NO	Kauai	2 good	NO
767	Levant	sloop	1860	YES	Hawaii	4 poor	NO
609	Liberty B Flatbed (1)	vehicle		NO	Oahu	1 confirm	YES
610	Liberty B Flatbed (2)	vehicle		NO	Oahu	1 confirm	YES
621	Liberty B Flatbed (3)	vehicle		NO	Oahu	1 confirm	YES
623	Liberty B Flatbed (4)	vehicle		NO	Oahu	1 confirm	YES
646	Liberty B Flatbed (5)	vehicle		YES	Oahu	1 confirm	YES
713	Light Truck (4)	vehicle		YES	Oahu	1 confirm	YES
716	Light Truck (5)	vehicle		YES	Oahu	1 confirm	YES
400	Liholiho	schooner	1893	NO	Kauai	2 good	NO
401	Lihue	tugboat	1938	NO	Kauai	3 fair	NO
402	Like Like	steam screw	1930	YES	Oahu	4 poor	NO
403	Likelike	steam screw	1897	NO	Hawaii	3 fair	NO
404	Liliu	schooner	1877	NO	Oahu	3 fair	NO
405	Live Yankee	sloop	1878	NO	Oahu	3 fair	NO
1381	London	ship	1826	NO	Lanai	4 poor	NO
1382	Lookout	fishing vessel	1985	NO	Hawaii	4 poor	NO
406	Louise	tugboat	1930	NO	Molokai	1 confirm	NO
865	LSM-265	landing ship medium	1946	NO	Oahu	1 confirm	YES
919	LST	landing ship tank		NO	Oahu	2 good	YES
601	LST (2)	landing ship tank	1945	NO	Oahu	1 confirm	YES
606	LST-179	landing ship tank	1945	YES	Oahu	1 confirm	YES
770	LST-353	landing ship tank		YES	Oahu	4 poor	NO
768	LST-43	landing ship tank	1944	YES	Oahu	4 poor	NO
771	LST-480	landing ship tank	1944	NO	Oahu	1 confirm	YES
769	LST-69	landing ship tank		YES	Oahu	4 poor	NO
605	LST-884	landing ship tank	1946	YES	Oahu	1 confirm	YES
407	Lucy	sloop	1862	NO	Oahu	3 fair	NO
1383	Lucy	sailboat	1981	NO	Hawaii	3 fair	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
408	Lucy White	schooner	1869	NO	Kauai	3 fair	NO
409	Luka	schooner	1877	NO	Kauai	3 fair	NO
889	LVT Hawaii Kai	AMTRACK		NO	Oahu	1 confirm	YES
896	LVT Maui-5	AMTRACK		NO	Maui	2 good	NO
572	LVT Oahu-1	AMTRACK		NO	Oahu	1 confirm	YES
574	LVT Oahu-2	AMTRACK		NO	Oahu	1 confirm	YES
575	LVT Oahu-3	AMTRACK		NO	Oahu	1 confirm	NO
576	LVT Oahu-4	AMTRACK		NO	Oahu	1 confirm	YES
578	LVT Oahu-5	AMTRACK		NO	Oahu	1 confirm	YES
580	LVT Oahu-6	AMTRACK		NO	Oahu	1 confirm	YES
583	LVT Oahu-7	AMTRACK		NO	Oahu	1 confirm	YES
589	LVT Oahu-8	AMTRACK		NO	Oahu	1 confirm	NO
599	LVT Oahu-9	AMTRACK		NO	Oahu	1 confirm	YES
595	LVT(A)-1 Amtank (1)	AMTRACK		NO	Oahu	1 confirm	YES
742	LVT(A)-1 Amtank (2)	AMTRACK		NO	Oahu	1 confirm	YES
588	LVT-1 Alligator	AMTRACK		NO	Oahu	1 confirm	YES
571	LVT-2 Water Buffalo-1	AMTRACK		NO	Oahu	1 confirm	NO
573	LVT-2 Water Buffalo-2	AMTRACK		NO	Oahu	1 confirm	YES
577	LVT-2 Water Buffalo-3	AMTRACK		NO	Oahu	1 confirm	YES
579	LVT-2 Water Buffalo-4	AMTRACK		NO	Oahu	1 confirm	YES
581	LVT-2 Water Buffalo-5	AMTRACK		NO	Oahu	1 confirm	YES
582	LVT-2 Water Buffalo-6	AMTRACK		NO	Oahu	1 confirm	YES
590	LVT-2 Water Buffalo-7	AMTRACK		NO	Oahu	1 confirm	YES
593	LVT-2 Water Buffalo-8	AMTRACK		NO	Oahu	1 confirm	YES
596	LVT-2 Water Buffalo-9	AMTRACK		NO	Oahu	1 confirm	YES
431	LVT4 Maui-3	AMTRACK	1944	NO	Maui	1 confirm	YES
432	LVTA Maui-4	AMTRACK	1944	NO	Maui	2 good	YES
429	LVTA4 Maui-1	AMTRACK	1944	NO	Maui	1 confirm	YES
430	LVTA4 Maui-2	AMTRACK	1944	NO	Maui	1 confirm	YES
739	LVTP-5 Amtrac	AMTRACK		NO	Oahu	1 confirm	YES
805	Lyra	unknown	1830	NO	Maui	4 poor	NO
622	Mack Bulldog Dump Truck	vehicle		NO	Oahu	1 confirm	YES
776	Mahi	mine sweeper	1982	NO	Oahu	1 confirm	YES
410	Mahimahi	schooner	1894	NO	Oahu	3 fair	NO
411	Malolo	schooner	1851	NO	Oahu	3 fair	NO
412	Malolo	schooner	1887	NO	Lanai	4 poor	NO
415	Mana	passenger carrier	1948	NO	Kauai	2 good	NO
862	Manana	sloop	1892	YES	Molokai	4 poor	NO
416	Manini	freighter	1941	YES	Hawaii	4 poor	NO
1384	Manu Manui	fishing vessel	1995	NO	Hawaii	2 good	NO
417	Manuokawai	schooner	1888	NO	Oahu	3 fair	NO
418	Margaret	schooner	1861	NO	Kauai	3 fair	NO
420	Maria	schooner	1868	NO	Hawaii	3 fair	NO
421	Marianne	schooner	1852	YES	Kauai	4 poor	NO
422	Marilda	schooner	1870	NO	Kahoolawe	4 poor	NO

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423	Marion	schooner	1885	NO	Oahu	3 fair	NO
846	Marquis de Turenne (French)	unknown	1855	NO	Oahu	3 fair	NO
806	Martha Davis	bark	1905	NO	Hawaii	3 fair	NO
424	Mary	schooner	1857	NO	Molokai	4 poor	NO
807	Mary	schooner	1871	NO	Kauai	3 fair	NO
861	Mary	schooner	1891	NO	Kauai	3 fair	NO
425	Mary Alice	schooner	1884	NO	Lanai	2 good	NO
426	Mary E. Foster	schooner	1894	YES	Oahu	4 poor	NO
808	Mary Ellen	schooner	1880	NO	Kauai	3 fair	NO
428	Maui	steam screw	1917	NO	Hawaii	1 confirm	YES
1385	Maukiukiu	sloop	1868	NO	Hawaii	4 poor	NO
733	Mauna Kea	steam screw	1936	YES	Oahu	1 confirm	YES
613	Mechanical Mule	vehicle		NO	Oahu	1 confirm	YES
547	Mikiala	tugboat	1970	YES	Oahu	1 confirm	YES
809	Millie Morris	schooner	1901	NO	Oahu	3 fair	NO
435	Minnie-K	fishing vessel	1953	NO	Maui	4 poor	NO
436	Miss Philippine	fishing vessel	1949	NO	Maui	3 fair	NO
1386	Miyojin Maru	sailboat	1962	NO	Hawaii	4 poor	NO
437	Mizpah	fishing vessel	1958	NO	Oahu	2 good	NO
639	Mobile Searchlight Truck	vehicle		YES	Oahu	1 confirm	YES
438	Moi Wahine	schooner	1911	YES	Molokai	4 poor	NO
439	Moikeiki - aka Ka Moi Keiki	schooner	1874	NO	Molokai	3 fair	NO
440	Mokihana	schooner	1906	NO	Maui	3 fair	NO
830	Mokolii	steam screw	1928	NO	Oahu	4 poor	NO
831	Mokulele	schooner	1899	NO	Kauai	3 fair	NO
441	Mokuola	sloop	1849	NO	Maui	4 poor	NO
442	Mokuola	yacht	1950	NO	Oahu	2 good	NO
443	Mollilou	yacht	1958	YES	Oahu	4 poor	NO
1387	Monarch	sailboat	1962	NO	Hawaii	4 poor	NO
549	Motor Vessel Oahu-1	motor vessel		YES	Oahu	1 confirm	YES
616	Motorcycle	vehicle		NO	Oahu	1 confirm	YES
1388	Myyojin Maru	sailboat	1933	NO	Hawaii	4 poor	NO
444	Nahienaena	schooner	1851	NO	Kauai	4 poor	NO
811	Nakolaelua	sloop	1868	NO	Niihau	4 poor	NO
1389	Nancy M	schooner	1973	NO	Hawaii	4 poor	NO
659	Nash Single Six Sedan	vehicle		YES	Oahu	1 confirm	YES
651	Nash Touring Car	vehicle		YES	Oahu	1 confirm	YES
847	Nauticon	unknown	1856	NO	Oahu	2 good	NO
772	Neches AO-5	tanker	1942	YES	Kauai	2 good	NO
445	Nellie	schooner	1868	NO	Maui	3 fair	NO
446	Nettie Merrill	schooner	1888	NO	Kauai	2 good	NO
773	Nevada BB-36	battleship	1948	NO	Oahu	2 good	NO
774	New York BB-34	battleship	1948	NO	Oahu	3 fair	NO
810	Niagra (British)	ship	1882	NO	Oahu	2 good	NO

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812	Noeau	steam screw	1917	NO	Hawaii	2 good	NO
447	Nomad	schooner	1897	YES	Hawaii	4 poor	NO
448	Norma	schooner	1900	NO	Oahu	3 fair	NO
1504	O2U-3	aircraft	1936	YES		4 poor	NO
929	O2U-4	aircraft	1933	NO	Oahu	3 fair	NO
449	Odd Fellow	schooner	1875	NO	Kauai	3 fair	NO
1390	Ohana	fishing vessel	1987	NO	Hawaii	4 poor	NO
450	Ohayo Maru II	yacht	1942	YES	Kahoolawe	3 fair	NO
451	Okanogan	schooner	1919	NO	Kauai	2 good	NO
828	Oleson	schooner	1919	NO	Niihau	4 poor	NO
452	Olga	schooner	1906	NO	Kahoolawe	2 good	NO
454	Ortolan	schooner	1864	NO	Maui	2 good	NO
1055	OS2N-1 Kingfisher	aircraft	1942	YES	Oahu	3 fair	NO
1847	OS2N-1 KINGFISHER	aircraft	1945	YES		4 poor	NO
1159	OS2U-1 Kingfisher	aircraft	1941	YES	Lanai	4 poor	NO
1845	OS2U-1 KINGFISHER	aircraft	1943	YES		4 poor	NO
1449	OS2U-3 Kingfisher	aircraft	1942	NO	Oahu	4 poor	NO
1053	OS2U-3 Kingfisher	aircraft	1941	YES	Oahu	4 poor	NO
1054	OS2U-3 Kingfisher	aircraft	1943	NO	Oahu	2 good	NO
1839	OS2U-3 KINGFISHER	aircraft	1942	YES		4 poor	NO
1840	OS2U-3 KINGFISHER	aircraft	1942	YES		4 poor	NO
1841	OS2U-3 KINGFISHER	aircraft	1942	YES		4 poor	NO
1842	OS2U-3 KINGFISHER	aircraft	1942	YES		4 poor	NO
1843	OS2U-3 KINGFISHER	aircraft	1942	YES		4 poor	NO
1844	OS2U-3 KINGFISHER	aircraft	1943	YES		4 poor	NO
1846	OS2U-3 KINGFISHER	aircraft	1944	YES		4 poor	NO
535	Outrigger Canoe	canoe		NO	Oahu	1 confirm	YES
455	Owana	schooner	1875	NO	Lanai	2 good	NO
1050	OY-1 Sentinel	aircraft	1944	NO	Hawaii	4 poor	NO
1052	OY-1 Sentinel	aircraft	1944	YES	Oahu	4 poor	NO
1837	OY-1 SENTINEL	aircraft	1944	YES		4 poor	NO
1838	OY-1 SENTINEL	aircraft	1945	YES		4 poor	NO
1051	OY-1D Sentinel	aircraft	1944	NO	Maui	4 poor	NO
1131	P2Y2	aircraft	1950	NO	Oahu	4 poor	NO
1506	P2Y-3	aircraft	1938	YES		4 poor	NO
842	P-40 Warhawk	aircraft		NO	Oahu	1 confirm	NO
844	P-40 Warhawk	aircraft		NO	Oahu	1 confirm	YES
876	P-40 Warhawk	aircraft		NO	Oahu	3 fair	YES
881	P-40 Warhawk	aircraft		NO	Oahu	2 good	YES
903	P-40B Tomahawk	aircraft	1941	NO	Oahu	3 fair	NO
843	P-47 Thunderbolt	aircraft	1944	NO	Oahu	1 confirm	YES
888	P-47N Thunderbolt	aircraft	1949	NO	Oahu	1 confirm	YES
887	PA-28R Piper Lance	aircraft	1972	NO	Oahu	1 confirm	YES
456	Paalua	schooner	1845	YES	Kauai	4 poor	NO
457	Pagan	yacht	1951	NO	Oahu	1 confirm	NO
627	Panel Truck	vehicle		YES	Oahu	1 confirm	YES

