Title
Environmental Analysis of Submerged Cultural Resource Survey Areas of the Kiska Island National Historic Landmark Maritime Battlefield

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Environmental Analysis of Submerged Cultural Resource Survey Areas of the Kiska Island National Historic Landmark Maritime Battlefield

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### Commonly Used Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAA</td>
<td>Anti-Aircraft Artillery</td>
</tr>
<tr>
<td>ADEC</td>
<td>Alaska Department of Environmental Conservation</td>
</tr>
<tr>
<td>ADF&amp;G</td>
<td>Alaska Department of Fish and Game</td>
</tr>
<tr>
<td>AI</td>
<td>Aleutian Islands</td>
</tr>
<tr>
<td>CDA</td>
<td>Coastal Defense Area</td>
</tr>
<tr>
<td>CORDC</td>
<td>Coastal Observation Research &amp; Development Center</td>
</tr>
<tr>
<td>DOD</td>
<td>Department of Defense</td>
</tr>
<tr>
<td>ESI</td>
<td>Environmental Sensitivity Index</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information Services</td>
</tr>
<tr>
<td>HCA</td>
<td>Habitat Conservation Area</td>
</tr>
<tr>
<td>KOCOA</td>
<td>Key terrain, Observation and fields of fire, Cover and concealment, Obstacles, and Avenues of Approach</td>
</tr>
<tr>
<td>MEC</td>
<td>Munitions and Explosives of Concern</td>
</tr>
<tr>
<td>MPA</td>
<td>Marine Protected Area</td>
</tr>
<tr>
<td>MMPA</td>
<td>Marine Mammal Protection Act</td>
</tr>
<tr>
<td>NOAA</td>
<td>National Oceanic and Atmospheric Administration</td>
</tr>
<tr>
<td>NDSA</td>
<td>Naval Defensive Sea Area</td>
</tr>
<tr>
<td>NPS</td>
<td>National Park Service</td>
</tr>
<tr>
<td>OER</td>
<td>Ocean Exploration and Research</td>
</tr>
<tr>
<td>PAH</td>
<td>Polycyclic Aromatic Hydrocarbons</td>
</tr>
<tr>
<td>PCB</td>
<td>Polychlorinated Biphenyl</td>
</tr>
<tr>
<td>POL</td>
<td>Petroleum, Oil, &amp; Lubricants</td>
</tr>
<tr>
<td>PR</td>
<td>Project Recover</td>
</tr>
<tr>
<td>SIO</td>
<td>Scripps Institution of Oceanography</td>
</tr>
<tr>
<td>SPR</td>
<td>Spill Prevention and Response</td>
</tr>
<tr>
<td>SSLPA</td>
<td>Steller Sea Lion Protected Area</td>
</tr>
<tr>
<td>STEM</td>
<td>Science, Technology, Engineering, &amp; Mathematics</td>
</tr>
<tr>
<td>UAF</td>
<td>University of Alaska Fairbanks</td>
</tr>
<tr>
<td>UASE</td>
<td>University of Alaska Southeast</td>
</tr>
<tr>
<td>UCSC</td>
<td>University of California Santa Cruz</td>
</tr>
<tr>
<td>UCSD</td>
<td>University of California San Diego</td>
</tr>
<tr>
<td>USFS</td>
<td>United States Forestry Service</td>
</tr>
<tr>
<td>USFWS</td>
<td>United States Fish and Wildlife Service</td>
</tr>
<tr>
<td>USGS</td>
<td>United States Geological Survey</td>
</tr>
</tbody>
</table>
Abstract

Project Recover, formally established in 2016, fuses historical data with the latest technology to research and locate submerged WWII wreckage and the associated servicemen that have been missing in action (Project Recover, 2018). In July 2018, Project Recover will conduct remote-sensing surveys in four locations off Kiska Island, Alaska. The terrestrial component of the Kiska battlefield has been well researched; the maritime component remains largely unknown. Little research has been done in the area regarding the submerged WWII cultural sites, as well as environmental assessments and analysis. Historical analysis of the Battle of Kiska, applying KOCOA (key terrain, observation and fields of fire, cover and concealment, obstacles, and avenues of approach) analysis to submerged maritime sites in the area, assessments of active contaminant sites, and analysis of environmental and habitat data of the area will aid in the creation of one composite geodatabase. The implementation of the geodatabase and other environmental support information is important in the planning stages of the survey and will serve to be a timely reference during the field data collection phase. Furthermore, analysis done in this Capstone project will help ensure another efficient and successful Project Recover survey and will contribute to the overall goal of Project Recover, which is to document and honor the final resting place of 167 U.S. and Japanese service members who lost their lives in the waters surrounding Kiska Island, thus ensuring the preservation of maritime cultural history.
INTRODUCTION

Background

Kiska is a volcanic island in the Rat Island group of the Aleutian Chain located approximately 1,450 miles west of Anchorage, Alaska and is approximately 30 miles long and 7 miles wide (Spennemann, 2012). Prior to about 1728, the Aleutian Islands, including Kiska, were occupied by about 12,000 Aleut people, a native, warrior race (Cloe, 1990). With Russian advancement in a quest to hunt and trap fur-bearing animals moving eastward through the Aleutians during much of the eighteenth century, the population of the Aleuts was decimated to a mere 2,000, mostly due to the degradation of Aleut culture and the subjection of disease (Cloe, 1990). By 1867, the fur trade had become an unprofitable business for the Russians, so they sold the nearly uninhabited Aleutian territory to the United States (Cloe, 1990). Except for the occasional visits by fur trappers, Kiska was uninhabited from about the 1830s to 1941 when the U.S. Navy installed a small weather station on the island, which was occupied by about ten personnel. However, on June 6, 1942, as part of the overall strategy for the Battle of Midway, Japanese forces invaded and occupied Kiska, constructing a seaplane and submarine base, a runway, a main camp comprised of various buildings for soldiers and weapons, and an array of coastal defense utilities such as anti-aircraft gun positions (Spennemann, 2012). Over the next year and several months, the U.S. Navy and Army Air Corps, through air assault and bombing raids, attempted to drive out the thousands of Japanese Army and Navy troops by destroying their weapons, planes, and ships. These raids were often hampered by intense weather conditions: dense fog made for low ceilings and almost zero visibility; snow, ice, and sub-zero temperatures made it almost impossible to operate aircraft; and “williwaws,” a word often used to describe the intense winds in the Aleutians, added to the already unfavorable conditions. After the U.S. captured Attu Island from the Japanese on May 30, 1943, the focus shifted to recapturing Kiska. Over the next few months, intense bombing raids pressed on, and approximately 34,000 U.S. and Canadian forces planned to invade Kiska via sea-going assets; however, in July 1943, 5,100 Japanese troops used the fog to their advantage and in less than one hour, escaped without being detected by both the American and Canadian forces (Spennemann, 2012). Kiska was taken back by the United States and August 15, 1943, marked the end of the Aleutian campaign (Cloe, 1990).

From the end of WWII to present day, there has been no permanent human occupancy on Kiska Island, which has enabled the Kiska battlefield to remain in a state of excellent preservation and one of only two battlefields world-wide where neither previous nor later settlement obscure military developments (Spennemann, 2012). On land, weapons used by the Japanese remain in position, although somewhat weathered and deteriorated. Remnants of a Japanese midget sub, seaplane parts, and anti-aircraft artillery (AAA) litter the once occupied Japanese military installations around Kiska Harbor and a partially sunken Japanese ship, the Borneo Maru, crests above the waters of Gertrude Cove (Figure 1). What are not visible, are the countless ships and planes, now dismembered and most likely the residences of various species of marine flora and fauna, submerged beneath the waters surrounding Kiska Island. This tundra-like and untouched
environment is a land that time seems to have forgot but serves as the haunting reminder of what was once a significant and active battleground.

Figure 1: Remnants of Japanese anti-aircraft gun (left) and midget submarine (right); (Rudis, USFWS)

The remoteness of Kiska, along with the fact that it remains uninhabited, and therefore undisturbed, enhances maritime preservation efforts for the terrestrial and submerged battlegrounds. Kiska lies within the Aleutian Islands (AI) Habitat Conservation Area (HCA) and is also a National Oceanic and Atmospheric Administration (NOAA) fisheries Marine Protected Area (MPA). (Figure 2).

Figure 2: Kiska Island within the Alaska Marine Protected Areas (NOAA)

Kiska Island is encompassed by a Stellar Sea Lion Protected Area (SSLPA), which restricts commercial fishing and has a primary conservation focus in natural heritage meaning that “MPAs or zones established and managed wholly or in part to sustain, conserve, restore, and understand the protected area’s natural biodiversity, populations,
communities, habitats, and ecosystems; the ecological and physical processes upon which they depend; and, the ecological services, human uses and values they provide to this and future generations” (NOAA, 2018). Such human uses include enhancing the education and knowledge of the value of submerged maritime archaeological sites. “Maritime heritage preserves and protects valuable historical, cultural, and archaeological resources within our coastal, marine, and Great Lakes environments and includes not only physical resources such as historic shipwrecks and prehistoric archaeological sites, but also archival documents and oral histories,” (NOAA, 2018). Assessing the Battle of Kiska, through historic documentation like photos, personal accounts, and archival resources allows us to feel a connection to our country’s history and a duty to preserve it. “Maritime heritage resources, when properly studied and interpreted, add an important dimension to our understanding and appreciation of our nation’s rich maritime legacy, and make us more aware of the critical need for us to be wise stewards of our ocean planet” (NOAA, 2018). As a nation that relies on its vast coastline as a source of economic stability and growth, U.S. citizens are obligated to understand and protect the legacy of our maritime culture and heritage.

Project Origin

Project Recover was established in 2012 with sponsorship from private and public entities. It was formalized in 2016 as a partnership among researchers at the University of Delaware’s College of Earth, Ocean and Environment, the Scripps Institution of Oceanography (SIO) at the University of California San Diego (UCSD), and the BentProp Project (Project Recover, 2018). Project Recover merges the latest science and technology with in-depth archival and historical research to locate submerged cultural sites associated with WWII aircraft in an effort to successfully locate American servicemen still unaccounted for and provide closure to family members (Project Recover, 2018).

The footprint for Project Recover is expanding around the globe. In July 2018, Project Recover will conduct an exploratory remote-sensing survey to locate and document WWII-era submerged cultural resources in the waters off Kiska Island, Alaska, an area of cultural significance that has been largely unexplored (Terrill et al., 2018). This archaeological survey is sponsored by NOAA’s Office of Ocean Exploration and Research (OER) (Terrill et al., 2018).

Project Recover’s goals for the Kiska survey are to: provide an inventory of submerged cultural resources associated with the Kiska Island National Historic Landmark and baseline environmental/benthic data for site management and preservation; interpret documented sites though the lens of battlefield archaeology and contextualized within the greater maritime landscape to elucidate our understanding of the Aleutian Campaign; research, develop, and refine new maritime search capabilities, concepts of operations, and data exploitation for maritime archaeology to increase efficiency, accuracy, and cost effectiveness; promote an increased awareness of maritime cultural heritage and the NOAA mission through technology, such as 3D photogrammetric models, that allow a distant public access to one of our country’s most remote battlefield sites; foster a meaningful integration of education and outreach opportunities through this project that
bridges both Science, Technology, Engineering and Mathematics (STEM) related fields and the social sciences by active participation in the field efforts and generation of learning products from the results by way of print media, video/web/social media production, teaching modules, displays, presentations, models, and professional publications; and document and honor the final resting place of 167 U.S. and Japanese service members who lost their lives in the waters surrounding Kiska Island (Terrill et al., 2018).

Purpose

In alignment with the goals of Project Recover, the purpose of this Capstone Project is set forth by the following goals:

- Create a database for Kiska Island including historic and environmental data. Since little is known about the maritime component of the Battle of Kiska in terms of the analysis of submerged wreckage and environmental conditions in the area, including critical habitat and environmental sensitivity data, one composite data source – a geodatabase created via the ArcGIS suite – would serve as an inventory of all said resources. This geodatabase would be of value, especially since the geodatabase and respective metadata can be edited at the convenience of the Project Recover team.
- Use KOCOA analysis for the terrestrial environment to derive assessments about the surrounding maritime environment and cultural resources. Although KOCOA analysis is primarily used for the terrestrial battlefield, it can be applied to the maritime environment (Spennemann, 2011). By interpreting the landscape of the terrestrial battlefield and how it is contextualized within the surrounding maritime landscape, along with understanding each of the elements of KOCOA as they apply to land, similar analysis of why certain events occurred in the maritime environment can be conducted, thus enabling a more comprehensive understanding of the submerged maritime archaeology in the waters surrounding Kiska Island.
- Use analysis to provide recommendations for areas of concern regarding any environmental hazards to ensure a successful and efficient survey. Active sites of munitions and explosives of concern (MECs) have been documented on Kiska Island and in Kiska Harbor and are the remnants of weapons used during the Battle of Kiska over 70 years ago. The geodatabase will be used to conduct analysis of their potential effects on the surrounding biological environment, as well as their location in proximity to the remote-sensing survey sites could prove to be critical information to the Project Recover team, to include divers and survey equipment.
- Implement the geodatabase and environmental support data as a baseline of environmental analysis for future surveys and to promote increased awareness of maritime cultural heritage through Geographic Information System (GIS) technology and capabilities. The utilization of user-friendly products, like the geodatabase, along with key environmental information regarding Kiska Island, will aid in providing insight and recommendations to the Project Recover team, thus contributing to a successful and efficient remote-sensing survey. This may also
increase awareness and education of maritime cultural heritage and the importance of its preservation.