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
458	Pato	schooner	1881	NO	Hawaii	2 good	NO
459	Pauahi	schooner	1884	NO	Hawaii	3 fair	NO
813	Paukalohua (Paukalehua)	schooner	1850	NO	Kauai	3 fair	NO
460	Paulina	bark	1860	NO	Maui	3 fair	NO
1450	PB2Y-2 Coronado	aircraft	1942	NO	Oahu	4 poor	NO
867	PB4Y-1 Liberator	aircraft	1944	NO	Maui	1 confirm	YES
1046	PB4Y-1 Liberator	aircraft	1943	YES	Oahu	4 poor	NO
1047	PB4Y-1 Liberator	aircraft	1944	YES	Oahu	4 poor	NO
1048	PB4Y-1 Liberator	aircraft	1944	NO	Maui	4 poor	NO
1835	PB4Y-1 LIBERATOR	aircraft	1944	YES		4 poor	NO
1049	PB4Y-2 Privateer	Aircraft	1945	YES	Oahu	4 poor	NO
1836	PB4Y-2 PRIVATEER	aircraft	1945	YES		4 poor	NO
1822	PBJ-1 MITCHELL	aircraft	1944	YES		4 poor	NO
1122	PBM-3D Mariner	aircraft	1944	YES	Maui	4 poor	NO
1123	PBM-3D Mariner	aircraft	1944	YES	Oahu	4 poor	NO
1461	PBM-3D Mariner	aircraft	1945	NO	Oahu	4 poor	NO
2337	PBM-3D MARINER	aircraft	1944	YES		4 poor	NO
1124	PBM-5 Mariner	aircraft	1945	NO	Oahu	4 poor	NO
1125	PBM-5 Mariner	aircraft	1945	YES	Oahu	4 poor	NO
1460	PBM-5 Mariner	aircraft	1944	NO	Oahu	4 poor	NO
1462	PBM-5 Mariner	aircraft	1945	NO	Oahu	4 poor	NO
2338	PBM-5 MARINER	aircraft	1945	YES		4 poor	NO
2339	PBM-5 MARINER	aircraft	1945	YES		4 poor	NO
878	PBM-5S Mariner	aircraft	1945	NO	Oahu	1 confirm	YES
1446	PBY Catalina	aircraft	1941	YES	Niihau	4 poor	NO
932	PBY-1 Catalina	aircraft	1938	YES	Hawaii	3 fair	NO
1423	PBY-1 Catalina	aircraft	1938	YES	Oahu	4 poor	NO
834	PBY-5 Catalina	aircraft	1941	NO	Oahu	1 confirm	YES
913	PBY-5 Catalina	aircraft	1941	NO	Niihau	2 good	NO
1044	PBY-5 Catalina	aircraft	1943	NO	Hawaii	3 fair	NO
1045	PBY-5 Catalina	aircraft	1944	YES	Oahu	4 poor	NO
1447	PBY-5 Catalina	aircraft	1942	NO	Oahu	4 poor	NO
1448	PBY-5 Catalina	aircraft	1943	YES	Oahu	4 poor	NO
1823	PBY-5 CATALINA	aircraft	1941	YES		4 poor	NO
1824	PBY-5 CATALINA	aircraft	1942	YES		4 poor	NO
1828	PBY-5 CATALINA	aircraft	1942	YES		4 poor	NO
1829	PBY-5 CATALINA	aircraft	1943	YES		4 poor	NO
1831	PBY-5 CATALINA	aircraft	1944	YES		4 poor	NO
1832	PBY-5 CATALINA	aircraft	1944	YES		4 poor	NO
1042	PBY-5A Catalina	aircraft	1942	NO	Oahu	3 fair	NO
1043	PBY-5A Catalina	aircraft	1942	YES	Oahu	4 poor	NO
1132	PBY-5A Catalina	aircraft	1946	NO	Hawaii	4 poor	NO
1825	PBY-5A CATALINA	aircraft	1942	YES		4 poor	NO
1826	PBY-5A CATALINA	aircraft	1942	YES		4 poor	NO
1827	PBY-5A CATALINA	aircraft	1942	YES		4 poor	NO
1830	PBY-5A CATALINA	aircraft	1943	YES		4 poor	NO
1833	PBY-5A CATALINA	aircraft	1944	YES		4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
1834	PBY-5A CATALINA	aircraft	1945	YES		4 poor	NO
921	PC-1239	patrol boat		YES	Oahu	1 confirm	YES
536	PC-578, USS	patrol boat		YES	Oahu	1 confirm	YES
537	PC-594, USS ex	patrol boat		YES	Oahu	1 confirm	YES
930	PD-1	aircraft	1933	YES	Oahu	3 fair	NO
461	Pele	steam screw	1895	NO	Kauai	1 confirm	YES
470	Pilot	schooner	1845	NO	Oahu	2 good	NO
570	Piper Cherokee Warrior	aircraft	1995	YES	Oahu	1 confirm	YES
931	PK-1	aircraft	1934	YES	Oahu	4 poor	NO
1503	PK-1	aircraft	1932	YES		4 poor	NO
552	PK-1 Seaplane-1	aircraft		YES	Oahu	1 confirm	NO
553	PK-1 Seaplane-2	aircraft		YES	Oahu	1 confirm	YES
554	PK-1 Seaplane-3	aircraft		YES	Oahu	1 confirm	NO
555	PK-1 Seaplane-4	aircraft		YES	Oahu	1 confirm	YES
471	Planter	steam screw	1886	NO	Niihau	2 good	NO
626	Plymouth Woody	vehicle		YES	Oahu	1 confirm	YES
472	Pohoiki	schooner	1885	YES	Hawaii	4 poor	NO
814	Pomaikai	sloop	1868	NO	Hawaii	4 poor	NO
1391	Pomare	brigantine	1883	NO	Oahu	4 poor	NO
815	Potapsco	brigantine	1849	NO	Oahu	4 poor	NO
473	Premier	LOR	1853	NO	Hawaii	3 fair	NO
618	Prime Mover (1)	vehicle		NO	Oahu	1 confirm	YES
619	Prime Mover (2)	vehicle		NO	Oahu	1 confirm	YES
744	Prime Mover (3)	vehicle		NO	Oahu	1 confirm	YES
746	Prime Mover (4)	vehicle		NO	Oahu	1 confirm	YES
747	Prime Mover (5)	vehicle		NO	Oahu	1 confirm	YES
748	Prime Mover (6)	vehicle		NO	Oahu	1 confirm	YES
749	Prime Mover (7)	vehicle		NO	Oahu	1 confirm	YES
474	Prince	schooner	1883	NO	Maui	3 fair	NO
475	Prince of Hawaii	schooner	1858	YES	Kauai	4 poor	NO
476	Prince Regent	schooner	1824	NO	Oahu	2 good	NO
816	Prosper	schooner	1916	NO	Kauai	3 fair	NO
1392	Prusa	freighter	1941	YES	Hawaii	4 poor	NO
817	Pueokahi	schooner	1879	NO	Molokai	3 fair	NO
1056	PV-1 Ventura	aircraft	1943	YES	Oahu	3 fair	NO
1059	PV-1 Ventura	aircraft	1945	YES	Oahu	4 poor	NO
1848	PV-1 VENTURA	aircraft	1943	YES		4 poor	NO
1849	PV-1 VENTURA	aircraft	1944	YES		4 poor	NO
1850	PV-1 VENTURA	aircraft	1944	YES		4 poor	NO
1057	PV-2 Harpoon	aircraft	1945	YES	Oahu	4 poor	NO
1058	PV-2 Harpoon	aircraft	1945	YES	Oahu	4 poor	NO
2340	R4D-5 SKYTRAIN	aircraft	1945	YES		4 poor	NO
1502	R-6L	aircraft	1926	YES		4 poor	NO
720	Radial Engine	aircraft		NO	Oahu	1 confirm	YES
477	Rainbow	schooner	1909	NO	Molokai	3 fair	NO
478	Rainbow	fishing vessel	1949	NO	Kauai	3 fair	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
642	REO Speedwagon	vehicle		YES	Oahu	1 confirm	YES
479	Rialto	schooner	1857	NO	Kauai	2 good	NO
645	Roadster (1)	vehicle		YES	Oahu	1 confirm	YES
647	Roadster (2)	vehicle		YES	Oahu	1 confirm	YES
714	Roadster (3)	vehicle		YES	Oahu	1 confirm	YES
480	Rob Roy	schooner	1908	NO	Oahu	3 fair	NO
851	Royal George (British)	unknown	1824	NO	Oahu	2 good	NO
2500	Royal Taipan	passenger carrier	1996	YES	Oahu	1 confirm	NO
481	S. J. Clara	fishing vessel	1952	NO	Maui	3 fair	NO
483	S. S.	schooner	1857	NO	Oahu	3 fair	NO
818	S.C. Allen	bark	1913	NO	Oahu	2 good	NO
522	S-19, USS ex	submarine	1938	YES	Oahu	1 confirm	YES
775	S-28	submarine	1944	NO	Oahu	2 good	YES
2494	S-35	submarine	1946	YES	Oahu	4 poor	NO
521	S-4, USS ex	submarine	1936	YES	Oahu	1 confirm	YES
546	Sailing Ketch Oahu-1	yacht	1997	NO	Oahu	1 confirm	YES
484	Sally	schooner	1858	NO	Hawaii	2 good	NO
1393	Sally June	fishing vessel	1955	NO	Hawaii	2 good	NO
837	San Pedro	fishing vessel		NO	Oahu	1 confirm	NO
787	Sarah and Ella	schooner	1897	NO	Oahu	3 fair	NO
1060	SB2C -1C Helldiver	aircraft	1944	YES	Oahu	4 poor	NO
1893	SB2C HELLDIVER	aircraft	1944	YES		4 poor	NO
891	SB2C-1 Helldiver	aircraft	1944	NO	Maui	1 confirm	YES
1811	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1856	SB2C-1 HELLDIVER	aircraft	1943	YES		4 poor	NO
1857	SB2C-1 HELLDIVER	aircraft	1943	YES		4 poor	NO
1865	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1867	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1868	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1869	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1870	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1871	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1874	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1875	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1876	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1877	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1878	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1879	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1883	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1889	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1909	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1911	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1937	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1938	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
1939	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1940	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1941	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1942	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1943	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1944	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1945	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1946	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1957	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1958	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1960	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1961	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
1963	SB2C-1 HELLDIVER	aircraft	1944	YES		4 poor	NO
2038	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2039	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2040	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2041	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2042	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2043	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2044	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2045	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2046	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2047	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2048	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2049	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2050	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2051	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2052	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2053	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2054	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2055	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2056	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2057	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2058	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2059	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2060	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2061	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2062	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2063	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2064	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2065	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2066	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2067	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2068	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2069	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2070	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2071	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
2072	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2073	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
2074	SB2C-1A HELLDIVER	aircraft	1945	YES		4 poor	NO
1061	SB2C-1C Helldiver	aircraft	1944	NO	Oahu	4 poor	NO
1062	SB2C-1C Helldiver	aircraft	1944	YES	Maui	4 poor	NO
1063	SB2C-1C Helldiver	aircraft	1944	YES	Maui	4 poor	NO
1064	SB2C-1C Helldiver	aircraft	1944	YES	Hawaii	4 poor	NO
1065	SB2C-1C Helldiver	aircraft	1944	YES	Hawaii	4 poor	NO
1066	SB2C-1C Helldiver	aircraft	1944	NO	Oahu	3 fair	NO
1067	SB2C-1C Helldiver	aircraft	1944	NO	Lanai	4 poor	NO
1068	SB2C-1C Helldiver	aircraft	1944	YES	Oahu	4 poor	NO
1069	SB2C-1C Helldiver	aircraft	1944	NO	Maui	3 fair	NO
1070	SB2C-1C Helldiver	aircraft	1944	NO	Maui	3 fair	NO
1866	SB2C-1C HELLDIVER	aircraft	1944	YES		4 poor	NO
1872	SB2C-1C HELLDIVER	aircraft	1944	YES		4 poor	NO
1873	SB2C-1C HELLDIVER	aircraft	1944	YES		4 poor	NO
1881	SB2C-1C HELLDIVER	aircraft	1944	YES		4 poor	NO
1882	SB2C-1C HELLDIVER	aircraft	1944	YES		4 poor	NO
1884	SB2C-1C HELLDIVER	aircraft	1944	YES		4 poor	NO
1887	SB2C-1C HELLDIVER	aircraft	1944	YES		4 poor	NO
1890	SB2C-1C HELLDIVER	aircraft	1944	YES		4 poor	NO
1891	SB2C-1C HELLDIVER	aircraft	1944	YES		4 poor	NO
1914	SB2C-1C HELLDIVER	aircraft	1945	YES		4 poor	NO
1947	SB2C-1C HELLDIVER	aircraft	1944	YES		4 poor	NO
1948	SB2C-1C HELLDIVER	aircraft	1944	YES		4 poor	NO
1949	SB2C-1C HELLDIVER	aircraft	1944	YES		4 poor	NO
1956	SB2C-1C HELLDIVER	aircraft	1944	YES		4 poor	NO
1964	SB2C-1C HELLDIVER	aircraft	1944	YES		4 poor	NO
1965	SB2C-1C HELLDIVER	aircraft	1944	YES		4 poor	NO
1966	SB2C-1C HELLDIVER	aircraft	1944	YES		4 poor	NO
1968	SB2C-1C HELLDIVER	aircraft	1944	YES		4 poor	NO
1970	SB2C-1C HELLDIVER	aircraft	1944	YES		4 poor	NO
1972	SB2C-1C HELLDIVER	aircraft	1944	YES		4 poor	NO
1975	SB2C-1C HELLDIVER	aircraft	1944	YES		4 poor	NO
1993	SB2C-1C HELLDIVER	aircraft	1945	YES		4 poor	NO
1994	SB2C-1C HELLDIVER	aircraft	1945	YES		4 poor	NO
1995	SB2C-1C HELLDIVER	aircraft	1945	YES		4 poor	NO
1998	SB2C-1C HELLDIVER	aircraft	1945	YES		4 poor	NO
1999	SB2C-1C HELLDIVER	aircraft	1945	YES		4 poor	NO
2000	SB2C-1C HELLDIVER	aircraft	1945	YES		4 poor	NO
2001	SB2C-1C HELLDIVER	aircraft	1945	YES		4 poor	NO
2094	SB2C-1C HELLDIVER	aircraft	1945	YES		4 poor	NO
2095	SB2C-1C HELLDIVER	aircraft	1945	YES		4 poor	NO
1071	SB2C-3 Helldiver	aircraft	1944	YES	Maui	4 poor	NO
1072	SB2C-3 Helldiver	aircraft	1944	YES	Kahoolawe	4 poor	NO
1073	SB2C-3 Helldiver	aircraft	1944	YES	Oahu	4 poor	NO
1074	SB2C-3 Helldiver	aircraft	1944	YES	Oahu	4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
1075	SB2C-3 Helldiver	aircraft	1944	YES	Maui	4 poor	NO
1079	SB2C-3 Helldiver	aircraft	1945	YES	Hawaii	4 poor	NO
1086	SB2C-3 Helldiver	aircraft	1945	YES	Molokai	4 poor	NO
1087	SB2C-3 Helldiver	aircraft	1945	NO	Hawaii	2 good	NO
1452	SB2C-3 Helldiver	aircraft	1944	NO	Oahu	4 poor	NO
1880	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1885	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1886	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1888	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1892	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1894	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1895	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1896	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1897	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1898	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1899	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1900	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1901	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1902	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1903	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1905	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1906	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1910	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1912	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1915	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
1916	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
1917	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
1919	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
1922	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
1927	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
1931	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
1934	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
1959	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1962	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1967	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1969	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1971	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1973	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1974	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1976	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1978	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1979	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1980	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1981	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1982	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1984	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1985	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
1987	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1989	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1990	SB2C-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
2002	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2003	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2004	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2005	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2006	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2007	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2008	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2009	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2010	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2011	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2012	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2013	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2014	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2015	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2016	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2017	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2018	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2019	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2020	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2021	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2022	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2023	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2024	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2026	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2027	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2079	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2080	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2081	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2082	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2083	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2084	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2085	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2086	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2087	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2088	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2089	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2090	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2091	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2092	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2093	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2101	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2108	SB2C-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
1977	SB2C-3E HELLDIVER	aircraft	1944	YES		4 poor	NO
1076	SB2C-4 Helldiver	aircraft	1944	YES	Oahu	4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
1078	SB2C-4 Helldiver	aircraft	1945	YES	Lanai	4 poor	NO
1080	SB2C-4 Helldiver	aircraft	1945	YES	Oahu	4 poor	NO
1082	SB2C-4 Helldiver	aircraft	1945	NO	Oahu	3 fair	NO
1083	SB2C-4 Helldiver	aircraft	1945	NO	Oahu	3 fair	NO
1453	SB2C-4 Helldiver	aircraft	1944	YES	Maui	4 poor	NO
1454	SB2C-4 Helldiver	aircraft	1944	YES	Maui	4 poor	NO
1455	SB2C-4 Helldiver	aircraft	1945	YES	Hawaii	4 poor	NO
1904	SB2C-4 HELLDIVER	aircraft	1944	YES		4 poor	NO
1907	SB2C-4 HELLDIVER	aircraft	1944	YES		4 poor	NO
1913	SB2C-4 HELLDIVER	aircraft	1944	YES		4 poor	NO
1920	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
1923	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
1925	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
1926	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
1929	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
1930	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
1932	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
1936	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
1952	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
2028	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
2029	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
2030	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
2031	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
2032	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
2033	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
2036	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
2037	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
2075	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
2076	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
2077	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
2102	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
2104	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
2105	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
2106	SB2C-4 HELLDIVER	aircraft	1945	YES		4 poor	NO
1081	SB2C-4E Helldiver	aircraft	1945	NO	Oahu	3 fair	NO
1084	SB2C-4E Helldiver	aircraft	1945	NO	Molokai	3 fair	NO
1085	SB2C-4E Helldiver	aircraft	1945	NO	Molokai	3 fair	NO
1918	SB2C-4E HELLDIVER	aircraft	1945	YES		4 poor	NO
1921	SB2C-4E HELLDIVER	aircraft	1945	YES		4 poor	NO
1924	SB2C-4E HELLDIVER	aircraft	1945	YES		4 poor	NO
1928	SB2C-4E HELLDIVER	aircraft	1945	YES		4 poor	NO
1933	SB2C-4E HELLDIVER	aircraft	1945	YES		4 poor	NO
1935	SB2C-4E HELLDIVER	aircraft	1945	YES		4 poor	NO
1996	SB2C-4E HELLDIVER	aircraft	1945	YES		4 poor	NO
1997	SB2C-4E HELLDIVER	aircraft	1945	YES		4 poor	NO
2034	SB2C-4E HELLDIVER	aircraft	1945	YES		4 poor	NO
2035	SB2C-4E HELLDIVER	aircraft	1945	YES		4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
2078	SB2C-4E HELLDIVER	aircraft	1945	YES		4 poor	NO
2100	SB2C-4E HELLDIVER	aircraft	1945	YES		4 poor	NO
2103	SB2C-4E HELLDIVER	aircraft	1945	YES		4 poor	NO
1141	SB2C-5 Helldiver	aircraft	1947	YES	Oahu	4 poor	NO
1144	SB2C-5 Helldiver	aircraft	1946	YES	Maui	4 poor	NO
1950	SB2C-5 HELLDIVER	aircraft	1945	YES		4 poor	NO
1951	SB2C-5 HELLDIVER	aircraft	1945	YES		4 poor	NO
1953	SB2C-5 HELLDIVER	aircraft	1945	YES		4 poor	NO
1954	SB2C-5 HELLDIVER	aircraft	1945	YES		4 poor	NO
1955	SB2C-5 HELLDIVER	aircraft	1945	YES		4 poor	NO
2107	SB2C-5 HELLDIVER	aircraft	1945	YES		4 poor	NO
566	SB2C-5 Helldiver (cockpit)	aircraft	1945	YES	Oahu	1 confirm	NO
567	SB2C-5 Helldiver (tail)	aircraft	1945	YES	Oahu	1 confirm	NO
841	SBC-3 Helldiver	aircraft	1939	NO	Oahu	1 confirm	NO
933	SBC-3 Helldiver	aircraft	1939	NO	Oahu	3 fair	NO
1424	SBC-3 Helldiver	aircraft	1940	YES	Oahu	4 poor	NO
1507	SBC-3 HELLDIVER	aircraft	1940	YES		4 poor	NO
1410	SBD-1 Dauntless	aircraft	1942	NO	Oahu	4 poor	NO
1480	SBD-1 DAUNTLESS	aircraft	1941	YES		4 poor	NO
1487	SBD-1 DAUNTLESS	aircraft	1942	YES		4 poor	NO
925	SBD-2 Dauntless	aircraft	1941	YES	Oahu	4 poor	NO
934	SBD-2 Dauntless	aircraft	1941	NO	Oahu	3 fair	NO
935	SBD-2 Dauntless	aircraft	1941	YES	Oahu	4 poor	NO
1408	SBD-2 Dauntless	aircraft	1941	NO	Oahu	4 poor	NO
1409	SBD-2 Dauntless	aircraft	1942	NO	Oahu	4 poor	NO
1479	SBD-2 DAUNTLESS	aircraft	1941	YES		4 poor	NO
1481	SBD-2 DAUNTLESS	aircraft	1941	YES		4 poor	NO
1483	SBD-2 DAUNTLESS	aircraft	1942	YES		4 poor	NO
1484	SBD-2 DAUNTLESS	aircraft	1942	YES		4 poor	NO
2470	SBD-2 DAUNTLESS	aircraft	1942	YES		4 poor	NO
558	SBD-2 Dauntless	aircraft	1942	YES	Oahu	1 confirm	YES
559	SBD-2 Dauntless	aircraft	1942	YES	Oahu	1 confirm	YES
1473	SBD-2P DAUNTLESS	aircraft	1942	NO	Maui	3 fair	NO
926	SBD-3 Dauntless	aircraft	1942	YES	Oahu	4 poor	NO
927	SBD-3 Dauntless	aircraft	1942	YES	Oahu	4 poor	NO
928	SBD-3 Dauntless	aircraft	1942	YES	Oahu	4 poor	NO
1411	SBD-3 Dauntless	aircraft	1942	NO	Oahu	4 poor	NO
1472	SBD-3 DAUNTLESS	aircraft	1942	NO	Oahu	3 fair	NO
1482	SBD-3 DAUNTLESS	aircraft	1942	YES		4 poor	NO
1485	SBD-3 DAUNTLESS	aircraft	1942	YES		4 poor	NO
1486	SBD-3 DAUNTLESS	aircraft	1942	YES		4 poor	NO
1489	SBD-3 DAUNTLESS	aircraft	1943	YES		4 poor	NO
1157	SBD-4 Dauntless	aircraft	1943	YES	Oahu	4 poor	NO
1158	SBD-4 Dauntless	aircraft	1943	NO	Oahu	3 fair	NO
1488	SBD-4 DAUNTLESS	aircraft	1943	YES		4 poor	NO
1789	SBD-4 DAUNTLESS	aircraft	1943	YES		4 poor	NO
1792	SBD-4 DAUNTLESS	aircraft	1943	YES		4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
2473	SBD-4 DAUNTLESS	aircraft	1944	YES		4 poor	NO
2474	SBD-4 DAUNTLESS	aircraft	1944	YES		4 poor	NO
2477	SBD-5 DAUNTLESS	aircraft	1944	YES		4 poor	NO
1034	SBD-5 Dauntless	aircraft	1943	YES	Oahu	3 fair	NO
1035	SBD-5 Dauntless	aircraft	1944	YES	Molokai	4 poor	NO
1036	SBD-5 Dauntless	aircraft	1944	YES	Oahu	4 poor	NO
1037	SBD-5 Dauntless	aircraft	1944	YES	Oahu	4 poor	NO
1038	SBD-5 Dauntless	aircraft	1944	YES	Oahu	4 poor	NO
1039	SBD-5 Dauntless	aircraft	1944	YES	Oahu	4 poor	NO
1040	SBD-5 Dauntless	aircraft	1944	YES	Oahu	4 poor	NO
1128	SBD-5 Dauntless	aircraft	1944	YES	Oahu	4 poor	NO
1129	SBD-5 Dauntless	aircraft	1944	NO	Oahu	4 poor	NO
1443	SBD-5 Dauntless	aircraft	1944	YES	Oahu	4 poor	NO
1444	SBD-5 Dauntless	aircraft	1944	YES	Oahu	4 poor	NO
1463	SBD-5 Dauntless	aircraft	1944	NO	Oahu	3 fair	NO
1465	SBD-5 Dauntless	aircraft	1943	YES	Oahu	4 poor	NO
1466	SBD-5 Dauntless	aircraft	1943	YES	Oahu	4 poor	NO
1490	SBD-5 DAUNTLESS	aircraft	1943	YES		4 poor	NO
1788	SBD-5 DAUNTLESS	aircraft	1943	YES		4 poor	NO
1790	SBD-5 DAUNTLESS	aircraft	1943	YES		4 poor	NO
1791	SBD-5 DAUNTLESS	aircraft	1943	YES		4 poor	NO
1793	SBD-5 DAUNTLESS	aircraft	1943	YES		4 poor	NO
1794	SBD-5 DAUNTLESS	aircraft	1943	YES		4 poor	NO
1795	SBD-5 DAUNTLESS	aircraft	1943	YES		4 poor	NO
1796	SBD-5 DAUNTLESS	aircraft	1944	YES		4 poor	NO
1797	SBD-5 DAUNTLESS	aircraft	1944	YES		4 poor	NO
1798	SBD-5 DAUNTLESS	aircraft	1944	YES		4 poor	NO
1799	SBD-5 DAUNTLESS	aircraft	1944	YES		4 poor	NO
1803	SBD-5 DAUNTLESS	aircraft	1944	YES		4 poor	NO
1804	SBD-5 DAUNTLESS	aircraft	1944	YES		4 poor	NO
1805	SBD-5 DAUNTLESS	aircraft	1944	YES		4 poor	NO
1806	SBD-5 DAUNTLESS	aircraft	1944	YES		4 poor	NO
1807	SBD-5 DAUNTLESS	aircraft	1944	YES		4 poor	NO
1808	SBD-5 DAUNTLESS	aircraft	1944	YES		4 poor	NO
1809	SBD-5 DAUNTLESS	aircraft	1944	YES		4 poor	NO
1810	SBD-5 DAUNTLESS	aircraft	1944	YES		4 poor	NO
1812	SBD-5 DAUNTLESS	aircraft	1944	YES		4 poor	NO
1813	SBD-5 DAUNTLESS	aircraft	1944	YES		4 poor	NO
1814	SBD-5 DAUNTLESS	aircraft	1944	YES		4 poor	NO
2349	SBD-5 DAUNTLESS	aircraft	1944	YES		4 poor	NO
2350	SBD-5 DAUNTLESS	aircraft	1944	YES		4 poor	NO
2351	SBD-5 DAUNTLESS	aircraft	1945	YES		4 poor	NO
2352	SBD-5 DAUNTLESS	aircraft	1945	YES		4 poor	NO
2353	SBD-5 DAUNTLESS	aircraft	1945	YES		4 poor	NO
2469	SBD-5 DAUNTLESS	aircraft	1943	YES		4 poor	NO
2471	SBD-5 DAUNTLESS	aircraft	1943	YES		4 poor	NO
2472	SBD-5 DAUNTLESS	aircraft	1943	YES		4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
2475	SBD-5 DAUNTLESS	aircraft	1943	YES		4 poor	NO
2476	SBD-5 DAUNTLESS	aircraft	1943	YES		4 poor	NO
560	SBD-5 Dauntless	aircraft	1943	NO	Oahu	1 confirm	YES
1456	SBW-3 Helldiver	aircraft	1944	NO	Oahu	4 poor	NO
1983	SBW-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1986	SBW-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1988	SBW-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1991	SBW-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
1992	SBW-3 HELLDIVER	aircraft	1944	YES		4 poor	NO
2025	SBW-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2096	SBW-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2097	SBW-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2098	SBW-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
2099	SBW-3 HELLDIVER	aircraft	1945	YES		4 poor	NO
1126	SC-1 Seahawk	aircraft	1945	YES	Oahu	4 poor	NO
1127	SC-1 Seahawk	aircraft	1945	NO	Oahu	2 good	NO
2342	SC-1 SEAHAWK	aircraft	1945	YES		4 poor	NO
2343	SC-1 SEAHAWK	aircraft	1945	YES		4 poor	NO
2344	SC-1 SEAHAWK	aircraft	1945	YES		4 poor	NO
2345	SC-1 SEAHAWK	aircraft	1945	YES		4 poor	NO
2346	SC-1 SEAHAWK	aircraft	1945	YES		4 poor	NO
2347	SC-1 SEAHAWK	aircraft	1945	YES		4 poor	NO
2348	SC-1 SEAHAWK	aircraft	1945	YES		4 poor	NO
1420	SC-2	aircraft	1927	NO	Maui	4 poor	NO
485	Schuyler Colfax	Liberty ship	1947	YES	Oahu	4 poor	NO
836	Sea Tiger	fishing vessel	1999	NO	Oahu	1 confirm	NO
486	Seabird	fishing vessel	1951	NO	Oahu	2 good	NO
487	Selina	brigantine	1887	NO	Hawaii	2 good	NO
1283	Shawna Lee	sailboat		NO	Oahu	1 confirm	NO
718	Ship's Crows Nest	other		NO	Oahu	1 confirm	YES
1396	SM U-43	submarine	1927	YES	Oahu	4 poor	NO
1130	SNB-2 Kansan	aircraft	1948	NO	Oahu	4 poor	NO
1033	SNJ-3 Texan	aircraft	1942	NO	Oahu	3 fair	NO
1781	SNJ-3 TEXAN	aircraft	1944	YES		4 poor	NO
1782	SNJ-3 TEXAN	aircraft	1944	YES		4 poor	NO
1786	SNJ-3 TEXAN	aircraft	1945	YES		4 poor	NO
1787	SNJ-3 TEXAN	aircraft	1945	YES		4 poor	NO
1784	SNJ-4 TEXAN	aircraft	1944	YES		4 poor	NO
1785	SNJ-4 TEXAN	aircraft	1945	YES		4 poor	NO
1783	SNJ-5 TEXAN	aircraft	1944	YES		4 poor	NO
1442	SNJ-6 Texan	aircraft	1945	YES	Hawaii	4 poor	NO
1451	SO3C-1 Seamew	aircraft	1942	NO	Oahu	4 poor	NO
1853	SOC-1 SEAGULL	aircraft	1942	YES		4 poor	NO
1855	SOC-1 SEAGULL	aircraft	1943	YES		4 poor	NO
1854	SOC-2 SEAGULL	aircraft	1942	YES		4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
2463	SOC-3 SEAGULL	aircraft	1941	YES		4 poor	NO
488	Socorro	fishing vessel	1942	NO	Oahu	2 good	NO
1851	SON-1 SEAGULL	aircraft	1941	YES		4 poor	NO
1852	SON-1 SEAGULL	aircraft	1941	YES		4 poor	NO
750	Spartan	ship	1905	NO	Maui	1 confirm	YES
894	St Anthony	fishing vessel	1997	NO	Maui	1 confirm	NO
845	Stanley Cochrane	freighter	1941	YES	Molokai	4 poor	NO
490	Starling	schooner	1851	NO	Maui	3 fair	NO
1399	Sterlet, USS	submarine	1969	YES	Oahu	4 poor	NO
777	Stickleback	submarine	1958	YES	Oahu	2 good	NO
1394	Store A Long	yacht	1971	NO	Hawaii	4 poor	NO
629	Studebaker Phaeton	vehicle		YES	Oahu	1 confirm	YES
1395	Sumiyosh Maru	sailboat	1934	NO	Hawaii	4 poor	NO
491	Surprise	schooner	1901	NO	Kauai	3 fair	NO
1422	T3M-2	aircraft	1930	NO	Oahu	3 fair	NO
492	Tamerlane	bark	1892	NO	Hawaii	4 poor	NO
620	Tar Boiler	other		NO	Oahu	1 confirm	YES
743	Target Barge (5)	barge		NO	Oahu	1 confirm	YES
936	TBD-1 Devastator	aircraft	1941	YES	Oahu	4 poor	NO
1509	TBD-1 DEVASTATOR	aircraft	1941	YES		4 poor	NO
1510	TBD-1 DEVASTATOR	aircraft	1941	YES		4 poor	NO
1744	TBD-1 DEVASTATOR	aircraft	1941	YES		4 poor	NO
2479	TBD-1 DEVASTATOR	aircraft	1941	YES		4 poor	NO
1111	TBF-1 Avenger	aircraft	1942	YES	Oahu	4 poor	NO
1112	TBF-1 Avenger	aircraft	1942	YES	Oahu	4 poor	NO
1113	TBF-1 Avenger	aircraft	1942	YES	Oahu	4 poor	NO
1114	TBF-1 Avenger	aircraft	1943	YES	Maui	4 poor	NO
1115	TBF-1 Avenger	aircraft	1943	YES	Hawaii	4 poor	NO
1117	TBF-1 Avenger	aircraft	1944	NO	Oahu	2 good	NO
1119	TBF-1 Avenger	aircraft	1944	NO	Oahu	3 fair	NO
1120	TBF-1 Avenger	aircraft	1944	YES	Molokai	4 poor	NO
1121	TBF-1 Avenger	aircraft	1945	YES	Oahu	4 poor	NO
2298	TBF-1 AVENGER	aircraft	1942	YES		4 poor	NO
2299	TBF-1 AVENGER	aircraft	1943	YES		4 poor	NO
2300	TBF-1 AVENGER	aircraft	1943	YES		4 poor	NO
2301	TBF-1 AVENGER	aircraft	1943	YES		4 poor	NO
2302	TBF-1 AVENGER	aircraft	1943	YES		4 poor	NO
2303	TBF-1 AVENGER	aircraft	1943	YES		4 poor	NO
2304	TBF-1 AVENGER	aircraft	1943	YES		4 poor	NO
2305	TBF-1 AVENGER	aircraft	1943	YES		4 poor	NO
2306	TBF-1 AVENGER	aircraft	1943	YES		4 poor	NO
2307	TBF-1 AVENGER	aircraft	1943	YES		4 poor	NO
2308	TBF-1 AVENGER	aircraft	1943	YES		4 poor	NO
2309	TBF-1 AVENGER	aircraft	1943	YES		4 poor	NO
2310	TBF-1 AVENGER	aircraft	1943	YES		4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
2311	TBF-1 AVENGER	aircraft	1943	YES		4 poor	NO
2312	TBF-1 AVENGER	aircraft	1943	YES		4 poor	NO
2315	TBF-1 AVENGER	aircraft	1943	YES		4 poor	NO
2316	TBF-1 AVENGER	aircraft	1943	YES		4 poor	NO
2317	TBF-1 AVENGER	aircraft	1943	YES		4 poor	NO
2318	TBF-1 AVENGER	aircraft	1943	YES		4 poor	NO
2319	TBF-1 AVENGER	aircraft	1943	YES		4 poor	NO
2323	TBF-1 AVENGER	aircraft	1944	YES		4 poor	NO
2329	TBF-1 AVENGER	aircraft	1944	YES		4 poor	NO
2335	TBF-1 AVENGER	aircraft	1945	YES		4 poor	NO
564	TBF-1 Avenger	aircraft	1942	NO	Oahu	1 confirm	YES
565	TBF-1 Avenger	aircraft	1942	NO	Oahu	1 confirm	YES
880	TBF-1C	aircraft	1945	NO	Oahu	2 good	YES
1116	TBF-1C Avenger	aircraft	1944	YES	Maui	4 poor	NO
1118	TBF-1C Avenger	aircraft	1944	YES	Oahu	4 poor	NO
2119	TBF-1C AVENGER	aircraft	1944	YES		4 poor	NO
2313	TBF-1C AVENGER	aircraft	1943	YES		4 poor	NO
2314	TBF-1C AVENGER	aircraft	1943	YES		4 poor	NO
2320	TBF-1C AVENGER	aircraft	1943	YES		4 poor	NO
2321	TBF-1C AVENGER	aircraft	1943	YES		4 poor	NO
2322	TBF-1C AVENGER	aircraft	1943	YES		4 poor	NO
2324	TBF-1C AVENGER	aircraft	1944	YES		4 poor	NO
2325	TBF-1C AVENGER	aircraft	1944	YES		4 poor	NO
2326	TBF-1C AVENGER	aircraft	1944	YES		4 poor	NO
2327	TBF-1C AVENGER	aircraft	1944	YES		4 poor	NO
2328	TBF-1C AVENGER	aircraft	1944	YES		4 poor	NO
2330	TBF-1C AVENGER	aircraft	1944	YES		4 poor	NO
2331	TBF-1C AVENGER	aircraft	1944	YES		4 poor	NO
2332	TBF-1C AVENGER	aircraft	1944	YES		4 poor	NO
2333	TBF-1C AVENGER	aircraft	1944	YES		4 poor	NO
2341	TBF-1C AVENGER	aircraft	1944	YES		4 poor	NO
2334	TBF-1D AVENGER	aircraft	1944	YES		4 poor	NO
2336	TBF-1D AVENGER	aircraft	1945	YES		4 poor	NO
2109	TBM-1 AVENGER	aircraft	1943	YES		4 poor	NO
1088	TBM-1C Avenger	aircraft	1943	YES	Oahu	4 poor	NO
1089	TBM-1C Avenger	aircraft	1944	YES	Oahu	4 poor	NO
1090	TBM-1C Avenger	aircraft	1944	YES	Oahu	4 poor	NO
1091	TBM-1C Avenger	aircraft	1944	YES	Oahu	4 poor	NO
1092	TBM-1C Avenger	aircraft	1944	YES	Oahu	4 poor	NO
1093	TBM-1C Avenger	aircraft	1944	YES	Hawaii	4 poor	NO
1094	TBM-1C Avenger	aircraft	1944	YES	Oahu	4 poor	NO
1095	TBM-1C Avenger	aircraft	1944	YES	Oahu	4 poor	NO
1096	TBM-1C Avenger	aircraft	1944	YES	Lanai	4 poor	NO
1098	TBM-1C Avenger	aircraft	1944	YES	Oahu	4 poor	NO
1100	TBM-1C Avenger	aircraft	1945	YES	Molokai	4 poor	NO
1101	TBM-1C Avenger	aircraft	1945	YES	Hawaii	4 poor	NO
1102	TBM-1C Avenger	aircraft	1945	YES	Lanai	4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
1103	TBM-1C Avenger	aircraft	1945	YES	Oahu	4 poor	NO
1457	TBM-1C Avenger	aircraft	1944	YES	Kauai	4 poor	NO
1458	TBM-1C Avenger	aircraft	1944	YES	Molokai	4 poor	NO
1459	TBM-1C Avenger	aircraft	1944	NO	Oahu	4 poor	NO
2110	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2111	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2112	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2113	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2114	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2115	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2116	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2117	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2118	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2120	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2209	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2210	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2211	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2212	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2213	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2214	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2215	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2216	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2217	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2218	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2219	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2220	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2221	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2222	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2223	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2224	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2225	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2226	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2227	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2228	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2229	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2230	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2231	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2232	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2234	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2235	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2236	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2237	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2238	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2239	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2240	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2242	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2243	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
2244	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2245	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2249	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2251	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2254	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2255	TBM-1C AVENGER	aircraft	1945	YES		4 poor	NO
2256	TBM-1C AVENGER	aircraft	1945	YES		4 poor	NO
2260	TBM-1C AVENGER	aircraft	1945	YES		4 poor	NO
2262	TBM-1C AVENGER	aircraft	1945	YES		4 poor	NO
2268	TBM-1C AVENGER	aircraft	1945	YES		4 poor	NO
2269	TBM-1C AVENGER	aircraft	1945	YES		4 poor	NO
2270	TBM-1C AVENGER	aircraft	1945	YES		4 poor	NO
2273	TBM-1C AVENGER	aircraft	1945	YES		4 poor	NO
2274	TBM-1C AVENGER	aircraft	1945	YES		4 poor	NO
2279	TBM-1C AVENGER	aircraft	1945	YES		4 poor	NO
2281	TBM-1C AVENGER	aircraft	1945	YES		4 poor	NO
2283	TBM-1C AVENGER	aircraft	1945	YES		4 poor	NO
2284	TBM-1C AVENGER	aircraft	1945	YES		4 poor	NO
2285	TBM-1C AVENGER	aircraft	1945	YES		4 poor	NO
2292	TBM-1C AVENGER	aircraft	1945	YES		4 poor	NO
2462	TBM-1C AVENGER	aircraft	1944	YES		4 poor	NO
2233	TBM-1CP AVENGER	aircraft	1944	YES		4 poor	NO
2263	TBM-1D AVENGER	aircraft	1945	YES		4 poor	NO
1097	TBM-3 Avenger	aircraft	1944	YES	Oahu	4 poor	NO
1104	TBM-3 Avenger	aircraft	1945	YES	Oahu	4 poor	NO
1142	TBM-3 Avenger	aircraft	1946	YES	Oahu	4 poor	NO
2246	TBM-3 AVENGER	aircraft	1944	YES		4 poor	NO
2247	TBM-3 AVENGER	aircraft	1944	YES		4 poor	NO
2248	TBM-3 AVENGER	aircraft	1944	YES		4 poor	NO
2252	TBM-3 AVENGER	aircraft	1944	YES		4 poor	NO
2253	TBM-3 AVENGER	aircraft	1944	YES		4 poor	NO
2258	TBM-3 AVENGER	aircraft	1945	YES		4 poor	NO
2259	TBM-3 AVENGER	aircraft	1945	YES		4 poor	NO
2261	TBM-3 AVENGER	aircraft	1945	YES		4 poor	NO
2265	TBM-3 AVENGER	aircraft	1945	YES		4 poor	NO
2266	TBM-3 AVENGER	aircraft	1945	YES		4 poor	NO
2267	TBM-3 AVENGER	aircraft	1945	YES		4 poor	NO
2271	TBM-3 AVENGER	aircraft	1945	YES		4 poor	NO
2272	TBM-3 AVENGER	aircraft	1945	YES		4 poor	NO
2275	TBM-3 AVENGER	aircraft	1945	YES		4 poor	NO
2276	TBM-3 AVENGER	aircraft	1945	YES		4 poor	NO
2277	TBM-3 AVENGER	aircraft	1945	YES		4 poor	NO
2280	TBM-3 AVENGER	aircraft	1945	YES		4 poor	NO
2287	TBM-3 AVENGER	aircraft	1945	YES		4 poor	NO
2291	TBM-3 AVENGER	aircraft	1945	YES		4 poor	NO
2296	TBM-3 AVENGER	aircraft	1945	YES		4 poor	NO
1099	TBM-3D Avenger	aircraft	1945	YES	Oahu	4 poor	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
2241	TBM-3D AVENGER	aircraft	1944	YES		4 poor	NO
2250	TBM-3D AVENGER	aircraft	1944	YES		4 poor	NO
2257	TBM-3D AVENGER	aircraft	1945	YES		4 poor	NO
1013	TBM-3E Avenger	aircraft	1945	NO	Oahu	4 poor	NO
1105	TBM-3E Avenger	aircraft	1945	YES	Hawaii	4 poor	NO
1106	TBM-3E Avenger	aircraft	1945	YES	Maui	4 poor	NO
1107	TBM-3E Avenger	aircraft	1945	YES	Oahu	4 poor	NO
1108	TBM-3E Avenger	aircraft	1945	YES	Oahu	4 poor	NO
1109	TBM-3E Avenger	aircraft	1945	YES	Maui	4 poor	NO
1110	TBM-3E Avenger	aircraft	1945	YES	Oahu	4 poor	NO
2278	TBM-3E AVENGER	aircraft	1945	YES		4 poor	NO
2282	TBM-3E AVENGER	aircraft	1945	YES		4 poor	NO
2286	TBM-3E AVENGER	aircraft	1945	YES		4 poor	NO
2288	TBM-3E AVENGER	aircraft	1945	YES		4 poor	NO
2289	TBM-3E AVENGER	aircraft	1945	YES		4 poor	NO
2290	TBM-3E AVENGER	aircraft	1945	YES		4 poor	NO
2293	TBM-3E AVENGER	aircraft	1945	YES		4 poor	NO
2294	TBM-3E AVENGER	aircraft	1945	YES		4 poor	NO
2295	TBM-3E AVENGER	aircraft	1945	YES		4 poor	NO
2297	TBM-3E AVENGER	aircraft	1945	YES		4 poor	NO
1139	TBM-3N Avenger	aircraft	1951	NO	Oahu	4 poor	NO
1140	TBM-3N Avenger	aircraft	1949	YES	Molokai	4 poor	NO
2264	TBM-3P AVENGER	aircraft	1945	YES		4 poor	NO
1505	TG-2	aircraft	1937	YES		4 poor	NO
778	Tinosa	submarine	1960	NO	Oahu	3 fair	NO
644	Touring Phaeton	vehicle		YES	Oahu	1 confirm	YES
779	TR-4	torpedo boat		YES	Maui	4 poor	NO
664	Truck (2)	vehicle		YES	Oahu	1 confirm	YES
819	Twilight	schooner	1902	NO	Kauai	2 good	NO
524	Type A Submarine (bow-section)	submarine	1941	YES	Oahu	1 confirm	YES
523	Type A Submarine (mid-section)	submarine	1941	YES	Oahu	1 confirm	YES
525	Type A Submarine (stern-section)	submarine	1941	YES	Oahu	1 confirm	YES
493	Uilama	schooner	1883	NO	Maui	2 good	NO
820	Union	sloop	1866	NO	Maui	3 fair	NO
822	unknown	fishing vessel	1909	NO	Oahu	4 poor	NO
823	unknown	sampan	1910	NO	Oahu	4 poor	NO
832	unknown	unknown		NO	Kauai	1 confirm	YES
856	unknown	junk		NO	Oahu	3 fair	NO
864	unknown	motor vessel	1909	NO	Molokai	4 poor	NO
868	unknown	aircraft		NO	Oahu	1 confirm	NO
869	unknown	aircraft		NO	Oahu	1 confirm	NO
877	unknown	motor vessel		NO	Oahu	2 good	YES
892	unknown	sailboat		NO	Maui	1 confirm	YES