- To have the analysis done in this Capstone project contribute not only to the remote-sensing surveys but to Project Recover’s “big picture,” overall goal, which is to document and honor the final resting place of 167 U.S. and Japanese service members who lost their lives in the waters surrounding Kiska Island (Terrill et al., 2018). The analysis conducted in this project is just a small contribution to help Project Recover locate and repatriate service members that were lost over 70 years ago, however, said analysis will help contribute to the education and preservation of yet another piece of America’s maritime cultural heritage.

**METHODOLOGY**

**The Data**

GIS serves to store, display, and analyze spatial data (ESRI, 2018). The ESRI ArcGIS suite was used to create one composite file geodatabase that stores and displays important historical and environmental data and was also used to perform analyses regarding survey sites and their proximity to habitats and contaminated areas. To begin the creation of the file geodatabase, a basemap of Kiska Island, provided by the Coastal Observation Research and Development Center (CORDC) at SIO, was added in ArcMap in order to add existing shapefiles and digitize those that were created as feature classes in ArcMap.

After adding the basemap and bathymetric data, a file geodatabase containing 21 feature classes (not including the seven feature classes created via geoprocessing tools) was created by compiling existing shapefiles (.zip files) and by creating new feature classes by either deriving references from specific sources or converting .csv files to shapefiles (Table 1). Existing .zip files were downloaded from their source(s), imported into ArcCatalog as a new feature class, then added as a “layer” to the Table of Contents in ArcMap. Shapefiles not already existing or available for download, were created by “creating a new feature class” within the file geodatabase in ArcCatalog. The new feature classes were then added as a “layer” to the Table of Contents in ArcMap and then digitized according to their locations, which were referenced using their respective sources. Data in the form of .csv files were converted to shapefiles by “Adding XY Data” in ArcMap, done by importing the .csv file. The .csv file was then added as XY data to the map and then converted to an actual shapefile, which was then added as a “layer” to ArcMap’s “Table of Contents.” See Table 1 for information regarding the 21 shapefiles.
Table 1: Feature classes downloaded or created in ArcGIS; *denotes data derived from ESI data from the USFWS (Appendix D)

<table>
<thead>
<tr>
<th>Shapefile (Feature Class) Name</th>
<th>Digitized (Y/N)</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWC_Kiska</td>
<td>No</td>
<td>ADF&amp;G (.zip file)</td>
</tr>
<tr>
<td>Bird_Nesting_Colonies*</td>
<td>Yes</td>
<td>USFWS</td>
</tr>
<tr>
<td>Coastline*</td>
<td>Yes</td>
<td>USFWS</td>
</tr>
<tr>
<td>Contaminated_Sites</td>
<td>Yes</td>
<td>Alaska DEC</td>
</tr>
<tr>
<td>Critical_Habitat</td>
<td>No</td>
<td>USFWS (.zip file)</td>
</tr>
<tr>
<td>Fish_Species*</td>
<td>Yes</td>
<td>USFWS</td>
</tr>
<tr>
<td>Habitat_Shoreline*</td>
<td>Yes</td>
<td>USFWS</td>
</tr>
<tr>
<td>Historic_Japanese_Military</td>
<td>Yes</td>
<td>USNPS, PR Team</td>
</tr>
<tr>
<td>Intertidal</td>
<td>No</td>
<td>USFS, UASE</td>
</tr>
<tr>
<td>MPAI_v2017</td>
<td>No</td>
<td>NOAA</td>
</tr>
<tr>
<td>Pier</td>
<td>Yes</td>
<td>USNPS, Google Maps</td>
</tr>
<tr>
<td>Pinniped*</td>
<td>Yes</td>
<td>USFWS</td>
</tr>
<tr>
<td>Place_Names</td>
<td>Yes</td>
<td>USNPS, Google Maps</td>
</tr>
<tr>
<td>Sea_Otter*</td>
<td>Yes</td>
<td>USFWS</td>
</tr>
<tr>
<td>Sediments_Kiska</td>
<td>No</td>
<td>NOAA (.zip file)</td>
</tr>
<tr>
<td>SideScanTracks_1989</td>
<td>No</td>
<td>PR</td>
</tr>
<tr>
<td>Streams</td>
<td>No</td>
<td>USFS, UASE, ADF&amp;G, AHTWG, USGS (.zip file)</td>
</tr>
<tr>
<td>SurveyAreas</td>
<td>Yes</td>
<td>PR Team</td>
</tr>
<tr>
<td>Unconfirmed_Side_Scan_Locations1989</td>
<td>No</td>
<td>PR Team (.csv file)</td>
</tr>
<tr>
<td>Volcano*</td>
<td>Yes</td>
<td>USFWS</td>
</tr>
<tr>
<td>Wrecks_Confirmed</td>
<td>No</td>
<td>PR Team (.csv file)</td>
</tr>
</tbody>
</table>

Attribute tables for each feature class contain information pertaining to the individual feature class. For example, the attribute tables for the shapefiles derived from the United States Fish and Wildlife Service’s (USFWS) Environmental Sensitivity Index (ESI) data contain information from the ESI catalog specific to that digitized shapefile. Downloaded shapefiles (.zip files) already contain attributes created by their original source and .csv files contain coordinate data (XY) that was used to create the shapefile. Other attributes can vary and are typically up to the creator of the feature class in ArcCatalog. Information can be edited. Metadata for all feature classes was added and/or edited in ArcCatalog and can be edited at any time. Metadata can be referenced in Appendix E.

Marine Mammals
Data pertaining to marine mammals was not included in the file geodatabase but compiled in Microsoft Office Power Point format (Appendix B) to be used as a reference or guide by the Project Recover team serving as environmental support information for the Kiska Island maritime environment. Since Kiska Island is within a designated MPA, marine mammals and their resources are protected, therefore they are highly likely to forage and/or rest in the relative area. Marine mammal information was gathered from NOAA’s Alaska Fisheries website and includes marine mammals that could be found in the vicinity of Kiska Island and are either species listed under the Endangered Species Act (ESA) or the Marine Mammal Protection Act (MMPA) (Table 2).
### Marine Mammals Protected by the ESA

<table>
<thead>
<tr>
<th>Marine Mammals Protected by the ESA</th>
<th>Marine Mammals Protected by the MMPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steller Sea Lion</td>
<td>Ribbon Seal</td>
</tr>
<tr>
<td>Blue Whale</td>
<td>Harbor Seal</td>
</tr>
<tr>
<td>Fin Whale</td>
<td>Baird’s Beaked Whale</td>
</tr>
<tr>
<td>Humpback Whale</td>
<td>Harbor Porpoise</td>
</tr>
<tr>
<td>North Pacific Right Whale</td>
<td>Killer Whale</td>
</tr>
<tr>
<td>Western North Pacific Right Whale</td>
<td>Pacific White-Sided Dolphin</td>
</tr>
<tr>
<td>Sperm Whale</td>
<td>Northern Fur Seal</td>
</tr>
<tr>
<td></td>
<td>Dall’s Porpoise</td>
</tr>
<tr>
<td></td>
<td>Minke Whale</td>
</tr>
<tr>
<td></td>
<td>Stejneger’s Beaked Whale</td>
</tr>
</tbody>
</table>

Table 2: Marine mammals that could be found in the vicinity of Kiska Island that are either protected by the Endangered Species Act (ESA) or the Marine Mammal Protection Act (MMPA); Source, NOAA.

### Kelp

Kelp species data were not included in the file geodatabase but compiled in Microsoft Office Power Point format (Appendix A) to be used as a reference or guide by the Project Recover team serving as environmental support information for the Kiska Island maritime environment. General kelp data for all possible kelp found in the area of Kiska Island was gathered (photos and statistics) via the Seaweeds of Alaska website (Appendix A). More specific data for kelp in 24 survey locations around the eastern side of Kiska Island and Little Kiska Island were provided by Dr. Brenda Konar from the University of Alaska Fairbanks (UAF) and Mike Kenner from the University of California Santa Cruz (UCSC). UAF and UCSC conducted the kelp surveys and collected the data, which was gathered in the years 1993, 2008, 2009, 2014, 2015, 2016, and 2017 in one-quarter meter transects at 20-25 feet depth. Of note, not all survey sites were sampled all of the time (in each year). Table 3 contains a list of the kelp species found in the Aleutian Islands based on this research.

#### Table 3:

<table>
<thead>
<tr>
<th><em>Eualaria fistulosa</em></th>
<th>Dragon Kelp</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Laminaria yezoensis</em></td>
<td>Suction-Cup Kelp</td>
</tr>
<tr>
<td><em>Laminaria longipes</em></td>
<td>Northern Rhizome Kelp</td>
</tr>
<tr>
<td><em>Agarum clathratum</em></td>
<td>Sieve Kelp</td>
</tr>
<tr>
<td><em>Agarum turneri</em></td>
<td>Smooth Sieve Kelp</td>
</tr>
<tr>
<td><em>Thalassiothamnion clathrus</em></td>
<td>Spiral Sieve Kelp</td>
</tr>
<tr>
<td><em>Cymathaea triplicate</em></td>
<td>Three-Ribbed Kelp</td>
</tr>
<tr>
<td><em>Desmarestia viridis</em></td>
<td>Stringy Acid Kelp</td>
</tr>
<tr>
<td><em>Alaria marginata</em></td>
<td>Ribbon Kelp</td>
</tr>
<tr>
<td><em>Chorda filum</em></td>
<td>Spaghetti Kelp</td>
</tr>
<tr>
<td><em>Saccharina groenlandica</em></td>
<td>Split Kelp</td>
</tr>
<tr>
<td><em>Saccharina latissimi</em></td>
<td>Sugar Kelp</td>
</tr>
<tr>
<td><em>Saccharina dentigera</em></td>
<td>Northern Stiff-Stiped Kelp</td>
</tr>
<tr>
<td><em>Petalonia fascia</em></td>
<td>False Kelp</td>
</tr>
<tr>
<td><em>Porphyra gardnerti</em></td>
<td>Laver Kelp</td>
</tr>
<tr>
<td><em>Coelosmeme fucicola</em></td>
<td>Fringe Kelp</td>
</tr>
</tbody>
</table>

*Denotes kelp not found in the survey data but could potentially be found in the vicinity of Kiska Island (Seaweeds of Alaska, 2018; Konar and Kenner, 2018).
Survey data for the kelp found in the vicinity of Kiska Island will be extremely useful in terms of knowing where certain species are most likely to be found and will aid in determining what species are more prevalent than others based on patterns found in the survey data. Higher densities of kelp can interfere with Project Recover’s remote-sensing surveys by impeding with the survey equipment (side-scan sonars, multi-beam echosounders, remotely operated vehicles) and can also prevent divers from conducting efficient dive operations.

Tides and Tidal Currents
Tide predictions for Kiska Harbor and Gertrude Cove, for the month of July 2018, were gathered via the NOAA website (Figures 3 and 4). Current predictions for Sea Lion Pass, on the eastern side of Kiska Island, for the month of July, were gathered via the NOAA website (Figure 5). This is the only location closest to Kiska Island in which NOAA had predictive current data.

![Figure 3: Tide predictions for Kiska Harbor, July 2018 (NOAA)](image)
Figure 4: Tide predictions for Gertrude Cove, July 2018 (NOAA)
Figure 5: Tidal current predictions, Sea Lion Pass, July 2018 (NOAA)

Although subject to change based on the fluctuation of local weather patterns, the predictive tide and tidal current data allows the Project Recover team to gain insight as to what to expect in terms of specific tide and current patterns for the month of July, and if necessary, can allow them to adapt to varying tidal and current conditions.
ANALYSIS AND DISCUSSION

Environmental Analysis and Geoprocessing Tools

Habitat Analysis
Geoprocessing is a framework and set of tools for processing geographic and related data and can be used to perform spatial analysis or manage GIS data in an automated way (ESRI, 2018). To determine the habitats residing within the four survey areas, the geoprocessing tool “Intersect” was used in ArcMap. “Intersect” computes a geometric calculation of the input features and features or portions of features which overlap all layers and/or feature classes will be written to the output feature class (ESRI, 2018). The “SurveyAreas” feature class (an input feature) was intersected with the following feature classes (also input features), each individually:

1) Bird_Nesting_Colonies
2) AWC Streams (Anadromous Waters Catalog)
3) Sea_Otter
4) Pinniped
5) Fish_Species
6) Shoreline_Habitat
7) Streams

Upon completion of running the intersect tool seven separate times, each new feature class (output feature) was added as a layer to the Table of Contents in ArcMap for a total of seven new feature classes: NestingColonies_int; StreamsAWC_int; SeaOtter_int; Pinniped_int; Fish_int; Shoreline_int; and Streams_int. Only two of the four survey areas displayed habitats after running the intersect tool: the Gertrude Cove Survey Area and the Kiska Harbor Survey Area. See Figure 6 and Figure 7.
Figure 6: Gertrude Cove Survey Area and habitats

Figure 7: Kiska Harbor survey area and habitats.
Further analysis of the two survey areas was completed in a Microsoft Excel spreadsheet to produce charts that displayed more detailed information about the number of habitats found in each survey area and furthermore, names of species found among fish, nesting birds, and marine mammals (Figures 8 and 9). Images of species in Figure 9 can be found in Appendix C.

Figure 8: Habitats within Kiska Harbor and Gertrude Cove
All species of nesting birds found within the Kiska Harbor survey area are nesting during the months of April through September (USFWS, 2018). Pink Salmon in both the Kiska Harbor and Gertrude Cove survey areas spawn during the months of July through September, therefore the adults of these species will be found within these locations from July through September, more specifically at the anadromous waterways and streams found within the survey areas (USFWS, 2018). The Dolly Varden can be found at both survey areas throughout the year, both as juveniles and adults (USFWS, 2018). Adult Coho Salmon are only present during their spawning season, which is from October through December (USFWS, 2018). Steller Sea Lions are federally endangered and can be found around the coastline of Kiska Island throughout the year (USFWS, 2018). Since their haul out location is primarily in the Kiska Harbor survey area, based on the analysis, it is important to note that their pupping season is from May through July and their molting season is from July through December (USFWS, 2018). The Northern Sea Otter pupping season is the month of May (USWFS).