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
899	unknown	sampan		NO	Hawaii	1 confirm	YES
900	unknown	steam screw		NO	Lanai	1 confirm	YES
905	unknown	aircraft		NO	Oahu	3 fair	NO
911	unknown	ship		YES	Oahu	2 good	YES
915	unknown	unknown		NO	Oahu	2 good	YES
916	unknown	steam screw		NO	Oahu	2 good	YES
917	unknown	steam screw		NO	Oahu	2 good	YES
918	unknown	schooner		NO	Oahu	2 good	YES
920	unknown	sampan		NO	Oahu	2 good	YES
1163	Unknown	unknown		NO	Oahu	1 confirm	YES
1164	Unknown	unknown		NO	Oahu	1 confirm	YES
1165	Unknown	unknown		NO	Oahu	1 confirm	YES
1166	Unknown	unknown		NO	Oahu	1 confirm	YES
1167	Unknown	unknown		NO	Oahu	1 confirm	YES
1168	Unknown	unknown		YES	Oahu	1 confirm	YES
1169	Unknown	unknown		NO	Oahu	1 confirm	YES
1170	Unknown	unknown		NO	Oahu	1 confirm	YES
1171	Unknown	unknown		NO	Oahu	1 confirm	YES
1172	Unknown	unknown		NO	Oahu	1 confirm	YES
1173	Unknown	unknown		NO	Oahu	1 confirm	YES
1174	Unknown	unknown		NO	Oahu	1 confirm	YES
1175	Unknown	unknown		NO	Oahu	1 confirm	YES
1176	Unknown	unknown		NO	Oahu	1 confirm	YES
1177	Unknown	unknown		NO	Oahu	1 confirm	YES
1178	Unknown	unknown		NO	Oahu	1 confirm	YES
1179	Unknown	unknown		NO	Oahu	1 confirm	YES
1180	Unknown	unknown		NO	Oahu	1 confirm	YES
1181	Unknown	unknown		NO	Oahu	1 confirm	YES
1182	Unknown	unknown		NO	Oahu	1 confirm	YES
1183	Unknown	unknown		NO	Oahu	1 confirm	YES
1184	Unknown	unknown		NO	Oahu	1 confirm	YES
1185	Unknown	unknown		NO	Oahu	1 confirm	YES
1186	Unknown	unknown		NO	Oahu	1 confirm	YES
1187	Unknown	unknown		NO	Oahu	1 confirm	YES
1188	Unknown	unknown		NO	Oahu	1 confirm	YES
1189	Unknown	unknown		NO	Oahu	1 confirm	YES
1190	Unknown	unknown		NO	Oahu	1 confirm	YES
1191	Unknown	unknown		NO	Oahu	1 confirm	YES
1192	Unknown	unknown		NO	Oahu	1 confirm	YES
1193	Unknown	unknown		NO	Oahu	1 confirm	YES
1194	Unknown	unknown		NO	Oahu	1 confirm	YES
1195	Unknown	unknown		NO	Oahu	1 confirm	YES
1196	Unknown	unknown		NO	Oahu	1 confirm	YES
1197	Unknown	unknown		YES	Oahu	1 confirm	YES
1198	Unknown	unknown		NO	Oahu	1 confirm	YES
1199	Unknown	unknown		NO	Oahu	1 confirm	YES
1200	Unknown	unknown		NO	Oahu	1 confirm	YES

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
1201	Unknown	unknown		YES	Oahu	1 confirm	YES
1202	Unknown	unknown		YES	Oahu	1 confirm	YES
1203	Unknown	unknown		NO	Oahu	1 confirm	YES
1204	Unknown	unknown		NO	Oahu	1 confirm	YES
1205	Unknown	unknown		NO	Oahu	1 confirm	YES
1206	Unknown	unknown		NO	Oahu	1 confirm	YES
1207	Unknown	unknown		NO	Oahu	1 confirm	YES
1208	Unknown	unknown		NO	Oahu	1 confirm	YES
1209	Unknown	unknown		YES	Oahu	1 confirm	YES
1210	Unknown	unknown		NO	Oahu	1 confirm	YES
1211	Unknown	unknown		NO	Oahu	1 confirm	YES
1212	Unknown	unknown		NO	Oahu	1 confirm	YES
1213	Unknown	unknown		NO	Oahu	1 confirm	YES
1214	Unknown	unknown		NO	Oahu	1 confirm	YES
1215	Unknown	unknown		YES	Oahu	1 confirm	YES
1216	Unknown	unknown		NO	Oahu	1 confirm	YES
1217	Unknown	unknown		NO	Oahu	1 confirm	YES
1218	Unknown	unknown		YES	Oahu	1 confirm	YES
1219	Unknown	unknown		NO	Oahu	1 confirm	YES
1220	Unknown	unknown		NO	Oahu	1 confirm	YES
1221	Unknown	unknown		NO	Oahu	1 confirm	YES
1222	Unknown	unknown		NO	Oahu	1 confirm	YES
1223	Unknown	unknown		NO	Oahu	1 confirm	YES
1224	Unknown	unknown		NO	Oahu	1 confirm	YES
1225	Unknown	unknown		NO	Oahu	1 confirm	YES
1226	Unknown	unknown		NO	Oahu	1 confirm	YES
1227	Unknown	unknown		NO	Oahu	1 confirm	YES
1228	Unknown	unknown		NO	Oahu	1 confirm	YES
1229	Unknown	unknown		NO	Oahu	1 confirm	YES
1230	Unknown	unknown		NO	Oahu	1 confirm	YES
1231	Unknown	unknown		NO	Oahu	1 confirm	YES
1232	Unknown	unknown		NO	Oahu	1 confirm	YES
1233	Unknown	unknown		NO	Oahu	1 confirm	YES
1234	Unknown	unknown		NO	Oahu	1 confirm	YES
1235	Unknown	unknown		NO	Oahu	1 confirm	YES
1236	Unknown	unknown		YES	Oahu	1 confirm	YES
1237	Unknown	unknown		NO	Oahu	1 confirm	YES
1238	Unknown	unknown		NO	Oahu	1 confirm	YES
1239	Unknown	unknown		NO	Oahu	1 confirm	YES
1240	Unknown	unknown		NO	Oahu	1 confirm	YES
1241	Unknown	unknown		NO	Oahu	1 confirm	YES
1242	Unknown	unknown		NO	Oahu	1 confirm	YES
1243	Unknown	unknown		NO	Oahu	1 confirm	YES
1244	Unknown	unknown		NO	Oahu	1 confirm	YES
1245	Unknown	unknown		NO	Oahu	1 confirm	YES
1246	Unknown	unknown		NO	Oahu	1 confirm	YES
1247	Unknown	unknown		NO	Oahu	1 confirm	YES