Through analysis done via the “Intersect” geoprocessing tool, in conjunction with the USFWS habitat information, it can be concluded that during the month of July, which is when the Project Recover remote-sensing surveys will take place around Kiska Island, that the team be aware of the presence of nesting birds, the presence of Pink Salmon and Dolly Varden and the fact that it is the spawning season for both, the Steller Sea Lion pupping and molting season, and also the presence of the Northern Sea Otter.

Shoreline Analysis
The “Intersect” geoprocessing tool was also used to determine the type of shoreline habitats within the survey areas. The “SurveyAreas” feature class was intersected with
the “Shoreline_Habitats” feature class; the output feature class was named “Shoreline_int.” Only two of the four survey areas displayed shoreline habitats within their bounds: Gertrude Cove and Kiska Harbor (Figure 10 and Figure 11).

Figure 10: Gertrude Cove Survey Area and shoreline types.
The purpose of running the intersect tool for the shoreline habitats was to display the types of coastline within the survey area. “Assessment of the environmental sensitivity of a particular intertidal habitat is based on an understanding of the dynamics of the coastal environments, not just the substrate type” (USFWS, 2018).

- Exposed rocky shores are where “the intertidal zone is composed of bedrock, steep (greater than 30° slope), and thus very narrow; sediment accumulations are uncommon because waves remove the debris that has slumped from the eroding cliffs; they are regularly exposed to wave action and strong currents; attached organisms are accustomed to the impacts of the waves and the associated hydraulic pressure; there is strong vertical zonation of intertidal biological communities; species density and diversity vary greatly, but barnacles, snails, mussels, and macroalgae dominate; they are common throughout the area along headlands and offshore islands wherever there is open fetch facing the direction of storm-generated winds” (USFWS, 2018).

- Exposed wave-cut platforms in bedrock are where “the shores consist of a bedrock shelf or platform of variable width (up to hundreds of meters wide) and very gentle slope; the surface of the platform is irregular and the presence of tidal pools is common; the shoreline may be backed by a steep rock scarp or low bluffs; there may be a narrow gravel beach at the base of the scarp; species density and diversity varies greatly, but barnacles, snails, mussels, and macroalgae are often very abundant; attached organisms are accustomed to the impacts of the waves and the associated hydraulic pressure” (USFWS, 2018).
- Fine to medium-grained sand beaches are where “the beaches are flat to moderately sloping and relatively hard packed; they are composed of predominantly quartz sand; they are utilized by birds for resting and foraging; backshore habitats include dunes and wetlands which are important seasonally as nesting areas for birds” (USFWS, 2018).
- Salt and brackish water marshes can vary in width, “from a narrow fringe along lagoons to extensive areas at stream mouths, though most marshes are small in area; sediments are composed of mixtures of mud, sand, and gravel; resident flora and fauna are abundant with numerous species and high utilization by birds, fish, and shellfish” (USFWS, 2018).

Rocky shorelines and shorelines with wave-cut platforms in bedrock may experience more wave action, so close proximity to that type of shoreline habitat may be hazardous to survey vessels and divers. Fine to medium-grained sand beaches may be conducive to beach landings. All three shoreline habitat classifications are critical habitat areas of pinnipeds and are also conducive to inhabiting nesting birds. These shoreline types may also serve as the transition zone of salt water habitats and the salt and brackish water marsh habitats, in which a variety of diverse marine flora and fauna may reside.

**Contaminated Areas**

Analysis of the contaminated areas was conducted without the use of geoprocessing tools because there were only two specified areas, one of which is terrestrial based. The second site is located at the center of Kiska Harbor. Both areas are important to consider when assessing contamination in the Kiska Harbor survey area.

“Terrestrial research and historical data have shown that due to the high amount of activity at Kiska Island during WWII, there remains a high amount of MECs scattered across Kiska Island, as well as in its coastal waters, which was noted in an underwater survey conducted in 1989” (Rudis, 2013). “MECs do pose potential physical hazards to divers but present a low ecological risk under expected scenarios in the marine environment because any chemical releases would only directly affect sediments” (Rudis, 2013).

Contaminants derived from WWII activity on Kiska Island were observed by the USFWS during a series of investigations during 1987-1990, in which “visual observations were made of waste, debris, and oil contaminants, as well as potential runoff of these contaminants into adjacent harbors and coastlines, which have been determined to pose ecological and human risks” (Rudis, 2013). “At some sites, fuel products have been leaking since WWII, including submerged wreckage” (Rudis, 2013). The terrestrially situated site is elevated and several streams, including an anadromous waterway, reside in its vicinity, flowing downslope and emptying into Trout Lagoon and potentially Kiska Harbor. This contaminated area, known as the Kiska Island Garrison, has been assessed by the Alaska Department of Environmental Conservation (ADEC) Spill Prevention and Response (SPR) to have “petroleum and lubricant contamination” (ADEC SPR, 2017).

Due to the Japanese invasion in 1942, and the fact that the Japanese established military installations on Kiska and ran their operations here for over a year, petroleum, oil and
lubricants (POL) tanks and POL contaminated soil are still present here (ADEC SPR, 2017). “Numerous contaminants have been identified at this site ranging from polycyclic aromatic hydrocarbons (PAH’s) to polychlorinated biphenyls (PCB’s) to POL’s” (ADEC SPR, 2017). The contaminated area in Kiska Harbor, the Kiska Island Naval Defensive Sea Area (NDSA), is “composed of the underwater areas surrounding Kiska Island where Munitions and Explosives of Concern (MEC) were historically deposited/disposed as a result of DoD activities” (ADEC SPR, 2017). This area has also been assessed by the ADEC SPR and MEC may be present in the near-shore environment of Kiska Harbor, as well as submerged across the harbor (ADEC SPR, 2017). Japanese occupation of Kiska Island from June 1942 to July 1943, and their use of Kiska Harbor to transport munitions from ship to land and vice versa, as well as establishing AAA and Coastal Defense Artillery (CDA) that fired munitions over-water, deposition of MECs at the bottom of Kiska Harbor was quite frequent, whether it was accidental or intentional, in terms of military operations against the U.S. (ADEC SPR, 2017) (Figure 12).

![Contaminated Sites at Kiska Harbor Survey Area](image_url)

**Figure 12:** Kiska Harbor survey area and contaminated sites and submerged wrecks.

**KOCOA Analysis**

KOCOA analysis is “primarily used for land-based combat between two opposing forces” and is “inherently unsuited for open sea Naval Warfare or for aerial warfare” (Spennemann, 2011). “KOCOA is also of limited use in a situation where an opposing force holds an environmentally circumscribed terrain, such as an island, but where no ground-to-ground combat occurred” (Spennemann, 2011) (Figure 13). Despite the fact
that Kiska Island is not a traditional battlefield in the sense that no ground-to-ground combat took place, KOCOA can still be loosely applied to the maritime environment surrounding the terrestrial battlefield (Spennemann, 2011).

<table>
<thead>
<tr>
<th>Battlefield Element</th>
<th>Definition</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key Terrain</td>
<td>A portion of the battlefield, possession of which gives an advantage to the possessor.</td>
<td>Road junctions, bridges, high ground.</td>
</tr>
<tr>
<td>Observation and Fields of Fire</td>
<td>Any point on the landscape that allows observation of the movements, deployments, and activity of the enemy that is not necessarily key terrain, offers opportunity to see over an area and acquire targets, and allows flat-trajectory weapons to be brought to bear on the enemy.</td>
<td>High ground, sloping approaches to entrenched positions.</td>
</tr>
<tr>
<td>Cover and Concealment</td>
<td>Landforms or landscape elements that provide protection from fire and hide troop positions from observation.</td>
<td>Walls, structures, forests, ravines, riverbanks, entrenchments, ditches.</td>
</tr>
<tr>
<td>Obstacles</td>
<td>Landscape elements that hinder movement and affect the ultimate course of the battle.</td>
<td>Rivers, walls, dense vegetation, fortifications, ravines, ditches.</td>
</tr>
<tr>
<td>Avenues of Approach</td>
<td>Corridors used to transfer troops between the core battle area and outer logistical areas.</td>
<td>Roads, paths, creek beds, railroads</td>
</tr>
</tbody>
</table>

Figure 13: Definitions of KOCOA Battlefield Evaluation System used by the NPS (Spennemann, 2011).

**Key Terrain:** Spennemann (2011) states that “all of Kiska that was occupied and defended by the Japanese was key terrain.” From historical data added as the feature class “Japanese_Historical_Data” in the file geodatabase for this project, Japan had an advantage to overtaking and occupying Kiska. They utilized the island to establish a seaplane base and submarine base, as well as several areas of concentrated AAA and CDA – all of which enabled them to carry out their operations against the U.S. Japanese occupation was established on the eastern side of Kiska Island (Kiska Harbor area) suggesting that this side of the island was key terrain more so than the western side; the shelter of the harbor along with the beach slope composed of fine-grained sand made
this area conducive for a submarine and seaplane base and for cargo ships to offload supplies (Figure 14).

**Observation and Fields of Fire:** Japan established AAA and CDA sites on both sides of Kiska Harbor that were also on elevated ground giving them an advantage to detect incoming U.S. bombing raids. “The first Japanese medium Anti-Aircraft (AA) position was set up on the rise just inland from what was to become known as the main camp area” (Spennemann, 2011). There were also AA establishments on elevated ground both south of Kiska Harbor (South Head area) and the North Head area (Figure 14). These AA positions would “provide an effective coverage of Kiska Harbor above 500 feet, which would cover all but low-flying strafing aircraft for most of the approaches (and) any aircraft that flew above 1,000 feet was at risk from AA fire” (Spennemann, 2011). Japan also used its ships for AA fire, almost all of which resided in Kiska Harbor. On the other hand, during the Battle of Kiska, the U.S. used all of the island as their “fields of fire,” since their raids were all airborne.

**Cover and Concealment:** “Concealment could play a vital role in how ships were deployed during the course of a battle. Islands could be used to conceal vessels or even entire fleets” (Sabick and Dennis, 2011). Spennemann (2011) documents that landings by the Japanese were “shielded by the elevation of North Head (the northern area of Kiska Harbor) and that the approach was shielded until less than 1,000 yards away.” The weather itself, particularly cloud cover and fog, served as a form of “cover and
concealment” for both the U.S. and Japanese during the Battle of Kiska. The weather hampered the air attacks conducted by the U.S. on Kiska from both the east and the west. The west approach provided more concealment than the east approach due to the elevated terrain.

**Obstacles:** Pertaining to the maritime environment, like that of Kiska Island, obstacles can take on a number of forms, such as islands, reefs, shoals, shallow water, strong currents, high winds, and fog – all of which are natural obstacles (Sabick and Dennis, 2011). The weather in Kiska is notoriously hazardous and was the main cause of many of the shipwrecks and air collisions during the Battle of Kiska, which, in turn resulted in both Japanese and American casualties. “Regarded as one of the cloudiest regions of the Northern Hemisphere, the Aleutian Chain experiences broken to overcast conditions for more than 90% of the time, with only two to four clear days a month” (Spennemann, 2011). Kiska Island is composed of extremely soft, soot-like sediment due to volcanic ash so it’s underfoot is more consistent with that of tundra-like conditions making it difficult for the Japanese to navigate the island by foot or vehicle. However, during the Battle of Kiska, the Japanese experienced little to no obstacles except for the weather. The U.S. had to overcome the obstacles of both the weather and the terrain, flying around the Kiska Volcano (1,220 meters elevation) either on a west or east approach.

**Avenues of Approach and Withdrawal:** “In principle, the U.S. aircraft had a limited number of options for attacking the harbor. Unless they flew very low, using the landforms for concealment, their approaches would have been noted, giving the Japanese sufficient time to man the AA positions” (Spennemann, 2011). The U.S. approached Kiska Harbor from the east or the west: the eastern approach was “through the mouth of the Harbor and gave the U.S. pilots time to choose and line up their targets as the approached;” the western approach was “flying through the pass just to the west of Trout Lagoon but depending on the height of the approach, some or much of the approach would have been concealed, thus possible catching the Japanese off-guard” (Spennemann, 2011). Approaches by the U.S. from the east (Figure 15) “gave the Japanese AA gunners time to spot and aim at incoming aircraft” and the western approach (Figure 16), with the surrounding hillsides, “offered the pilots no escape route, and as a result, the Japanese AA gunners could follow a plane in or out, without having to readjust their aim” (Spennemann, 2011). Whether from the east or the west, the U.S. approaches to Kiska Island were aimed at bombing Kiska Harbor in order to destroy Japanese cargo ships filled with military supplies, thus potentially crippling the Japanese Army and Navy. The Japanese would respond to the U.S. approaches by aiming and firing their AA guns and as seen in Figure 13, the majority of wrecks and other submerged military assets, both U.S. and Japanese, are found in Kiska Harbor.

On July 28, 1943, the Japanese withdrew from Kiska Island by successfully embarking over 5,000 Imperial Japanese Army and Navy personnel on eleven ships in under an hour, then slipping through the cover of the fog (Spennemann, 2011). The U.S. continued to conduct bombing raids over Kiska Harbor, for the next month, unbeknownst to them that all Japanese forces had quietly disappeared and that they were conducting operations against an abandoned landscape.
Figure 15: Approach from the east by U.S. aircraft over Kiska Harbor (Spennemann, 2011).