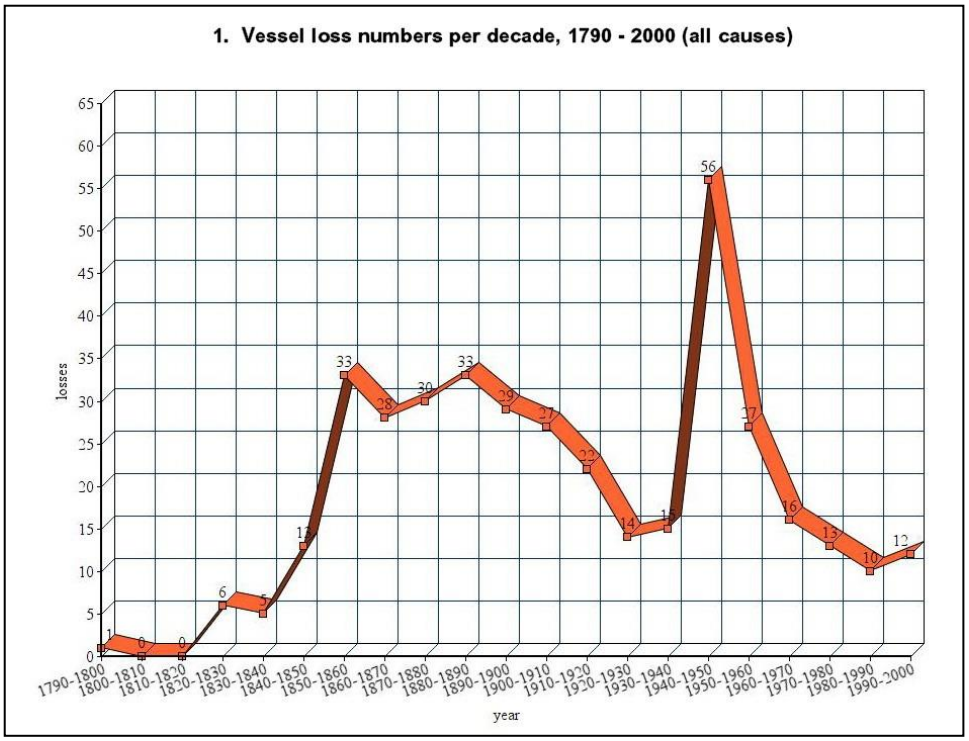
Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
1248	Unknown	unknown		NO	Oahu	1 confirm	YES
1249	Unknown	unknown		NO	Oahu	1 confirm	YES
1250	Unknown	unknown		NO	Maui	1 confirm	NO
1251	Unknown	unknown		NO	Maui	1 confirm	NO
1252	Unknown	unknown		NO	Maui	1 confirm	NO
1253	Unknown	unknown		NO	Molokai	1 confirm	NO
1255	Unknown	unknown		NO	Oahu	1 confirm	NO
1257	Unknown	unknown		NO	Oahu	1 confirm	NO
1260	Unknown	unknown		NO	Oahu	1 confirm	NO
1261	Unknown	unknown		NO	Oahu	1 confirm	NO
1262	Unknown	unknown		NO	Oahu	1 confirm	NO
1263	Unknown	unknown		NO	Oahu	1 confirm	NO
1264	Unknown	unknown		NO	Oahu	1 confirm	NO
1265	Unknown	unknown		NO	Oahu	1 confirm	NO
1266	Unknown	unknown		NO	Oahu	1 confirm	NO
1267	Unknown	Unknown		NO	Oahu	1 confirm	NO
1268	Unknown	unknown		NO	Oahu	1 confirm	NO
1269	Unknown	unknown		NO	Oahu	1 confirm	NO
1270	Unknown	unknown		NO	Oahu	1 confirm	NO
1272	Unknown	unknown		NO	Oahu	1 confirm	NO
1273	Unknown	unknown		NO	Oahu	1 confirm	NO
1274	Unknown	unknown		NO	Oahu	1 confirm	NO
1275	Unknown	unknown		NO	Oahu	1 confirm	NO
1276	Unknown	unknown		NO	Oahu	1 confirm	NO
1277	Unknown	unknown		NO	Oahu	1 confirm	NO
1278	Unknown	unknown		NO	Oahu	1 confirm	NO
1279	Unknown	unknown		NO	Oahu	1 confirm	NO
1280	Unknown	unknown		NO	Oahu	1 confirm	NO
1281	Unknown	unknown		NO	Oahu	1 confirm	NO
1282	Unknown	unknown		NO	Oahu	1 confirm	NO
1284	Unknown	unknown		NO	Oahu	1 confirm	NO
1285	Unknown	unknown		NO	Oahu	1 confirm	NO
1286	Unknown	unknown		NO	Oahu	1 confirm	NO
1287	Unknown	unknown		NO	Oahu	1 confirm	NO
1288	Unknown	unknown		YES	Oahu	1 confirm	NO
1289	Unknown	unknown		NO	Oahu	1 confirm	NO
1290	Unknown	unknown		NO	Oahu	1 confirm	NO
1292	Unknown	unknown		NO	Oahu	1 confirm	NO
1294	Unknown	unknown		NO	Kauai	1 confirm	NO
1295	Unknown	unknown		NO	Kauai	1 confirm	NO
1296	Unknown	unknown		NO	Kauai	1 confirm	NO
1297	Unknown	unknown		NO	Kauai	1 confirm	NO
1298	Unknown	unknown		NO	Kauai	1 confirm	NO
1299	Unknown	unknown		YES	Kauai	1 confirm	NO
1300	Unknown	unknown		YES	Kauai	1 confirm	NO
1301	Unknown	unknown		YES	Kauai	1 confirm	NO
1302	Unknown	unknown		YES	Kauai	1 confirm	NO

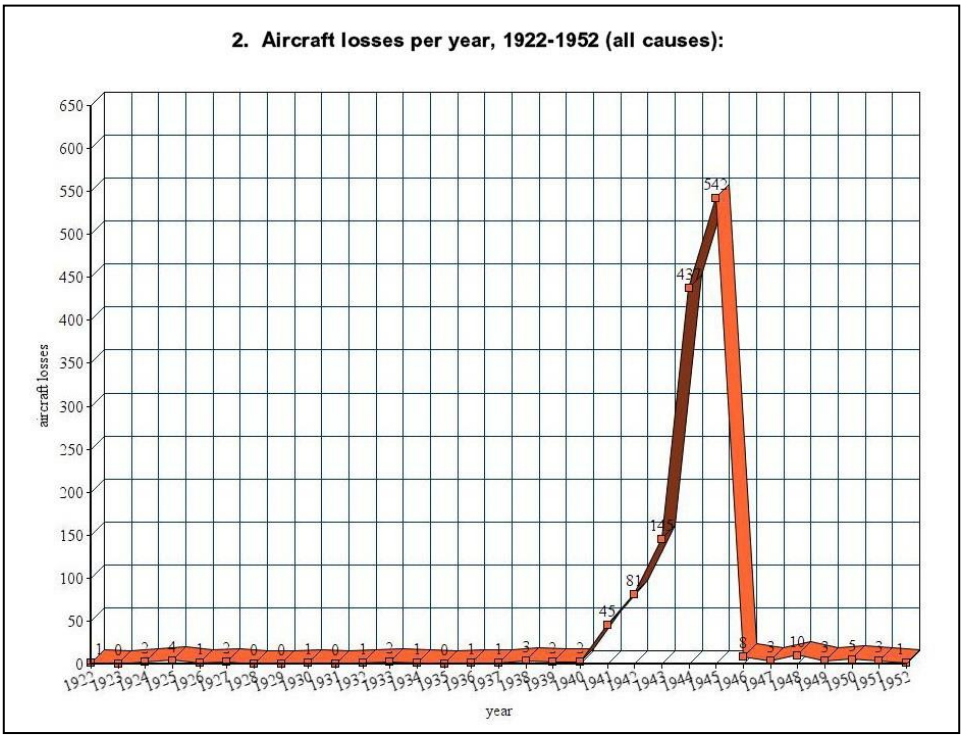
Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
1303	Unknown	unknown		YES	Kauai	1 confirm	NO
1304	Unknown	unknown		YES	Kauai	1 confirm	NO
1305	Unknown	unknown		YES	Kauai	1 confirm	NO
1306	Unknown	unknown		YES	Kauai	1 confirm	NO
1307	Unknown	unknown		YES	Kauai	1 confirm	NO
1308	Unknown	unknown		YES	Kauai	1 confirm	NO
1309	Unknown	unknown		YES	Kauai	1 confirm	NO
1310	Unknown	unknown		YES	Kauai	1 confirm	NO
1311	Unknown	unknown		YES	Kauai	1 confirm	NO
1312	Unknown	unknown		YES	Kauai	1 confirm	NO
1313	Unknown	unknown		YES	Kauai	1 confirm	NO
1314	Unknown	unknown		YES	Kauai	1 confirm	NO
1315	Unknown	unknown		YES	Oahu	1 confirm	NO
1316	Unknown	unknown		YES	Oahu	1 confirm	NO
1317	Unknown	unknown		YES	Oahu	1 confirm	NO
1318	Unknown	unknown		YES	Oahu	1 confirm	NO
1319	Unknown	unknown		YES	Lanai	1 confirm	NO
1321	Unknown	unknown		YES	Niihau	1 confirm	NO
1322	Unknown	unknown		NO	Oahu	2 good	YES
1323	Unknown	unknown		NO	Kauai	2 good	NO
1324	Unknown	unknown		NO	Lanai	2 good	NO
1326	Unknown	unknown		NO	Lanai	2 good	NO
1328	Unknown	unknown		NO	Lanai	2 good	NO
1329	Unknown	unknown		NO	Lanai	2 good	NO
1330	Unknown	barge		NO	Oahu	2 good	NO
1331	Unknown	barge		NO	Oahu	2 good	NO
1333	Unknown	sailboat		NO	Oahu	2 good	NO
1334	Unknown	unknown		NO	Oahu	2 good	NO
1335	Unknown	sailboat		NO	Oahu	2 good	NO
1337	Unknown	barge		NO	Oahu	2 good	YES
1340	Unknown	unknown		NO	Oahu	2 good	NO
1341	Unknown	unknown		NO	Oahu	2 good	NO
1344	Unknown	unknown		NO	Oahu	2 good	NO
1345	Unknown	barge		NO	Oahu	2 good	NO
1346	Unknown	unknown		NO	Oahu	2 good	NO
1347	Unknown	unknown		NO	Oahu	2 good	NO
1348	Unknown	unknown		NO	Oahu	2 good	NO
1349	Unknown	unknown		NO	Oahu	2 good	NO
2444	unknown	aircraft	1945	YES		4 poor	NO
544	Unknown Sampan	sampan		YES	Oahu	1 confirm	NO
501	unknown Waikiki-1	unknown		NO	Oahu	1 confirm	YES
821	unknown2	schooner	1852	NO	Kauai	4 poor	NO
543	Unkown Oahu-1	unknown		NO	Oahu	1 confirm	YES
1397	Unreal	unknown	1988	YES	Hawaii	3 fair	NO
1416	UO-1	aircraft	1925	YES	Oahu	4 poor	NO
1418	UO-1	aircraft	1925	YES	Maui	4 poor	NO
494	Upolu	steam screw	1901	NO	Hawaii	3 fair	NO