Figure 16: Approach from the west by U.S. aircraft over Kiska Harbor (Spennemann, 2011).
KOCOA analysis for Kiska can aid in understanding what remains today, both on land and what is submerged in the surrounding waters. By considering all elements of KOCOA and how they apply to both the U.S. and Japanese operations, more insight is gained as to why the eastern side of the island was heavily occupied by the Japanese. The key terrain of Kiska Harbor was conducive to the establishment of the Japanese military installations. By knowing this, it is evident as to why the U.S. approached Kiska Harbor, be it from either the east or west, when conducting their bombing raids. It can then be deduced that the majority of wreckage from airplanes, submarines, and ships rest at the bottom of Kiska Harbor and that the remote-sensing surveys would most likely find the majority of the submerged archaeology from the Battle of Kiska in this location.

KOCOA analysis also enhances the understanding of why the contaminated area in Kiska Harbor is present: the main camp area, the submarine base, and the seaplane base are all adjacent to the harbor and from those areas the majority of AA fire and MECs originated, most of which were lost at the bottom of the harbor. The majority of wreckage of planes, ships, and submarines carrying POLs and MECs also rest at the bottom of Kiska Harbor, further contributing to the contamination found at this site.

The use of KOCOA analysis, specified by the United State National Park Service (NPS), represents a means of understanding the geographical realities of combat, and combat decisions and capabilities, therefore rendering the importance of preservation of history, culture, and heritage.

**CONCLUSION**

The overall research of Kiska Island’s military history, the collection of data pertinent to the surrounding biological and physical environments, and the analysis of said data, all aided in meeting the goals set forth for this Capstone project.

One composite geodatabase was created via the ArcGIS suite and contains 28 feature classes, along with their respective metadata. This geodatabase represents an inventory of baseline historical and environmental data that can be used in the planning stages of the survey, as well as in the field and can be edited at the convenience of the Project Recover team. The geodatabase aided in the application of KOCOA analysis, as it helped contextualize the maritime landscape with the surrounding terrestrial landscape of Kiska Island. By using KOCOA analysis of the terrestrial environment surrounding Kiska Harbor, assessments about the surrounding maritime environment were derived, thus enhancing the understanding of why the Kiska Harbor area contained the majority of submerged wreckage, as well as active MEC sites. The geodatabase was used to enhance further analysis of the active MEC sites, and it was also used to further analyze the habitats and environmental sensitivity surrounding the remote-sensing survey areas, via geoprocessing tools. These analyses will provide the Project Recover team with critical information regarding these areas of concern and their locations in reference to the survey sites, potentially aiding in decision-making and recommendations, which will help to ensure another successful and efficient survey. The implementation of the geodatabase,
along with environmental support data, will serve as a baseline of environmental and historical analysis for future surveys and will promote increased awareness of maritime cultural heritage through GIS technology and capabilities.

The aforementioned goals of this project, successfully achieved through the utilization of research, various methods of analysis, and GIS technology, will inevitably contribute to the ultimate goal of Project Recover, which is also the overall goal of this Capstone Project: to document and honor the final resting place of the U.S. and Japanese service members whose lives were lost over 70 years ago in the water surrounding the Kiska Island National Historic Landmark Maritime Battlefield. Furthermore, outreach and education of such success could be paramount in ensuring that future generations will be inclined to continue the preservation of maritime cultural heritage and that history will forever continue to be repatriated and honored.
REFERENCES


USFWS. “Coastal Resources Inventory and Environmental Sensitivity Maps: Aleutians West Coastal Resource Service Area.” 1 May 2018. PDF File. Provided by USFWS.
APPENDIX

A: Kelp Information

Types of Kelp Found in the Vicinity of Kiska Island

Source for all photos and text: seaweedsofalaska.com

*Agarum clathratum* (aka Sieve Kelp)

**Description:** Thallus of this medium brown kelp has a branched holdfast (haptera), a stipe up to 30 cm (12 in) long, a stiff blade riddled with small, distinctive holes, and a wide midrib. The blade grows to 90 cm (35 in) long and 50 cm (20 in) wide. When present, fertile patches (sori) are found toward the edges of the blade. **Habitat:** This perennial kelp is found on rock in the very low intertidal to subtidal (to a depth of at least 15 m or 50’) and prefers a semi-protected habitat. **Similar taxa:** *Agarum fimbriatum, A. turneri, Thalassiophyllum.*
**Eulalia fistulosa** (aka Dragon Kelp)

**Description:** Thallus of this canopy-forming kelp is brown with a large branching holdfast (hapterea), a stipe 25 cm (10 in) long, and a blade with midrib up to 25 m (82 ft) long and 1 m (3.2 ft) wide. The midrib is 2-3 cm (0.8-1.2 in) wide with gas-filled chambers (fistulae) that hold the blade in the water column. Reproductive sporophylls develop on the upper portion of the stipe. **Habitat:** This fast growing annual occurs on rock from the low intertidal to subtidal and forms offshore kelp beds in cold, semi-protected to exposed habitats.

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**Alaria marginata** (aka Ribbon Kelp)

**Description:** Thallus of this common intertidal kelp is brown with a branched holdfast (hapterea), a stipe, cylindrical near the base but flattened near the blade, that can reach 30 cm (12 in) or more in length, and a thin, lanceolate blade up to 3 m (10 ft) long with solid midrib. Twenty to forty elliptical sporophylls form in spring on the upper portion of the stipe and grow up to 25 cm (10 in) long, thickening with maturity. **Habitat:** This kelp is an annual found on rock in the mid to low intertidal from semi-protected (if there is sufficient current) to exposed habitats.
**Chorda filum** (aka Spaghetti Kelp)

**Description:** This light brown kelp has a long, firm, smooth, cylindrical, whip-like thallus 0.5 cm (0.2 in) in diameter and up to 1 m (3.3 ft) or more tall, which tapers to a tiny discoidal holdfast. Air pockets are visible inside the thallus, causing the thallus to float toward the surface. There are no constrictions along the thallus. **Habitat:** This uncommon kelp is an annual and may be found growing on rock (often pebble or cobble) in the very low intertidal to upper subtidal in protected habitats with slight current. **Similar taxa:** *Scytosiphon lomentaria, Halosiphon tomentosus.*

![Image of Chorda filum](image1)

**Cymathaera triplicate** (aka Three-Ribbed Kelp)

**Description:** Thallus of this light to sometimes reddish-brown kelp has a discoidal holdfast, a stipe up to 25 cm (10 in) long, a linear blade up to 4 m (13 ft) long and 18 cm (7 in) wide, and three riblike folds. No other kelp has this configuration. This species has a distinctive cucumber-like aroma that can often be smelled before the kelp is seen, but the species is not palatable. **Habitat:** This annual kelp grows on rock (often cobble) in the low intertidal to upper subtidal from semi-protected to semi-exposed habitats.

![Image of Cymathaera triplicate](image2)
**Saccharina groenlandica** (aka Split Kelp)

**Description:** Thallus of this common kelp is medium to dark brown with a branched holdfast (hapter), a stipe up to 60 cm (24 in) long with microscopic mucilage ducts, and a blade up to 2 m (6 ft) long. The blade is often bullate when young but becomes thicker and smoother with age; it often splits into 2-3 segments. The stipe is cylindrical at the holdfast but is often flattened at the base of the blade. **Habitat:** This perennial kelp is found on rock in the low intertidal to shallow subtidal zones and occurs in semi-protected to semi-exposed habitats.

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**Laminaria longipes** (aka Northern Rhizome Kelp)

**Description:** Thallus of this brown kelp has a branched, rhizomatous holdfast, with numerous stipes arising from the extensive holdfast structure. A long, narrow blade, less than 5 cm (2 in) wide and up to 50 cm (20 in) long, extends from each stipe. *Cololodesme fucicola* and *Porphyra gardneri* are common epiphytes along old blade margins. **Habitat:** This perennial kelp grows on rock in the low intertidal of semi-exposed to exposed habitats. **Similar taxa:** *Lessoniopsis* also has narrow blades but a different holdfast.
**Saccharina latissima** (aka Sugar Kelp)

**Description:** Thallus of this very common kelp is light to medium brown with a finely branched holdfast (haptera), a cylindrical stipe up to 50 cm (20 in) long without mucilage ducts, and a blade up to 3.5 m (10 ft) long. The blade is moderately thin and undulate and frequently has rows of blister-like swellings or puckers (bullations) near the base. **Habitat:** Although this kelp is considered a perennial, the blade dies back in the fall/winter and re-grows in the spring. It attaches to rock in the low intertidal to subtidal and prefers protected to semi-protected habitats. **Similar taxa:** Saccharina subsimplex.

**Laminaria yezoensis** (aka Suction-cup Kelp)

**Description:** Thallus is medium to dark brown with a large disc- or suction-cup-like holdfast, a somewhat rigid stipe up to nearly 1 m (37 in) long although it is often shorter, and a thick blade that can be nearly as wide as long. The blade is usually split and has mucilage ducts, which are visible microscopically. **Habitat:** This perennial kelp is found on rock in the extreme low intertidal to subtidal zones from semi-protected to exposed habitats. **Similar taxa:** Laminaria solidungula, Saccharina spp.
**Petalonia fascia** (aka False Kelp)

**Description:** The thallus is a light to medium brown blade that tapers below to a tiny discoidal holdfast but lacks the complex cell differentiation of true kelps. The blade is thinner than kelps, and the margins are smooth. The thallus can grow up to 35 cm (14 in) tall. **Habitat:** This annual is found growing on rock in the mid intertidal to shallow subtidal from protected to semi-exposed habitats. **Similar taxa:** young *Laminaria*, young *Sacchorina*, *Punctaria*.

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**Agarum turneri** (aka Smooth Sieve Kelp)

**Description:** Thallus is a smooth, ovate brown blade to 90 cm (35 in) long and 30 cm (14 in) wide with a flattened midrib, large circular holes, and a branched holdfast. **Habitat:** The species occurs subtidally to at least 20 m depth in semi-exposed habitats. It is currently not considered a separate species from *A. clothratum* but is morphologically distinct.
**Thelassiothyllum clathrus** (aka Spiral Seive Kelp)

**Description:** Thallus of this unique kelp is brown with a branched holdfast (hapterae) and a woody stipe that is spirally twisted due to meristematic growth from which new blades unfurl. The blade can grow up to at least 50 cm (20 in) long and has somewhat regular perforations. Reproductive patches (sori) develop on the older portions of the blade. **Habitat:** This perennial kelp is found on rock in the very low intertidal and shallow subtidal and prefers semi-exposed habitats. It is also found in tidepools. **Similar taxa:** *Agarum*.

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**Porphyra gardneri** (aka Laver Kelp)

**Description:** Thallus is somewhat oval, to 12 cm (5 in) long, reddish pink, one cell layer thick, with the margin slightly ruffled to somewhat ragged. Sexes are intermixed. **Habitat:** This species grows in large numbers along the edges of blades of *Laminaria* and sometimes other kelps in the low intertidal and subtidal of semi-exposed and exposed habitats. **Similar taxa:** *Porphyra variegata*, another common epiphyte on kelps, is larger and has a blade sectored into separate male and female "halves".
**Coilodesme fucicola** (aka Fringe Kelp)

**Description:** Thallus is a flattened, obovate to elongate, light brown sac, with a narrow stipe, to 13 cm (5 in) tall and 0.8 cm (0.3 in) wide, attached by an inconspicuous discoidal holdfast. **Habitat:** This species grows in abundance along the margin of kelps, particularly *Laminaria longipes*, in the low intertidal of semi-exposed habitats.

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**Desmarestia viridis** (aka Stringy Acid Kelp)

**Description:** The light brown thallus has a cylindrical central axis, opposite branching, and a discoidal holdfast. The thallus is often delicate. It grows up to 120 cm (48 in) tall and is considered the most acidic of all the acid kelps, destroying itself and other seaweeds when damaged by releasing sulfuric acid. **Habitat:** This perennial is found on rock in the very low intertidal to subtidal zones in semi-protected to exposed habitats. **Similar taxa:** *Chordaria, Dictyosiphon.*
**Saccharina dentigera**
(aka Northern Stiff-Stiped Kelp)

**Description:** Thallus is dark brown, thick, reaching 1.5 m (5 ft) tall. The holdfast is branched, the stipe somewhat rigid, and the blade often split down to 10 cm above its base. Mucilage ducts occur near the surface of stipe. **Habitat:** This perennial is found on rock in the very low intertidal to shallow subtidal. **Similar taxa:** *Saccharina subsimplex*
Marine Mammals Found in the Vicinity of Kiska Island, Aleutian Chain, Alaska

(Marine mammals are listed under either the Endangered Species Act (ESA) or the Marine Mammal Protection Act (MMPA))

Source for all photos: NOAA

Steller Sea Lion (critical habitat)
Humpback Whale (ESA)

N. Pacific Right Whale (ESA)
Sperm Whale (ESA)

Western N. Pacific Gray Whale (ESA)
Ribbon Seal (MMPA)

Harbor Seal (MMPA)
Baird’s Beaked Whale (MMPA)

Harbor Porpoise (MMPA)
Killer Whale (MMPA)

Pacific White-Sided Dolphin (MMPA)
Northern Fur Seal (MMPA)

Dall’s Porpoise (MMPA)
Minke Whale (MMPA)

Stejneger’s Beaked Whale (MMPA)
Species From the Kiska Harbor and Gertrude Cove Survey Areas
(Nesting Birds, Anadromous Fish, Marine Mammals)

Nesting Birds

Pigeon Guillemot

Glaucous-winged Gull

Photo credit: All About Birds

Photo credit: National Audubon Society
Anadromous Fish

Pink Salmon

Dolly Varden

Photo credit: Alaska Dept. of Fish & Game

Anadromous Fish

Coho Salmon

Photo credit: NOAA Fish Image
Marine Mammals

Steller Sea Lion

Northern Sea Otter

Photo credit: NOAA

Photo credit: Alaska Dept. of Fish & Game
Coastal Resources Inventory and Environmental Sensitivity Maps: Aleutians West Coastal Resource Service Area

Introduction

Marine Fisheries Service, as well as other state and federal agencies and local councils, have identified and depicted in the maps the key biological resources that are most likely to risk the event of an oil spill. The maps are intended to be used as a tool in the management of the biological resources and to be used as a guide for the planning and implementation of oil spill contingency plans. The maps are intended to be used as a tool in the management of the biological resources and to be used as a guide for the planning and implementation of oil spill contingency plans.