Record Num	Vessel Name	Vessel type	Year of Loss	Hawaii OCS	Vicinity Island	Location Cat	Site Survey
780	Utah AG-16	battleship	1941	NO	Oahu	1 confirm	NO
1419	VE-7	aircraft	1925	NO	Oahu	4 poor	NO
1421	VE-7SF	aircraft	1927	NO	Oahu	4 poor	NO
617	Vehicle Chassis (1)	vehicle		NO	Oahu	1 confirm	YES
625	Vehicle Chassis (2)	vehicle		NO	Oahu	1 confirm	YES
628	Vehicle Chassis (3)	vehicle		YES	Oahu	1 confirm	YES
633	Vehicle Chassis (4)	vehicle		YES	Oahu	1 confirm	YES
634	Vehicle Chassis (5)	vehicle		YES	Oahu	1 confirm	YES
636	Vehicle Chassis (6)	vehicle		YES	Oahu	1 confirm	YES
656	Vehicle Chassis (7)	vehicle		YES	Oahu	1 confirm	YES
715	Vehicle Chassis (8)	vehicle		YES	Oahu	1 confirm	YES
495	Victoria	schooner	1850	NO	Kauai	3 fair	NO
496	W. P. Leleihoku	schooner	1851	YES	Oahu	4 poor	NO
497	Wachusett	ship	1900	YES	Maui	4 poor	NO
498	Waialua	schooner	1902	NO	Kauai	2 good	NO
860	Waiehu	schooner	1891	NO	Oahu	3 fair	NO
502	Waikolu	passenger carrier	1942	NO	Oahu	3 fair	NO
859	Wailama	schooner	1883	NO	Maui	2 good	NO
503	Wailele	steam screw	1919	YES	Kauai	4 poor	NO
504	Wailele	schooner	1836	NO	Oahu	3 fair	NO
827	Wailele	sloop	1871	NO	Oahu	4 poor	NO
505	Waiola	schooner	1876	NO	Oahu	2 good	NO
506	Warwick	schooner	1867	NO	Kauai	3 fair	NO
507	Warwick II	schooner	1881	YES	Oahu	4 poor	NO
853	West Point	steam screw	1856	NO	Kauai	2 good	NO
863	Wetmore	bark	1895	NO	Hawaii	4 poor	NO
508	William	schooner	1851	NO	Maui	4 poor	NO
2496	William B	freighter		YES	Oahu	1 confirm	YES
728	William Carson	bark	1899	NO	Oahu	1 confirm	YES
510	William Olsen	schooner	1919	NO	Niihau	4 poor	NO
511	YB 8	barge	1958	NO	Hawaii	2 good	NO
1401	YB-34	barge	1987	NO	Hawaii	4 poor	NO
781	YC-883	barge	1945	NO	Oahu	3 fair	NO
512	Yette	schooner	1868	NO	Kauai	3 fair	NO
782	YF-926	barge	1945	YES	Hawaii	4 poor	NO
1400	YG-44, USS	barge	1945	YES	Oahu	4 poor	NO
541	YO Fuel Oil barge	barge		NO	Oahu	1 confirm	YES
783	YO-21	tanker		NO	Lanai	1 confirm	YES
784	YO-257	tanker	1989	NO	Oahu	1 confirm	YES
785	YOGN-42	tanker	1954	NO	Lanai	1 confirm	YES
513	Young Hero	ship	1858	NO	Maui	2 good	NO
514	Young Thaddeus	schooner	1821	NO	Kauai	4 poor	NO
786	YP-183	sampan	1943	NO	Hawaii	1 confirm	NO
545	YW Water Barge	barge		NO	Oahu	1 confirm	NO
515	Zampa	schooner	1926	YES	Oahu	3 fair	NO
1402	Zaneta	sailboat	1978	NO	Hawaii	4 poor	NO

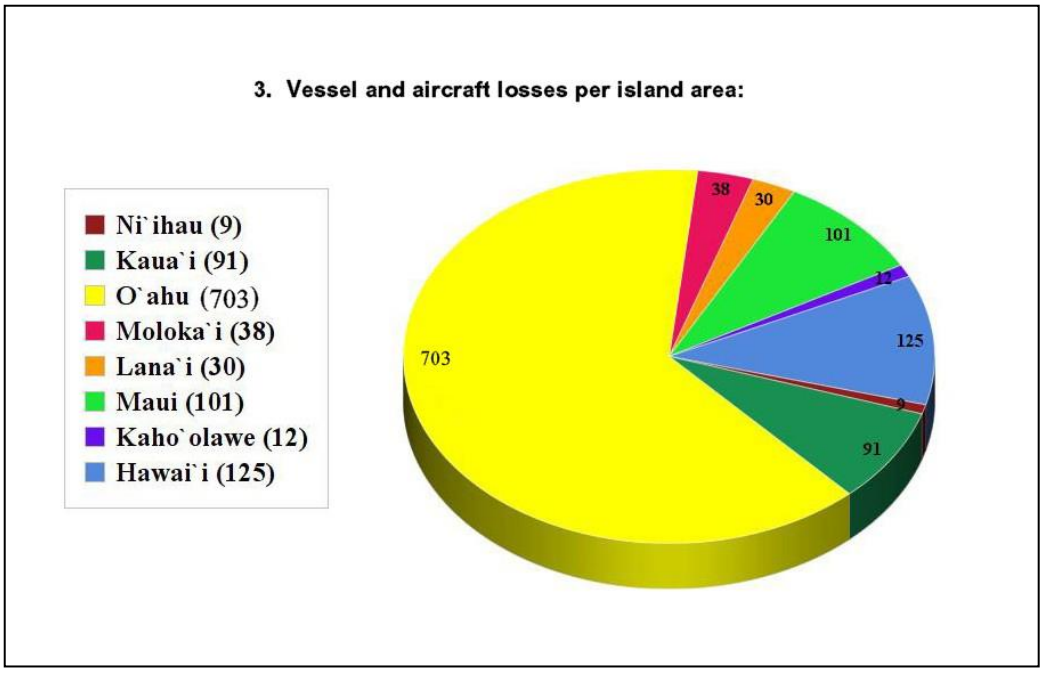
Appendix 5. Selected Inventory Statistics

Statistical interpretations are preliminary as the inventory is based on partial data. Some vessel losses do not have an identified year lost. Data sets are incomplete, as marine surveys are incomplete.





3. Vessel and aircraft losses per island area:

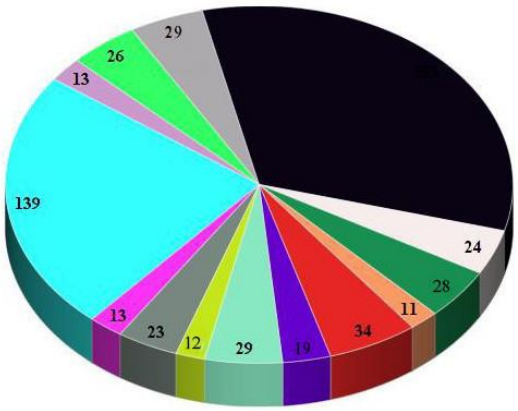


4. Vessel loss numbers per type:

AIR = aircraft **1375**	GBT = gunboat **0**	PAT = patrol boat **4**
AMV = amphibious vehicle **1**	GLN = galleon **0**	PC = pleasure craft **1**
ANC = anchor/chain **6**	GSS = gas screw **0**	PDL = paddlewheel boat **0**
BAR = bark **24**	HB = hopper barge **0**	SAI = sailboat **23**
BAT = battleship **4**	HEL = helicopter **0**	SAM = sampan motorized **13**
BGE = barge **28**	JNK = junk **1**	SB = schooner/barge **0**
BNK = barkentine **2**	LC = landing craft generic **2**	SCH = schooner **139**
BRG = brig **11**	LCI = landing craft infantry **1**	SDW = sidewheeler **2**
BRI = brigantine **1**	LCM = landing craft mechanized **10**	SHM = shrimp trawler **0**
BYT = buoy tender **0**	LCT = landing craft tank **9**	SHP = ship **11**
CAN = canoe **1**	LCU = landing craft utility **2**	SKI = skiff **0**
CCR = cabin cruiser **0**	LCV = landing craft	SLP = sloop **13**
CRB = crane barge **0**	LDC = landing craft **3**	SPY = supply vessel **0**
CRS = cruiser (naval) **2**	LIB = Liberty ship **1**	STM = steam screw **26**
CUT = cutter **0**	LOR = lorcha **1**	STW = sternwheeler **0**
DCK = dock **0**	LSM = landing ship medium **1**	SUB = submarine **29**
DES = destroyer escort **2**	LST = landing ship tank **9**	TB = tug or tow boat **7**
DIR = drilling rig/ship **0**	LUG = lugger **0**	TNK = tanker **4**
DRE = dredge **1**	LVT = AMTRACK **29**	TPB = torpedo boat **1**
DVT = dive tender **0**	MCH = merchant **0**	TRA = trawler **0**
EXP = exploration vessel **0**	MNL = mine layer **0**	UNK = unknown **175**
FER = ferryboat **0**	MSW = mine sweeper **1**	VEH = vehicle **66**
FRG = frigate **0**	MV = motor vessel **10**	WHL = whaler **1**
FRT = freighter **7**	OTH = other **3**	YCT = yacht **7**
FV = fishing vessel **35**	PAS = passenger carrier **12**	

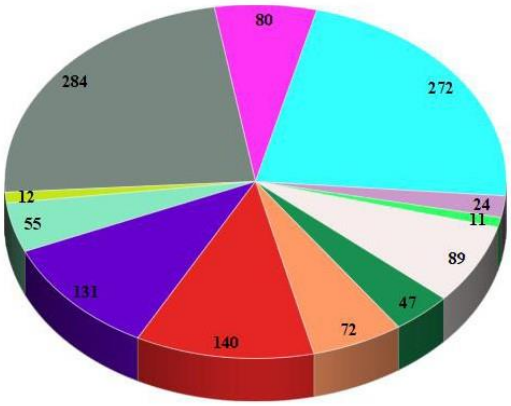
5. Primary (n>10) vessel losses per vessel type:

barks 24
barges 28
brigs 11
fishing vessels 34
landing craft 19
AMTRACKs 29
passenger carriers 12
sailboats 23
motorized sampans 13
schooners 139
sloops 13
steamships 26
submarines 29
unknown 175

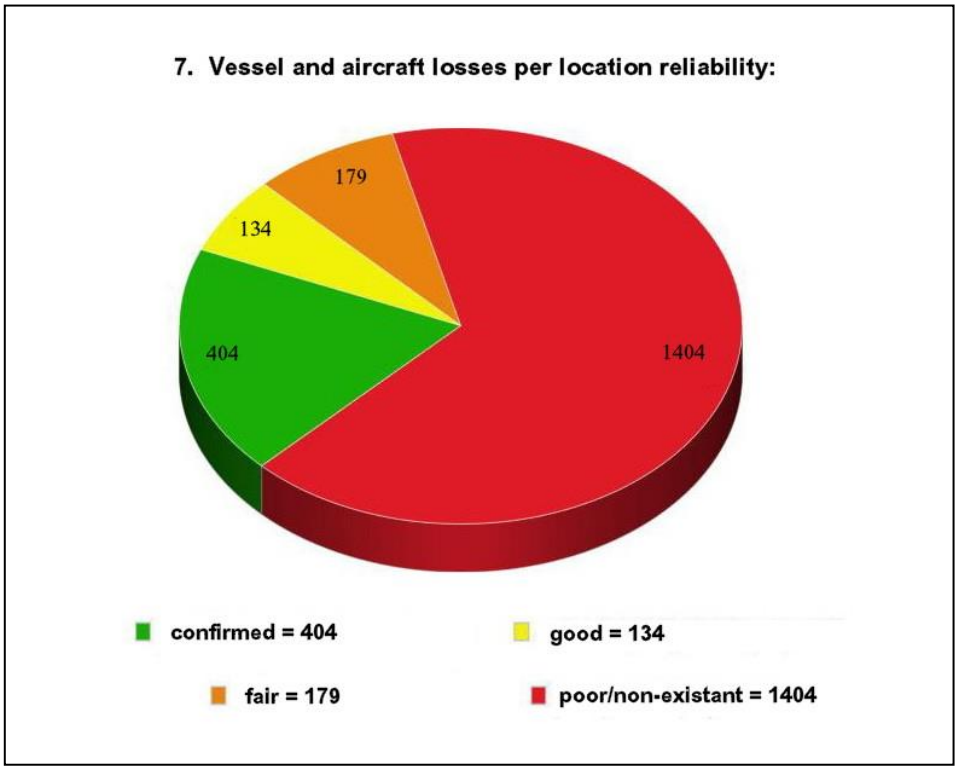


6. Primary (n>10) aircraft losses per aircraft type:

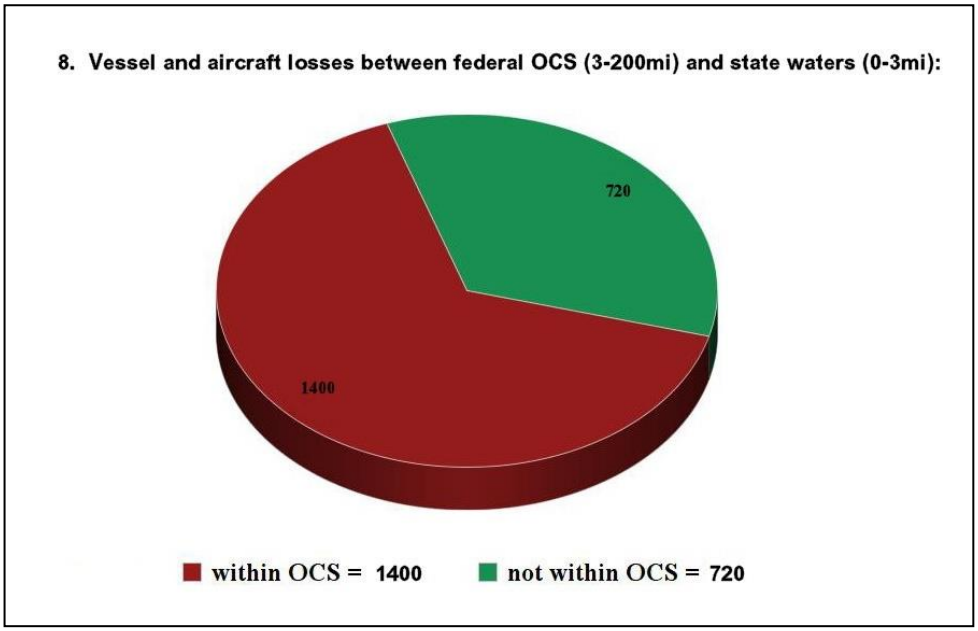
FM-2 Wildcat = 89
FG-1 Corsair = 47
F4F Wildcat = 72
F4U Corsair = 140
TBM Avenger = 131
TBF Avenger = 55
OS2U Kingfisher = 12
F6F Hellcat = 284
SBD Dauntless = 80
SB2C Helldiver = 272
PBY Catalina = 24
PBM Mariner = 11