Spatial distribution of the species on the maps is represented by polygons, color bands, and as proportions. The size of the polygons is an indication of the size of the area that contains the species of interest. The size of the color bands is an indication of the proportion of the area that contains the species of interest. The size of the proportions is an indication of the proportion of the area that contains the species of interest.

For many biological resources, information and expert knowledge may not be available for all geographic locations. For this reason, absence of a resource on a map does not necessarily mean it is not present. Under the descriptions of the various biological resource groups, the geographic limits of available knowledge or the survey boundaries of particular species are given when known.

Marine Resources

Marine resources depicted in the Aleutians West area also include seals, sea lions, walruses, and cetaceans. Although these species are not shown on the maps, they are included in the assessment and management of the marine environment. The maps are intended to be used as tools for the planning and implementation of oil spill contingency plans. The maps are intended to be used as tools for the planning and implementation of oil spill contingency plans.

Expert contacts for marine resources are available for the Aleutians West area from the NMFS National Marine Mammal Laboratory, Seattle, Washington; Dr. Smith, NMFS, Anchorage, Alaska; and USFWS Marine Mammal Management, Anchorage, Alaska.

Although birds are a major resource shown on the Aleutian West area maps, seabird concentrations are shown only where surveys have been conducted. Seabird nesting information was obtained from the Bird Atlas (1980) and (1981). The maps do not show the location of the nests of the species shown on the maps, but they do show the location of the species shown on the maps. The maps do not show the location of the nests of the species shown on the maps, but they do show the location of the species shown on the maps.

Each species is shown on the maps for the Aleutians West area with a unique color, symbol, letter, or number. In some cases, a species is shown on the maps for more than one year. In these cases, the maps show the location of the species shown on the maps for the year when the species was last shown on the maps. In some cases, a species is shown on the maps for more than one year. In these cases, the maps show the location of the species shown on the maps for the year when the species was last shown on the maps.
Coral and brown coral concentrations are shown on the map as polygons with an orange hatch pattern. If multiple Rooms types are linked and occupy the same polygon, a black-meshed multi-room polygon is used. A range tone with a color alias is associated with the polygons representing the distribution of color.

The MSF positioned under the oak tree links to a table on the reverse side of the map. In this table, the first column gives the species name, the second column describes the species, and the third column gives the scientific name. Each row contains information on one species. The table includes information on species diversity and distribution, as well as habitat requirements.

The MSF positioned under the oak tree links to the species-specific habitat requirements table. Each row in this table provides detailed information on the specific habitat requirements of each species.

Giant kelp beds can be found throughout the main islands. The highest densities of kelp are in the sheltered bays, however, kelp beds are also found in the open coastal waters around the islands. Egg masses are only mapped to the areas when they have been reported as being present, but kelp beds are shown as a character, extending along the coastline of all of the islands. For many species there is a temporal shift in seasonality and life-history along with spatial changes in location. Temporal information included in the tables is specific to the same polygon or site for all kelp beds.

HUMANITIES FEATURES

The human-human uses depicted on the maps are limited below. All features are represented by icons indicating the type of human use.

Minerals

Arable

Forestry

Mineral Resources

Volumetric data [Table 1]

MINING RESOURCES

Exploited and unexploited mineral resources are illustrated in the Minerals section. Gold, silver, copper, iron, limestone, coal, and placer deposits are illustrated.

AIRPORT FEATURES

The Aerial Zephyr A, being the product of long-term and ongoing utilization, is rich in geological resources. The most recent completion of the geological resources of the Zephyr was produced by Mairet et al. (1983), and was the primary source of geological information included in this atlas.

The geospatial databases of the Minerals are all compiled and maintained by the U.S. Geological Survey. The databases are updated regularly to reflect new data acquisition and changes in the resource base.

MINING RESOURCES

Exploited and unexploited mineral resources are illustrated in the Minerals section. Gold, silver, copper, iron, limestone, coal, and placer deposits are illustrated.

AIRPORT FEATURES

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MINING RESOURCES

Exploited and unexploited mineral resources are illustrated in the Minerals section. Gold, silver, copper, iron, limestone, coal, and placer deposits are illustrated.
The term tsunami applies to (improperly as opposed to incorrectly) generated greatly severe waves. They can be produced in three ways: 1) uplift or drop of a large area of the ocean floor during earthquakes, 2) tsunamis or subduction zone tsunamis, or 3) tsunamis associated with volcanic eruptions.

It is a common misconception that tsunamis are always triggered by submarine earthquakes. While some tsunamis are generated by submarine earthquakes, it is also possible for tsunamis to be generated by other processes, such as landslides, volcanic eruptions, and even the sudden release of water from a dam.

The process of tsunami generation is complex and can involve a variety of factors. In general, a tsunami is generated when a large volume of water is suddenly displaced or released, causing a disturbance in the ocean that propagates outward as a wave.

The characterization of tsunami waves is crucial for understanding their potential impact. Tsunamis can be classified based on their frequency, magnitude, and distance traveled. For example, tsunamis generated by earthquakes tend to be larger and travel longer distances than those generated by landslides or volcanic eruptions.

In summary, tsunamis are a significant natural hazard that can cause widespread destruction and loss of life. Understanding the processes that generate tsunamis and developing effective warning systems are essential for mitigating the impact of these events.

REFERENCES

For a comprehensive list of references, please consult the original source or related scientific literature.
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**SPECIES LIST**

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**SHELLFISH**

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**MARINE MOLLUSKS**

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**PLANTS**

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**SAV**

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</table>

* Threatened and endangered species are designated by underline.
SHORELINE DESCRIPTIONS

EXPOSED ROCKY SHORES

DESCRIPTION:
- The shoreline is composed of bedrock, steep (greater than 30°) slopes, and few wave refraction patterns.
- Wave refraction patterns are accentuated by waves focusing the energy of breaking waves.
- Attached vegetation is minimal due to the presence of tidal pools and the potential for wave refraction patterns.
- Sea birds may include seagulls, cormorants, and terns.
- Shoals are common throughout the area.
- Marshes and marshy areas are uncommon.

PREDICTED BEHAVIOR:
- Oil will be dispersed over the surface of the water, creating a thin film.
- Oil may accumulate on the shore, creating a visible sheen.

RESPONSE CONSIDERATIONS:
- Containment may not be necessary.
- shoreline clean-up may be required.
- Access can be difficult and dangerous.

EXPOSED WAVE-CUT PLATFORMS IN BEDROCK

DESCRIPTION:
- These areas are characterized by wave-cut platforms and open slopes.
- The presence of tidal pools is common.
- The shoreline may be undercut by a steep rock overhang.

PREDICTED BEHAVIOR:
- Oil will disperse over the surface of the water, creating a visible sheen.
- Oil may accumulate on the shore, creating a visible sheen.

RESPONSE CONSIDERATIONS:
- Containment may not be necessary.
- shoreline clean-up may be required.

MIXED SAND AND GRAVEL BEACHES

DESCRIPTION:
- These beaches are composed of sand and gravel.
- They are often adjacent to areas with wave refraction patterns.
- Waves focus the energy of breaking waves.

PREDICTED BEHAVIOR:
- Oil will disperse over the surface of the water, creating a visible sheen.
- Oil may accumulate on the shore, creating a visible sheen.

RESPONSE CONSIDERATIONS:
- Containment may not be necessary.
- shoreline clean-up may be required.

OBSERVATIONS:
- In-place nesting may be used to reach deeply buried oil layers in the middle and upper zones.
- Mechanical scraping of oil from the surface may be ineffective in areas regularly exposed to wave action.

NEW - Page 9

COARSE-GRANULED SAND BEACHES

DESCRIPTION:
- These beaches are wide and have relatively steep beach faces and sand stabilization.
- They can undergo rapid erosion/subsidence cycles, even within one tidal cycle.
- They are utilized by birds and mammals for nesting and foraging.
- Beachrock formations include dunes and ridges, which are important as nesting areas for birds.

PREDICTED BEHAVIOR:
- Oil accumulation may be dispersed as oily sheen on the surface.

RESPONSE CONSIDERATIONS:
- Containment may not be necessary.
- shoreline clean-up may be required.

MIXED SAND BEACHES

DESCRIPTION:
- These beaches are composed of sand and gravel.
- The presence of tidal pools is common.
- The shoreline may be undercut by a steep rock overhang.

PREDICTED BEHAVIOR:
- Oil will disperse over the surface of the water, creating a visible sheen.
- Oil may accumulate on the shore, creating a visible sheen.

RESPONSE CONSIDERATIONS:
- Containment may not be necessary.
- shoreline clean-up may be required.

OBSERVATIONS:
- In-place nesting may be used to reach deeply buried oil layers in the middle and upper zones.
- Mechanical scraping of oil from the surface may be ineffective in areas regularly exposed to wave action.

NEW - Page 9
**Gravel Beaches** (SHE - 6A)

**Description:**
- Gravel beaches are very steep, with multiple narrow-belt bars forming the upper beach.
- The gravel size of the gravel can vary widely, from small pebbles to large boulders.
- Deposition of sand or gravel is typically by the shore-discharge of the stream or by wave action, and alluvial sediment is a major source of sand and gravel.
- Deposition is common in areas of low-energy wave action, forming beaches with a wide range of sediment sizes.

**Predominant Gravel:**
- Gravel dominates the shoreline between the beach and the thalweg.
- Gravel is the predominant grain size in sand and gravel areas.

**Predominant Beach Material:**
- Gravel is the predominant material in beach areas.
- Gravel is the predominant material in areas of low-energy sand and gravel.

**Response Considerations:**
- Sheet erosion is a significant concern in gravel beaches.
- Stabilization of the beach is necessary to prevent further erosion.
- Beach nourishment may be necessary to maintain the beach.

**Sheltered Rocky Shore** (SHE - 6A)

**Description:**
- This sediment type is dominated by coarse and medium sand, with occasional gravel present.
- The substrates are typically solid and composed of boulders, although rocks and cobbles are also common.
- This sediment type is characterized by significant wave activity and strong currents.

**response Considerations:**
- Protecting the beach from erosion is critical to preserving the shoreline.
- Beach nourishment can be used to prevent further erosion.
- Stabilization of the beach may be necessary to maintain the beach.

**Sandy Shore** (SHE - 6A)

**Description:**
- Sandy shores are characterized by a significant amount of sand, with occasional gravel present.
- The sediments are typically fine to medium sand, with occasional gravel present.
- This sediment type is characterized by significant wave activity and strong currents.

**Response Considerations:**
- Protecting the beach from erosion is critical to preserving the shoreline.
- Beach nourishment can be used to prevent further erosion.
- Stabilization of the beach may be necessary to maintain the beach.

**Sheltered Sandy Shores** (SHE - 6A)

**Description:**
- This sediment type is characterized by a significant amount of sand, with occasional gravel present.
- The sediments are typically fine to medium sand, with occasional gravel present.
- This sediment type is characterized by significant wave activity and strong currents.

**Response Considerations:**
- Protecting the beach from erosion is critical to preserving the shoreline.
- Beach nourishment can be used to prevent further erosion.
- Stabilization of the beach may be necessary to maintain the beach.

**Sandy Flat** (SHE - 6A)

**Description:**
- Sandy flats are characterized by a significant amount of sand, with occasional gravel present.
- The sediments are typically fine to medium sand, with occasional gravel present.
- This sediment type is characterized by significant wave activity and strong currents.

**Response Considerations:**
- Protecting the beach from erosion is critical to preserving the shoreline.
- Beach nourishment can be used to prevent further erosion.
- Stabilization of the beach may be necessary to maintain the beach.

**Salt and Freshwater Riverbank** (SHE - 6A)

**Description:**
- Salt and freshwater riverbanks are characterized by a significant amount of gravel and sand.
- The sediments are typically fine to medium sand, with occasional gravel present.
- This sediment type is characterized by significant wave activity and strong currents.

**Response Considerations:**
- Protecting the beach from erosion is critical to preserving the shoreline.
- Beach nourishment can be used to prevent further erosion.
- Stabilization of the beach may be necessary to maintain the beach.
ALEUTIANS WEST COASTAL RESOURCES
SERVICE AREA, ALASKA

SHORELINE HABITAT RANKINGS

1A) EXPOSED ROCKY SHORES
2A) EXPOSED WAVE-CUT PLATFORMS IN BEDROCK
3A) FINE-TO MEDIUM-GRAINED SAND BEACHES
4) COARSE-GRAINED SAND BEACHES (NOT PRESENT IN ALEUTIANS WEST)
5) MIXED SAND AND GRAVEL BEACHES
6A) GRavel BEACHES
6B) RIPRAP
7) EXPOSED TIDAL FLATS
8A) SHELTERED ROCKY SHORES
9A) SHELTERED TIDAL FLATS
10A) SALT AND BRACKISH-WATER MARSHES

COASTAL HABITAT RANKINGS

1) EXPOSED ROCKY SHORES WITH OR WITHOUT WAVE-CUT PLATFORMS
2) EXPOSED HIGH ENERGY SHORELINE (UNIDENTIFIED CLIFFS, PLATFORMS, AND BEACHES)
3) BEACHES (FINE AND MEDIUM SAND, COARSE SAND, SAND AND GRAVEL, GRAVEL)
4) EXPOSED TIDAL FLATS
5) ESTUARINE VEGETATION AND SHELTERED COAST

OTHER FEATURES

△ GEOTHERMAL FEATURES (V=VAPOR;W=WATER;S=SUBLIFACE)
△ VOLCANOS (SEE INTRODUCTION FOR NAMES)

HUMAN-USE FEATURES

AIRPORTS MARINA/DOCKS
BOAT RAMPS MINING RESOURCES

SENSITIVE BIOLOGICAL RESOURCES

BIRD
ALCID AND PELAGIC BIRD
DIVING BIRD
GULL AND TERN
SHOREBIRD
WATERFOWL
NESTING COLONIES
0 - 100 1,001 - 10,000
101 - 1,000 >10,000

FISH
FISH
ANADROMOUS STREAM
INVERTEBRATE
BIVALVE
CRAB
PLANT

MARINE MAMMAL
Pinniped
SEA OTTER
HAULOUT SITE
MULTI-GROUP
THREATENED ENDANGERED
RAR NUMBER
AK Hydro modified AWC Points
File Geodatabase Feature Class
Thumbnail Not Available

Tags

Summary
These points are an abstract of the Anadromous Waters Catalog (AWC) data which are used to specify the water bodies referred to in AS 16.05.871 for the protection of waters important for the spawning, rearing or migration of anadromous fishes. They are not authoritative AWC content and, in some instances, have been moved from their original position that they integrate with the AK Hydro stream and networked features.