7. Vessel and aircraft losses per location reliability:



8. Vessel and aircraft losses between federal OCS (3-200mi) and state waters (0-3mi):

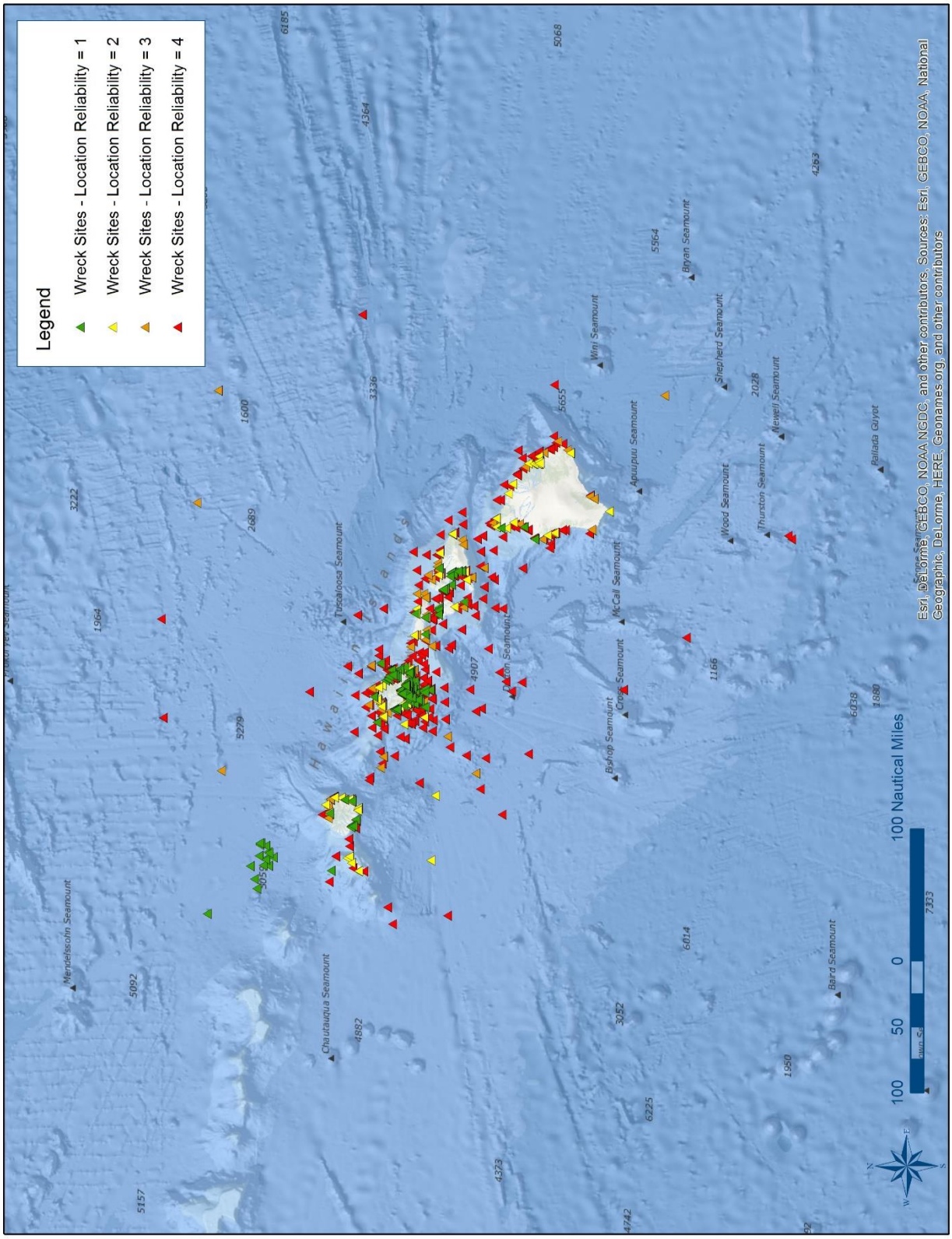


9. Vessel loss numbers per loss cause:

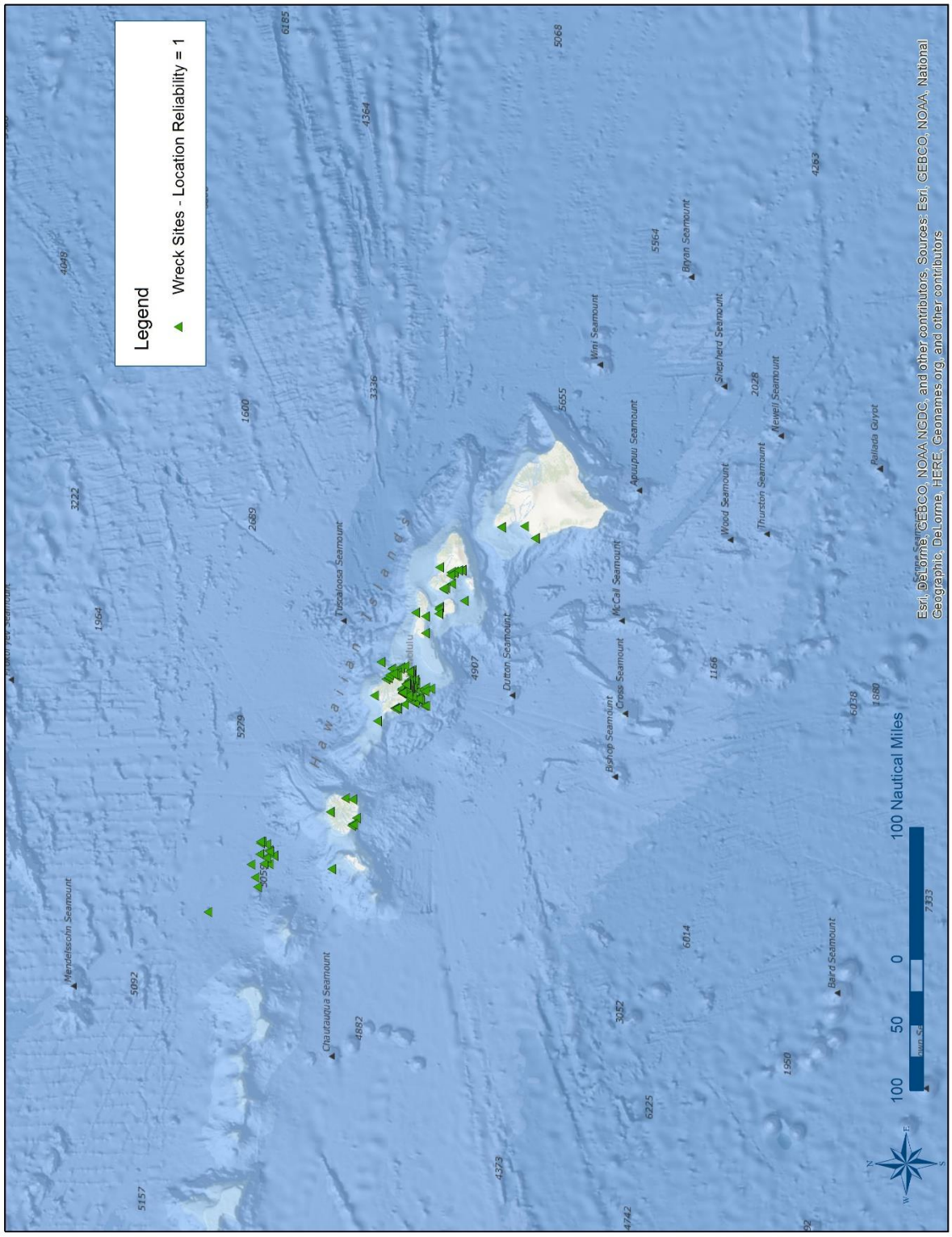
AB = abandoned **7**	EX = explosion **6**	SC = scuttled **71**	SU = sunk **1320**
BE = beached **1**	FR = fire **2**	SCT = scuttled/target **24**	TB = torpedoed/battle
BU = burned **7**	FO = foundered **50**	SP = scrapped **1**	UN = unknown **392**
CA = capsized **1**	FOC =	ST = stranded/swamped	
CO = collided **74**	GF = gunfire/battle **7**	STF = stranded/founder **23**	

Appendix 6. Selected Inventory Maps

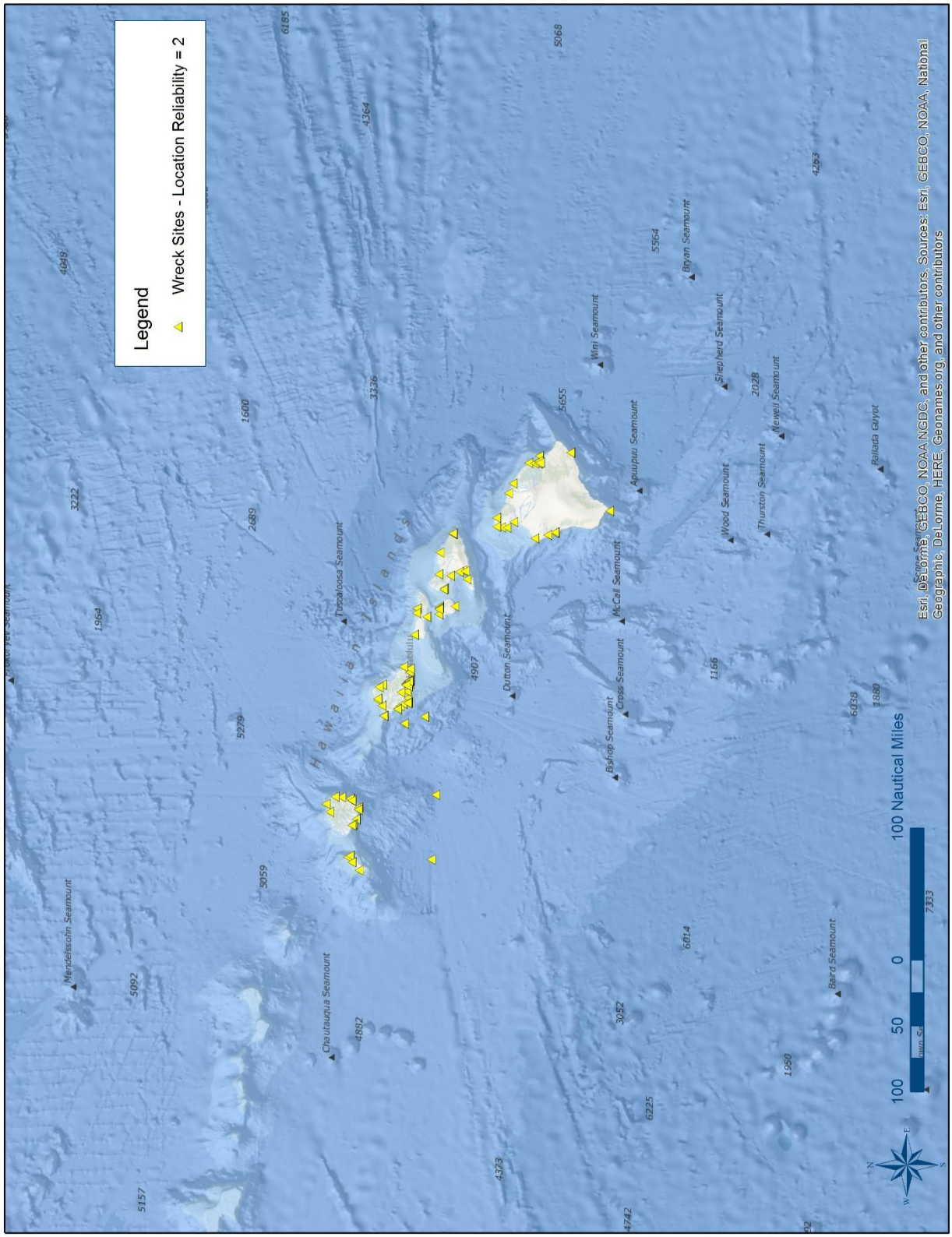
1. All sites (location reliability 1-4) (NOAA ONMS):



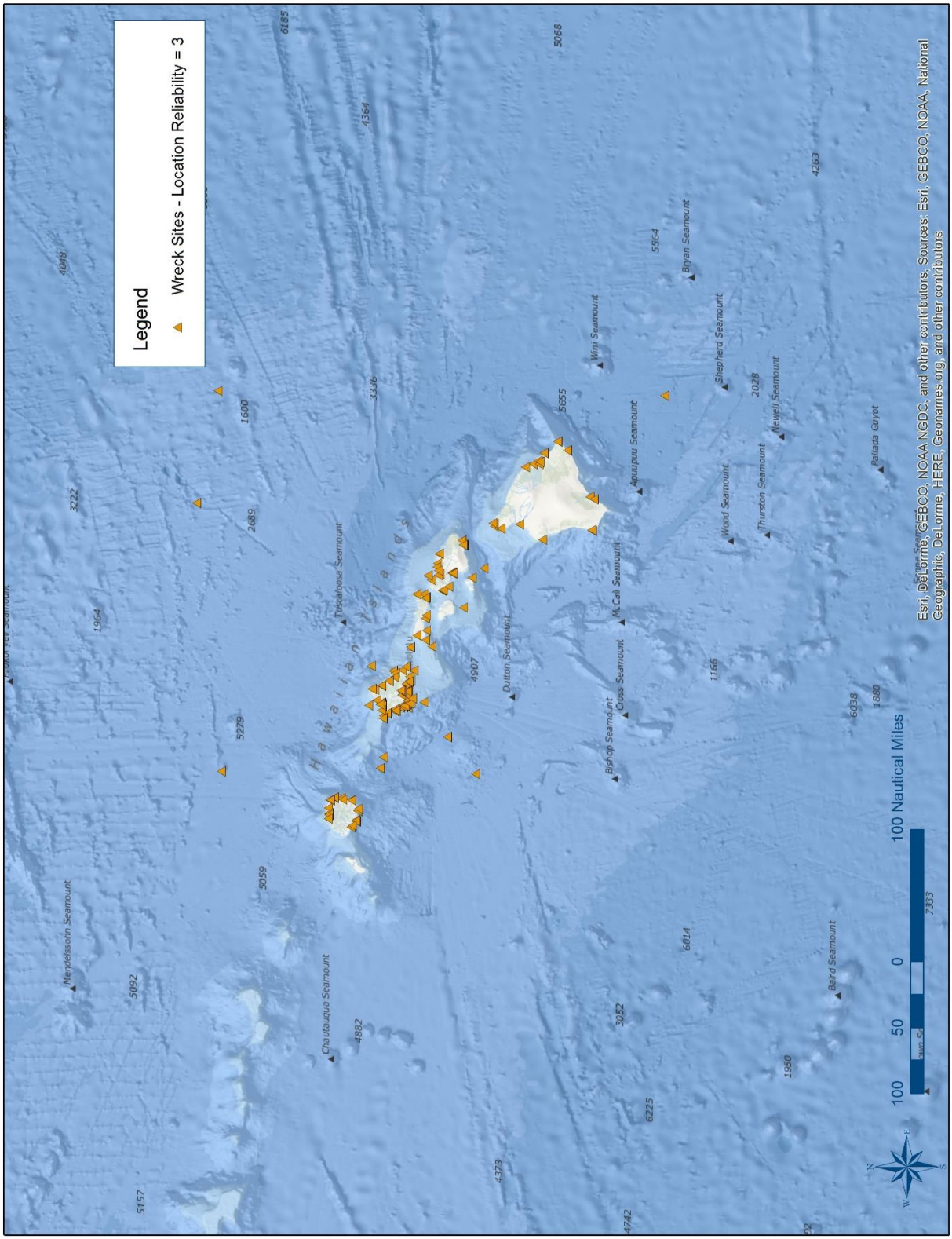
2. Confirmed sites (category 1), resource is verified as located and confirmed/recorded by standard DGPS coordinates (NOAA ONMS):



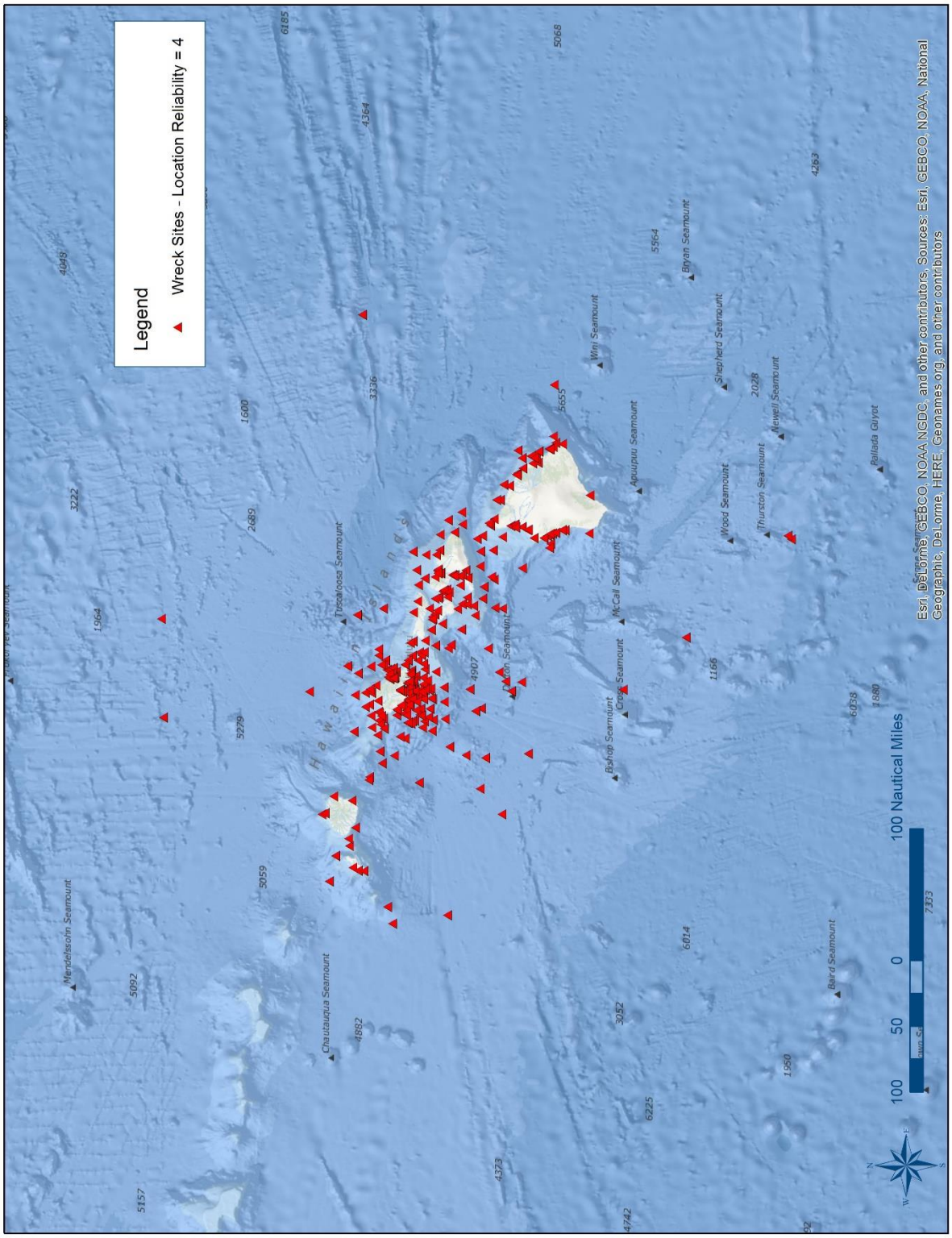
3. Moderate reliability sites (category 2), resource is not confirmed or actually located, but the location is reported to nearest actual minute of latitude and longitude (NOAA ONMS):



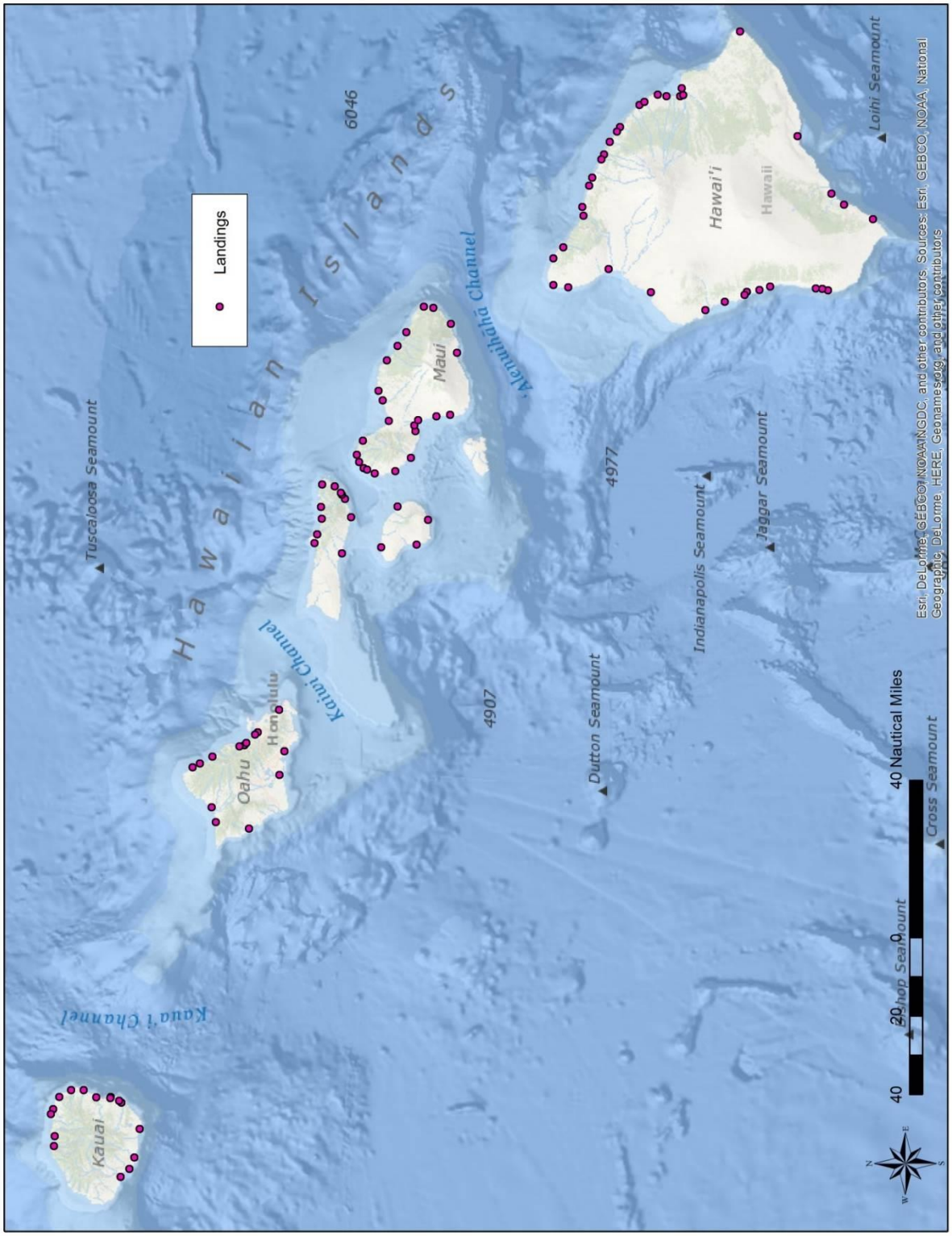
4. Fair reliability sites (category 3), resource reported location is only general, to nearest degree of latitude or longitude, or only referenced to a nearby landmark (NOAA ONMS):



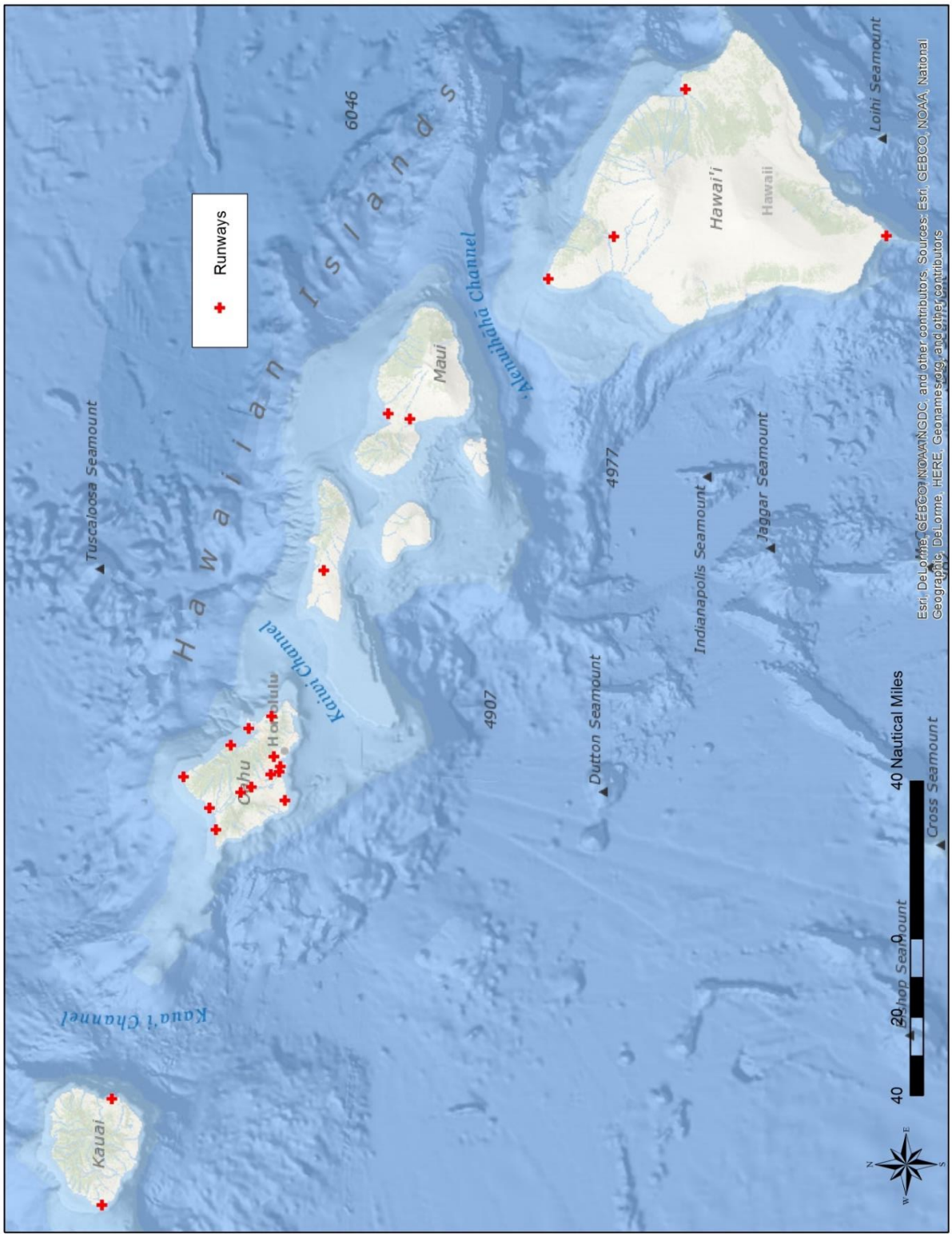
5. Poor reliability sites (category 4), resource location is unreliable or very vague, or without any directional component (NOAA ONMS):



6. Historic 19th century shoreline landing positions (NOAA ONMS):



7. World War II period army and navy air fields and bases (NOAA ONMS):



The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under US administration.

BOEM
Bureau of Ocean Energy Management

The Bureau of Ocean Energy Management

As a bureau of the Department of the Interior, the Bureau of Ocean Energy Management's (BOEM's) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS) in an environmentally sound and safe manner.

The BOEM Environmental Studies Program

The mission of the Environmental Studies Program (ESP) is to provide the information needed to predict, assess, and manage impacts from offshore energy and marine mineral exploration, development, and production activities on human, marine, and coastal environments.