Description
These features are not authoritative content from the state's Anadromous Waters Catalog. In some instances, these points have been moved (via snapping) from their original position so they can integrate with the AK Hydro geometric network - specifically, points within 10m of existing AK Hydro stream features have been snapped to the stream features so they participate in the geometric network. The points are provided in this revised format so that they can be used for network analysis and cartographic applications - they have no direct relationship to the AWC once published in this revised AK Hydro format.

The Alaska Department of Fish and Game’s (ADFG) Anadromous water bodies data is derived from the ADFG’s GIS shape files for the "Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes" (referred to as the "Catalog") and the "Atlas to the Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes" (referred to as the "Atlas"). It is produced for general visual reference and to aid users in generating various natural resource analyses and products. The shape files depict the known anadromous fish bearing lakes and streams within Alaska (from the mouth to the known upper extent of species usage). It incorporates data from a variety of sources including: USGS Digital Line Graph (DLG) and National Hydrography Dataset (NHD) hydrography data; Alaska Department of Natural Resources hydrography layer; and ADF shape files for the "Atlas" and "Catalog". ADF updates the Anadromous Streams data regularly. Note that stream numbers, locations, extent of cataloged habitat or species utilization of a given stream may change from year to year. Data for the shape files are current as of the 2014 revision of the "Atlas to the Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes" and the "Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes" effective July 1, 2015.

Credits
There are no credits for this item.
Use limitations
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merchandability and fitness) with respect to the character, function, or capabilities of the
electronic services or products or their appropriateness for any users purposes. In no event will
the State of Alaska be liable for any incidental, indirect, special, consequential or other damages
suffered by the user or any other person or entity whether from the use of the electronic services
or products, any failure thereof or otherwise, and in no event will the State of Alaska’s liability to
the requestor or anyone else exceed the fee paid for the electronic service or product. Users shall
not re-distribute this data. To ensure distribution of the most current public information, please
refer requests for data or products to ADF Division of Sport Fish (see distribution contact above).

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Bird_Nesting_Colonies

File Geodatabase Feature Class

Thumbnail Not Available

Tags
Kiska Island, Aleutian Islands, Alaska, Birds, Nesting, Colonies, Concentration

Summary
This feature class (point) was created by referencing location and species data from the U.S. Fish
and Wildlife Service. The feature class created in ArcCatalog was then added as a layer to
ArcMap and digitized by referencing location data via a U.S. Fish and Wildlife Service for the
Western Aleutian Islands (Kiska Island). Species data and other nomenclature, for each
individual point, was added as text in the attribute table.

Description
Birds are divided into several species subgroups based on taxonomy, morphology, behavior, and
oil spill vulnerability and sensitivity. The species table lists all the birds included on the maps,
sorted by subgroup. The major types of bird areas depicted in this atlas include: resident,
migratory, nesting, and overwintering waterfowl concentration areas; migratory shorebird
concentration areas; seabird concentration areas; and colonial waterbird nesting sites (for
seabirds and wading birds). Although birds are a major resource shown on the Aleutians West
ESI maps, seabirds concentration areas are shown only where surveys have been conducted.
Seabird nesting site information was obtained from the Beringian Seabird Colony Catalog
database. The points representing the location of the nesting colonies are usually located near
the geographic center of the colony. In some cases the point is located in the middle of an
island, even though birds nest along the shorelines all around the island, not necessarily in the
middle of the island. Waterfowl concentration areas shown on the map are derived from survey
data provided by Alaska Department of Fish and Game, U. S. Fish and Wildlife Service, and local
experts. Present but not shown are scattered distributions of emperor geese and Steller’s eider
around the islands of the Western Aleutians. Data were also incorporated from Audubon Society
Christmas bird counts. Eagle nest sites are found throughout the coastal zone of the Aleutians, however, because a comprehensive nest survey has not be conducted nesting sites are not shown. Eagles are present all year, but their most critical time is from March to August when they are nesting. Expert contacts for birds are in the U.S. Fish and Wildlife Service, Refuge and Migratory Bird Management Divisions and ADF&G Habitat and Restoration Division. Bird concentrations, including nesting areas for some species, are shown on the maps as polygons with a green hatch pattern. If multiple resource types (marine mammals and birds) occupy the same polygon, a black-hatched multi-group pattern is used. A green icon with the appropriate bird silhouettes (wading bird, raptor, etc.) is associated with the polygons. Seabird nesting sites from the U.S. Fish and Wildlife Service are shown with a green dot scaled to reflect the colony size. The RAR# under the icon links to a table on the reverse side of the map. In this table, the first column gives the species name. The second column indicates whether the species is listed as threatened (T) or endangered (E) on either the state (S) and/or federal (F) lists. The next column in the tables provides an estimate of the concentration of each species at the site. Concentration is indicated as a numerical value representing the number of breeding pairs occurring at a nesting site, or as HIGH, MEDIUM, and LOW to represent relative concentrations. “Unknown” is used where the birds have been surveyed but an accurate count was not available. A blank field in concentration indicates no concentration information was provided. Nesting concentrations at any particular site may fluctuate seasonally and annually based on local or regional conditions, or other factors. The species seasonality is shown in the next twelve columns representing the months of the year. If the species is present at that location in a particular month, an “X” is placed in the month column. The last columns denote the nesting period for each species, if nesting occurs in the particular area or site. Nesting refers to the entire nesting period, including laying, hatching, and fledging. For many species, there is a temporal shift in seasonality and reproduction along with spatial changes in location. Temporal information included in the tables is specific to the one polygon or point that it references.

Credits
Source: United States Fish and Wildlife Service

Use limitations
There are no access and use limitations for this item.

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Tags
Kiska Island, Aleutian Island Chain, Alaska, Coastline

Summary
This feature class (contour line) was created by referencing coastline location data from the U.S. Fish and Wildlife Service. The feature class created in ArcCatalog was then added as a layer to ArcMap and digitized by referencing coastline location data via a U.S. Fish and Wildlife Service for the Western Aleutian Islands (Kiska Island). Species data and other nomenclature, for each individual line, was added as text in the attribute table.

Description
This coverage depicts the entire boundary of Kiska Island, which is coastline.

Credits
Source: United States Fish and Wildlife Service

Use limitations
There are no access and use limitations for this item.

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| Minimum (zoomed out) | 1:150,000,000 |

Contaminated_Sites
File Geodatabase Feature Class
Thumbnail Not Available
Tags
Kiska Island, Aleutian Island Chain, Alaska, Contaminated, Sites, Active, Contained

Summary
This feature class (point) was created by referencing contamination data from the U.S. Fish and Wildlife Service. The feature class created in ArcCatalog was then added as a layer to ArcMap and digitized by referencing coordinate data for contamination points at Kiska Island via the Alaska Department of Environmental Conservation, Spill Prevention and Response. Contamination and other nomenclature, for each individual point, was added as text in the attribute table.
Description
The site report for the Kiska Island Garrison - Oil (Hazard ID 2619; Active Status), is as follows: Petroleum/lubricant contamination may be present. POL tanks and POL contaminated soils. Islands were invaded by Japanese task force in 1942. Left behind barracks, power plants, hospitals, defense fortifications, and ordnance. Three cargo ships lie on beaches. U.S. Army left structures, seaplane ramp, Japanese runway and numerous craters. Site entered by Shannon and Wilson. Numerous contaminants have been identified at this site ranging from PAH's, PCB's to POL's. Site is still in preliminary investigation stage. The USACE is attempting to use the CERCLA "Act of War" exclusion to limit DoD responsibility for remediating this site. Action information history: 12/30/1991 - Update or Other Action (Old R:Base Action Code = SI - Site Investigation). Based on FUDS Site Summary dated 2/21/96, SI for POL contaminated soils completed 12/30/91; 8/11/1993 - Preliminary Assessment Approved, based on FUDS Site Summary dated 2/21/96; 3/1/1996 - Update or Other Action, (Old R: Base Action Code = RIFS - Remedial Investigation / Feasibility Study). Final RI/FS report received. Seven operable units identified. Operable units A, B, and C have potential surface water and sediment impacts and additional investigation is recommended; 11/20/1996 - Site Added to Database, Site added by Shannon and Wilson; 3/1/1997 - Update or Other Action, (Old R:Base Action Code = RIFS - Remedial Investigation / Feasibility Study). Final Phase II RI/FS and risk assessment workplans received. Project on hold due to funding constraints; 4/2/2001 - Update or Other Action, ADEC received a copy of a letter from the U.S. EPA to the U.S. Army Corps of Engineers and U.S. Fish and Wildlife requesting the following work be done in coordination with ADEC and EPA: 1) develop and post warning signs on unexploded ordnance (UXO) during 2001, 2) Develop and distribute brochures on UXO safety to all permit holders for on-island activities, 3) Conduct SI and removals in 2006 to address ordnance, drums, and metals contaminated soil, 4) Conduct tribal consultation, and 5) notify all parties in writing if there is a schedule change; 6/14/2005 - Update or Other Action, File number update 2570.38.001; 6/26/2008 - Exposure Tracking Model Ranking, Initial ranking with ETM completed; 10/24/2014 - Update or Other Action, Current USACE FUDS schedule is to perform additional investigation/remediation during 2029. This schedule is subject to change; 12/1/2016 - Meeting or Teleconference Held, CS managers participate in the annual FUDS site management action plan meeting. The purpose of the is to collaborate with FUDS management on site progress and prioritization for all of the formerly used defense sites. FUDS prioritization is based on risk, congressional interest, state input and proximity to other sites on the prioritization list. FUDS has increased environmental restoration funding in Alaska for the 2017 and 2018 field seasons to meet National goals for site progress.

The site report for the Kiska Island NDSA (Hazard ID 26049, Active Status) is as follows:The Naval Defensive Sea Area (NDSA) site is composed of the underwater areas surrounding Kiska Island where Munitions and Explosives of Concern (MEC) were historically deposited/disposed as a result of DoD activities. Kiska Island was occupied by the Japanese from June 7, 1942 through early July 1943. The US began offensive operations against the Japanese on the island on or around June 7, 1942. Over 3,000 tons of bombs and over 15,000 naval projectiles were directed at Japanese positions on the island, between June 1942 and August 1943. While much of the ordnance was directed at positions on the island, several ships were sunk in Kiska Harbor and weather did not always allow for accurate delivery. The Japanese abandoned their defensive positions sometime in July 1943 prior to the Allied reoccupation on August 15, 1943. Allied forced occupied the island for several months. Anti-Aircraft Artillery (AAA) and Coastal Defense Artillery (CDA) gun positions were established. Practice firing was conducted over-water, depositing MEC into the marine environment. In addition MEC may be present in the near-shore environment associated with off-shore ordnance transfer and sunken naval vessels. Following the war areas of Kiska Harbor were used for rocket and bomb strikes against abandoned ships. MEC is present in the marine environment from several sources. The Navy will implement an IC program to inform potential visitors to the island of the potential hazards from MEC. Action information history: 12/18/2012 - CERCLA PA, Submit comments to NAVAC NW on the Draft Preliminary Assessment for Naval Defensive Sea Area - Kiska Island. Comments focused on the Navy's authority to address the NDSA as opposed to the USACE FUDS program, appropriate
terminology, and adequate institutional controls; 5/3/2013 - Site Added to Database, A new site has been added to the database; 6/13/2013 - CERCLA PA, Submit approval letter to NAVFAC NW on the Final Preliminary Assessment for NDSA Kiska Island. Executive Order 8680 provides the basis of the Navy's authority/responsibility to address MEC at the NDSA. The report recommends implementing an IC program to include "notice to mariners" and an information advisory to increase awareness of the presence of MEC in the area. The Navy will work with NOAA to include a "notice to mariners" on navigation charts of the island. The Navy intends to submit a Decision Document to finalize this decision with ADEC; 7/9/2014 - Submit comments to NAVFAC NW on the Draft Engineering Evaluation/Cost Assessment (EE/CA) for the Kiska Naval Defensive Sea Area (NDSA). The document evaluates two options for interim Institutional Controls for the site; 12/21/2015 - Report or Workplan Review-Other, Submit approval letter for the EE/CA for the Kiska Naval Defensive Sea Area. The EE/CA evaluates two different options for implementing Land Use Controls (LUCs) at the island to address underwater UXO.

Credits
Source: Alaska Department of Environmental Conservation, Spill Prevention and Response
http://dec.alaska.gov/Applications/SPAR/PublicMVC/CSP/SiteReport/2619
http://dec.alaska.gov/Applications/SPAR/PublicMVC/CSP/SiteReport/26049

Use limitations
There are no access and use limitations for this item.

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Scale Range

Maximum (zoomed in) 1:5,000
Minimum (zoomed out) 1:150,000,000

CRITHAB_POLY
Shapefile
Thumbnail Not Available

Tags
Kiska Island, Rat Islands, Aleutian Island Chain, Alaska, Critical Habitat, Steller Sea Lion, Northern Sea Otter

Summary
This feature class (polygon) was downloaded as a .zip file via the United States Fish and Wildlife Service website, then added to ArcMap as a feature class in order to display critical habitats near and around Kiska Island, Western Aleutian Islands, Alaska. Species data and other nomenclature, for polygons, are denoted in the attribute table.

Description
The .zip file was downloaded from https://ecos.fws.gov/ecp/report/table/critical-habitat.html, then added to the geodatabase as a feature class and then as a layer in ArcMap. Locations of Steller Sea Lion and Northern Sea Otter critical habitats were displayed over a basemap.
Credits

Use limitations
There are no access and use limitations for this item.

Extent

West -180.000000  East 180.000000
North 70.333363  South 13.639711

Scale Range
Maximum (zoomed in)  1:5,000
Minimum (zoomed out) 1:150,000,000

Fish_int
File Geodatabase Feature Class
Thumbnail Not Available

Tags
Kiska Island, Rat Islands, Aleutian Island Chain, Alaska, Survey Areas, Sites, Kiska Harbor, Twin Rocks, Gertrude Cove, North Head, anadromous fish species

Summary
This feature class (point) was created by using the geoprocessing tool "intersect." The input feature class "Fish_Species" was intersected with the input feature class "SurveyAreas" to create the output feature class, "Fish_int" to show what fish species are within the survey areas.

Description
This feature class shows what species of anadromous fish are within the Project Recover survey areas.

Credits
Source: Power Point presentation created by both Project Recover and the BentProp Project, 2018; United States Fish and Wildlife Service

Use limitations
There are no access and use limitations for this item.

Extent

West 177.431095  East 177.547479
North 51.982152  South 51.933425

Scale Range
Maximum (zoomed in)  1:5,000
Minimum (zoomed out) 1:150,000,000
Summary
This feature class (point) was created by referencing location and species data from the U.S. Fish and Wildlife Service. The feature class created in ArcCatalog was then added as a layer to ArcMap and digitized by referencing location data via a U.S. Fish and Wildlife Service for the Western Aleutian Islands (Kiska Island). Species data and other nomenclature, for each individual point, was added as text in the attribute table.

Description
The fish depicted in the Aleutians West ESI atlas include commercially important benthic and pelagic fish, herring spawning grounds, and streams important to anadromous fish. Not all species of environmental, recreational, or commercial interest are depicted. The anadromous streams shown on the map are from Alaska Department of Fish and Game database, Waters Important to Anadromous Fish. Species included in these streams are coho, chinook, chum, pink, and sockeye salmon, dolly varden, and cutthroat trout. While all of the anadromous streams in the database are shown, some of them are represented as a straight line, connecting the beginning point and endpoint of the stream, because the actual stream was not digitized. It is also cautioned that although this dataset is the best current representation of anadromous streams, it should not be considered definitive in determining the presence or absence of fish runs. Absence of anadromous streams on the maps for any particular location does not necessarily suggest that anadromous runs do not occur there. Expert contacts for anadromous fish are in the ADF&G Habitat and Restoration Division. Fish concentrations are shown on the maps as polygons with a blue hatch pattern. If multiple resource types (birds and fish) occupy the same polygon, a black-hatched multi-group pattern is used. A blue icon with an appropriate fish silhouette is associated with the polygons containing fish. For the anadromous fish streams, a blue line is used to mark the fish runs (in the mouth of the stream). A blue icon with a fish silhouette is associated with the line using a leader line. The RAR# positioned under the fish icon links to a table on the reverse side of the map. In this table, the first column gives the species name. The second column denotes whether the species has been designated as being endangered (E) or threatened (T) on either the state (S) and/or federal (F) lists. Concentration information was not available and was left blank. Seasonality is listed by month with an “X” indicating the species presence in any particular month. The last columns indicate time periods for various life-history stages or activities (spawning, eggs, larvae, juveniles, and adults). For many species there is a temporal shift in seasonality and life history along with spatial changes in location. Temporal information included in the tables is specific to the one polygon or site that it references.

Credits
Source: United States Fish and Wildlife Service

Use limitations
There are no access and use limitations for this item.

Extent
Habitat_Shoreline

File Geodatabase Feature Class

Thumbnail Not Available

Tags
Kiska Island, Rat Islands, Aleutian Island Chain, Alaska, Shoreline, Habitats, Rocky, Wave, Beach, Sand

Summary
This feature class (polygon) was created by referencing shoreline habitat location data from the U.S. Fish and Wildlife Service. The feature class created in ArcCatalog was then added as a layer to ArcMap and digitized by referencing shoreline habitat data via a U.S. Fish and Wildlife Service for the Western Aleutian Islands (Kiska Island). Delineation and description data, for each individual polygon, was added as text in the attribute table.

Description
Assessment of the environmental sensitivity of a particular intertidal habitat is based on an understanding of the dynamics of the coastal environments, not just the substrate type. The sensitivity ranking of a particular intertidal habitat is an integration of the following factors: 1) Shoreline type (substrate, grain size, tidal elevation, origin); 2) Exposure to wave and tidal energy; 3) Biological productivity and sensitivity; 4) Ease of cleanup (trafficability, permeability). These concepts have been used in the development of the ESI, which ranks shoreline environments in terms of their relative sensitivity to oil spills. The original concept of ranking coastal environments on a scale of relative sensitivity was developed at Lower Cook Inlet in 1976 (Michel et al. 1978). Generally speaking, areas exposed to high levels of physical energy, such as wave action and tidal currents, rank low on the scale, whereas sheltered areas with associated high biological activity have the highest ranking. The key to the sensitivity ranking is an understanding of the relationships between: shoreline type; substrate; physical processes, sediment transport patterns; product type; and fate and effect of oil. Since 1976, the ESI mapping scheme has been refined and expanded through repeated mapping and spill response experiences on most of the U.S. shorelines, including the Great Lakes. The result of these experiences is a standardized ESI shoreline habitat ranking system, consisting of 25 categories that encompass the general coastal habitats for the entire United States. This ranking system has been adopted by the National Oceanic and Atmospheric Administration and is a primary pollution response tool used by the United States Coast Guard (NOAA, 1997). In addition to the adoption of the ESI scheme by NOAA, the definitions of Environmentally Sensitive Areas (ESAs) as recorded in the Federal Register directly parallel the categories and concepts outlined in the ESI scheme (NOAA, 1994). These guidelines are commonly used for coastal zone management including: permitting, port development and management, and environmental assessment. The ESI shoreline habitats delineated in this atlas are listed below in order of increasing sensitivity: 1A) Exposed Rocky Shores; 2A) Exposed Wave-Cut Platforms in Bedrock; 3A) Fine- to Medium-Grained Sand Beaches; 4) Coarse-Grained Sand Beaches; 5) Mixed Sand and Gravel Beaches;
6A) Gravel Beaches; 6B) Riprap; 7) Exposed Tidal Flats; 8A) Sheltered Rocky Shores; 9A) Sheltered Tidal Flats; 10A) Salt-and Brackish-Water Marshes.

**Credits**
Source: United States Fish and Wildlife Service

**Use limitations**
There are no access and use limitations for this item.

**Extent**

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**Historic_Japanese_Military**

File Geodatabase Feature Class

Thumbnail Not Available

**Tags**
Kiska Island, Rat Islands, Aleutian Island Chain, Alaska, Battle of Kiska, Historic, Japanese, Military, Installations, Artillery, Guns, Bases

**Summary**
This feature class (polygon) was created by referencing location data from historical records from sources documenting the Battle of Kiska. The feature class created in ArcCatalog was then added as a layer to ArcMap and digitized by referencing historical maps from two different sources regarding areas of Japanese occupation on Kiska Island. Site information and descriptions, for each individual polygon, was added as text in the attribute table.

**Description**
Historical maps from two sources, one of which was provided by the U.S. National Park Service, were referenced to create the areas occupied by Japanese forces (Army and Navy) on Kiska Island. These areas may not be one hundred percent accurate, in terms of coordinates, but is approximate enough to denote the general area of the Japanese military installations. However, anti-aircraft depicted on the historical maps, which are also incorporated into the description of each site (in the attribute table) is accurate as these anti-aircraft sites are within the range of the military installations, per reference to the historical maps of Kiska Island.

**Credits**
Sources; The Aleutian Warriors: A History of the 11th Air Force & Fleet Air Wing 4, John Haile Cloe, 1990; The Cultural Landscape of the World War II Battlefield of
AK Hydro Saltwater Inundation Areas
File Geodatabase Feature Class
Thumbnail Not Available

**Tags**
tideline, coast, Alaska, shoreline, tide, coastline, intertidal, high tide, shore_hl, mean high tide, high, shore, mean high water, foreshore, inundation, Intertidal_PL, AK Hydro

**Summary**
The dataset was developed for submission to the USGS National Hydrography Dataset (NHD). It contains polygons describing high and low tide shorelines with delineated intertidal areas.

**Description**
This dataset contains polygons describing high and low tide shorelines with delineated intertidal areas for Southcentral Alaska.

**Credits**
Jim Schramek and Emil Tucker - USFS Tongass National Forest; Mike Plivelich - University of Alaska Southeast

**Use limitations**
There are no access and use limitations for this item.
Summary
NOAA's Marine Protected Areas Inventory (v2017) represents a collection of data compiled from various federal, state, tribal and territorial entities to provide a publicly available source of comprehensive information on place-based marine conservation efforts under U.S. federal, state, territorial, local, and tribal jurisdiction.

Description
The MPA Inventory is a comprehensive catalog that provides detailed information for existing marine protected areas in the United States. The inventory provides geospatial boundary information (in polygon format) and classification attributes that seek to define the conservation objectives, protection level, governance and related management criteria for all sites in the database. The comprehensive inventory of federal, state and territorial MPA sites provides governments and stakeholders with access to information to make better decisions about the current and future use of place-based conservation. The information also will be used to inform the development of the national system of marine protected areas as required by Executive Order 13158.

Credits
NOAA Marine Protected Areas Center in joint effort with the US Department of the Interior

Use limitations
These data are in the Public domain. The data are not to be used for navigation. For more information, see the accuracy section.

Extent

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- Minimum (zoomed out) 1:150,000,000

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**NestingColonies_int**

*File Geodatabase Feature Class*

*Thumbnail Not Available*

**Tags**

Kiska Island, Rat Islands, Aleutian Island Chain, Alaska, Survey Areas, Sites, Kiska Harbor, Twin Rocks, Gertrude Cove, North Head, bird nesting colonies

**Summary**

This feature class (point) was created by using the geoprocessing tool "intersect." The input feature class "Bird_Nesting_Colonies" was intersected with the input class "SurveyAreas" to create the output feature class, "NestingColonies_int" to show what bird nesting colonies are within the survey areas.

**Description**

This feature class shows what bird nesting colonies are within the Project Recover survey areas.

**Credits**

Source: Power Point presentation created by both Project Recover and the BentProp Project, 2018; United States Fish and Wildlife Service

**Use limitations**

There are no access and use limitations for this item.

**Extent**

- **West** 177.619666  **East** 177.626043
- **North** 51.961983  **South** 51.955588

**Scale Range**

- Maximum (zoomed in) 1:5,000
- Minimum (zoomed out) 1:150,000,000
**Pier**

**File Geodatabase Feature Class**

Thumbnail Not Available

**Tags**

Kiska Island, Rat Islands, Aleutian Island Chain, Alaska, Pier, Kiska Harbor

**Summary**

This feature class (point) was created by referencing high resolution imagery of Kiska Harbor via GoogleEarth. The feature class created in ArcCatalog was then added as a layer to ArcMap and digitized by referencing Kiska Island via GoogleEarth. Description and measurements were added in the attribute table.

**Description**

The pier feature class was added to ArcCatalog, then as a layer to ArcMap, and was digitized by referencing GoogleEarth in order to serve as a reference point for the Kiska Harbor area of Kiska Island, Alaska. Measurements of the pier (length and width) are approximate.

**Credits**

GoogleEarth

**Use limitations**

There are no access and use limitations for this item.

**Extent**

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**Scale Range**

- Maximum (zoomed in) 1:5,000
- Minimum (zoomed out) 1:150,000,000

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**Pinniped**

**File Geodatabase Feature Class**

Thumbnail Not Available

**Tags**

Kiska Island, Rat Islands, Aleutian Island Chain, Alaska, Pinniped, Concentration, Seals, Sea Lions

**Summary**

This feature class (point) was created by referencing location and species data from the U.S. Fish and Wildlife Service. The feature class, created in ArcCatalog was then added as a layer to ArcMap and digitized by referencing location data via a U.S. Fish and Wildlife Service for the Western Aleutian Islands (Kiska Island). Species data and other nomenclature, for each individual point, was added as text in the attribute table.
Description
Marine mammals depicted in the Aleutians West atlas include seals, sea lions, fur seals, walruses, and sea otters. Major haul-out sites for harbor seals, Steller sea lions, and northern fur seals, are depicted. Though only haul-out sites are mapped, seals can occur throughout the nearshore waters. Northern fur seals are currently listed as depleted under the Marine Mammal Protection Act. Expert contacts for marine mammals in the Aleutians are the NMFS National Marine Mammal Lab, Seattle Washington; Brad Smith, NMFS, Anchorage, Alaska; and USFWS Marine Mammals Management, Anchorage, Alaska. Marine mammal concentration areas are displayed on the maps as polygons with a brown hatch pattern. If multiple resource types (marine mammals and birds) occupy the same polygon, a black-hatched multi-group pattern is used. A brown icon with a pinniped or whale silhouette is used to indicate the presence of marine mammals. The RAR# under the icon links to a table on the reverse side of the map. In this table, the first column gives the species name. The second column denotes whether the species has been designated as being endangered (E) or threatened (T) on either the state (S) and/or federal (F) lists. The next column provides an estimate of the concentration of the species at the site. Concentration is indicated as “HIGH”, “MODERATE”, or “LOW”, or numeric values are used for seal and sea lion haul-out sites. The species seasonality is shown in the next twelve columns, representing the months of the year. If the species is present at that location in a particular month, an “X” is placed in the month column. The final columns list the time periods for sensitive life history stages or activities, such as pupping and molting for seals.

Credits
Source: United States Fish and Wildlife Service

Use limitations
There are no access and use limitations for this item.

Extent
West 177.211058  East 177.668748
North 52.135239  South 51.820198

Scale Range
Maximum (zoomed in) 1:5,000
Minimum (zoomed out) 1:150,000,000

Pinniped_int
File Geodatabase Feature Class
Thumbnail Not Available

Tags
Kiska Island, Rat Islands, Aleutian Island Chain, Alaska, Survey Areas, Sites, Kiska Harbor, Twin Rocks, Gertrude Cove, North Head, pinnipeds, steller sea lion

Summary
This feature class (point) was created by using the geoprocessing tool "intersect." The input feature class "Pinniped" was intersected with the input feature class "SurveyAreas" to create the output feature class, "Pinniped_int" to show pinnipeds within the survey areas.

Description
This feature class shows what pinnipeds and species of pinnipeds are within the Project Recover survey areas.

**Credits**
Source: Power Point presentation created by both Project Recover and the BentProp Project, 2018; United States Fish and Wildlife Service

**Use limitations**
There are no access and use limitations for this item.

**Extent**

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- Maximum (zoomed in): 1:5,000
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**Place_Names**

**File Geodatabase Feature Class**

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**Summary**
This feature class (point) was created by referencing locations and place names from historical and current maps. The feature class created in ArcCatalog was then added as a layer to ArcMap and digitized by referencing historical maps of the Battle of Kiska, as well as Google Earth, in order to accurately depict important locations with historical names and/or present day nomenclature. The name of the location, for each individual point, was added as text in the attribute table.

**Description**
Place names are annotated for various reference points that may be of historic value to the Battle of Kiska and/or of value in present day. These place names also aid in giving reference to locations of importance during the Battle of Kiska.

**Credits**

**Use limitations**
There are no access and use limitations for this item.

**Extent**

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Sea_Otter
File Geodatabase Feature Class

Summary
This feature class (point) was created by referencing location and species data from the U.S. Fish and Wildlife Service. The feature class, created in ArcCatalog was then added as a layer to ArcMap and digitized by referencing location data via a U.S. Fish and Wildlife Service for the Western Aleutian Islands (Kiska Island). Species data and other nomenclature, for each individual point, was added as text in the attribute table.

Description
Marine mammals depicted in the Aleutians West atlas include seals, sea lions, fur seals, walruses, and sea otters. For sea otters, concentration areas are shown where surveys have been conducted. Sea otters are present all year along the Aleutian Islands. Though not depicted on the maps, whales are highly mobile species, and they can occur throughout most of the waters. Many of the whales are listed as threatened or endangered species, and all marine mammals are protected under the Marine Mammal Protection Act of 1972. Sea Otters in the Aleutians are a candidate species for listing under the Endangered Species Act.

Credits
Source: United States Fish and Wildlife Service
Use limitations
There are no access and use limitations for this item.

Extent

West 177.292079   East 177.671365
North 52.084319   South 51.836617

Scale Range
Maximum (zoomed in) 1:5,000
Minimum (zoomed out) 1:150,000,000

SeaOtter_int
File Geodatabase Feature Class
Thumbnail Not Available

Tags
Kiska Island, Rat Islands, Aleutian Island Chain, Alaska, Survey Areas, Sites, Kiska Harbor, Twin Rocks, Gertrude Cove, North Head, northern sea otter

Summary
This feature class (point) was created by using the geoprocessing tool "intersect." The input feature class "Sea_Otter" was intersected with the input feature class "SurveyAreas" to create the output feature class, "SeaOtter_int" to show sea otters within the survey areas.

Description
This feature class shows sea otter areas within the Project Recover survey areas.

Credits
Source: Power Point presentation created by both Project Recover and the BentProp Project, 2018; United States Fish and Wildlife Service

Use limitations
There are no access and use limitations for this item.

Extent

West 177.577243   East 177.577243
North 51.977319   South 51.977319

Scale Range
Maximum (zoomed in) 1:5,000
Minimum (zoomed out) 1:150,000,000
**Summary**
The purpose for creating this data set was to provide the best available sediment information of the Aleutian Islands for predictive, geospatial modeling of sponge and coral abundance and diversity.

**Description**
We assembled 2.1 million National Ocean Service (NOS) bathymetric soundings extending 1,900 km along the Aleutian Islands from Unimak Island in the east to the Russian border in the west, and ranging approximately 500 km north of the central Aleutians to Petrel and Bowers Banks, and also the surrounding deep waters of the southeastern Bering Sea. These bathymetry data are available from the National Geophysical Data Center (NGDC: http://www.ngdc.noaa.gov), which archives and distributes data that were originally collected by the NOS and others. While various bathymetry data have been downloaded previously from NGDC, compiled, and used for a variety of projects, our effort differed in that we compared and corrected the digital bathymetry by studying the original analog source documents - digital versions of the original survey maps, called smooth sheets. Our editing included deleting erroneous and superseded values, digitizing missing values, and properly aligning all data sets to a common, modern datum. We also digitized 25,000 verbal surficial sediment descriptions from the smooth sheets, providing the largest single source of sediment information for the Aleutians.

**Credits**
Source: https://www.afsc.noaa.gov/RACE/groundfish/bathymetry/Aleutians.htm
https://www.afsc.noaa.gov/RACE/metadata/Zimmermann_AI_seds.xml#Abstract

**Use limitations**
There are no access and use limitations for this item.

**Extent**

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Shoreline_int
File Geodatabase Feature Class
Thumbnail Not Available

**Tags**
Kiska Island, Rat Islands, Aleutian Island Chain, Alaska, Survey Areas, Sites, Kiska Harbor, Twin Rocks, Gertrude Cove, North Head, shoreline, habitats, rocky, fine to medium grain sand, beaches, salt and brackish water marshes

**Summary**
This feature class (polygon) was created by using the geoprocessing tool "intersect." The input feature class "Habitat_Shoreline" was intersected with the input feature class "SurveyAreas" to create the output feature class, "Shoreline_int" to show what types of shoreline habitats are within the survey areas.

**Description**
This feature class shows what types of shoreline habitats are within the Project Recover survey areas.

**Credits**
Source: Power Point presentation created by both Project Recover and the BentProp Project, 2018; United States Fish and Wildlife Service

**Use limitations**
There are no access and use limitations for this item.

**Extent**

West  177.423974  East  177.637120  
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**Scale Range**

Maximum (zoomed in)  1:5,000  
Minimum (zoomed out)  1:150,000,000

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SideScanTracks_1989
File Geodatabase Feature Class
Thumbnail Not Available

**Tags**
Kiska Island, Rat Islands, Aleutian Island Chain, Alaska, Side scan sonar, tracks, survey area, Kiska Harbor

**Summary**
This feature class (contour line) was downloaded via a .zipfile, imported into ArcCatalog as a new feature class, then added as a new layer into ArcMap's Table of Contents.
Description
This feature class displays the side scan sonar tracks in Kiska Harbor done in a 1989 survey and was provided by the Project Recover team.

Credits
Project Recover team

Use limitations
There are no access and use limitations for this item.

Extent

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Scale Range

Maximum (zoomed in) 1:5,000
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Streams
File Geodatabase Feature Class

Tags
Kiska Island, Rat Islands, Aleutian Island chain, Alaska, river, channel, water, hydrology, stream, creek, rivers, watercourse, creeks, Alaska, salmon, fish, streams, hydrography, habitat, hydrographic, AWC, Anadromous Waters Catalog, NHD, National Hydrography Dataset, Stream_LN, AK Hydro

Summary
The streams dataset provides channel type classification and stream-class information for forest resource planners, fisheries biologists, hydrologists, and ecologists. Channel types provide information on fish habitat utilization, fish habitat capability, and fisheries enhancement options. They also provide information on suitable stream crossing locations and design criteria for road drainage structures and are useful to evaluate potential sediment delivery and retention for cumulative watershed effects analysis. This particular version of the dataset was developed to submit to the National Hydrography Dataset (NHD). Specifically, stream arcs were extended to the low tide shoreline to ensure inclusion of thousands of feet of the most productive intertidal stream habitats for salmon. Without extending the stream arcs, all or nearly all of the "estuarine" streams channel types would be dropped from the USDA-FS WATER Module under development.

Description
This dataset portrays the linear water features across Alaska. The layer also provides channel type information, stream class information and classifications particular to the State Anadromous Waters Catalog.
**Credits**
Jim Schramek and Emil Tucker - USFS Tongass National Forest; Mike Plivelich - University of Alaska Southeast; Alaska Department of Fish & Game, Sport Fish Division; Alaska Hydrography Technical Working Group; USGS National Geospatial Technical Operations Center

**Use limitations**
There are no access and use limitations for this item.

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**Scale Range**

- **Maximum (zoomed in)**: 1:5,000
- **Minimum (zoomed out)**: 1:150,000,000

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**Streams_int**

**File Geodatabase Feature Class**

**Thumbnail Not Available**

**Tags**
Kiska Island, Rat Islands, Aleutian Island Chain, Alaska, Survey Areas, Sites, Kiska Harbor, Twin Rocks, Gertrude Cove, North Head, streams

**Summary**
This feature class (contour line) was created by using the geoprocessing tool "intersect." The input feature class "Streams" was intersected with the input feature class "SurveyAreas" to create the output feature class, "Streams_int" to show what streams/waterways are within the survey areas.

**Description**
This feature class shows what streams are within the Project Recover survey areas.

**Credits**
Source: Power Point presentation created by both Project Recover and the BentProp Project, 2018; Jim Schramek and Emil Tucker - USFS Tongass National Forest; Mike Plivelich - University of Alaska Southeast; Alaska Department of Fish & Game, Sport Fish Division; Alaska Hydrography Technical Working Group; USGS National Geospatial Technical Operations Center

**Use limitations**
There are no access and use limitations for this item.

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StreamsAWC_int
File Geodatabase Feature Class
Thumbnail Not Available

Tags
Kiska Island, Rat Islands, Aleutian Island Chain, Alaska, Survey Areas, Sites, Kiska Harbor, Twin Rocks, Gertrude Cove, North Head, AWC, anadromous waterway, streams

Summary
This feature class (point) was created by using the geoprocessing tool "intersect." The input feature class "AWC_Kiska" was intersected with the input feature class "SurveyAreas" to create the output feature class, "StreamsAWC_int" to show anadromous waterways within the survey areas.

Description
This feature class shows what anadromous waterways are within the Project Recover survey areas.

Credits
Source: Power Point presentation created by both Project Recover and the BentProp Project, 2018; Alaska Department of Fish and Game

Use limitations
There are no access and use limitations for this item.

Extent

West 177.431311 East 177.570175
North 51.995948 South 51.935052

Scale Range
Maximum (zoomed in) 1:5,000
Minimum (zoomed out) 1:150,000,000
Summary
This feature class (polygon) was created by referencing survey area locations drawn out by the Project Recover team. The feature class created in ArcCatalog was then added as a layer to ArcMap and digitized by referencing survey locations around Kiska Harbor from a power point file created by the Project Recover team leads. The survey area name, for each individual area, were added as text in the attribute table.

Description
The four survey sites around Kiska Island were referenced by a power point file created by Project Recover. Exact coordinates for the survey area are not known. Locations for the survey areas are approximate but encompass the entire area expected to be surveyed by the Project Recover team.

Credits
Source: Power Point presentation created by both Project Recover and the BentProp Project, 2018.

Use limitations
There are no access and use limitations for this item.

Extent
West 177.418539 East 177.637120
North 52.038392 South 51.913360

Scale Range
Maximum (zoomed in) 1:5,000
Minimum (zoomed out) 1:150,000,000

Unconfirmed_Side_Scan_Locations1989
File Geodatabase Feature Class
Thumbnail Not Available

Tags
Kiska Island, Rat Islands, Aleutian Island chain, Alaska, Kiska Harbor, unconfirmed side scan locations, 1989

Summary
This feature class (point) was created by referencing historical data from a prior side scan sonar survey in Kiska Harbor in 1989. The feature class was created in ArcCatalog was then added as a layer to ArcMap and digitized by referencing the 1989 side scan survey data. Descriptions and other data for each individual point, were added as text in the attribute table.

Description
These locations from a 1989 side scan sonar survey of Kiska Harbor are unconfirmed targets. Coordinates are approximate.

Credits
Project Recover team
Use limitations
There are no access and use limitations for this item.

Extent

West 177.543491  East 177.564756
North 51.974780  South 51.959785

Scale Range
Maximum (zoomed in) 1:5,000
Minimum (zoomed out) 1:150,000,000

Volcano

File Geodatabase Feature Class
Thumbnail Not Available

Tags
Kiska Island, Rat Islands, Aleutian Island Chain, Alaska, Volcano, Morphology, Geothermal

Summary
This feature class (point) was created by referencing location data from the U.S. Fish and Wildlife Service. The feature class created in ArcCatalog was then added as a layer to ArcMap and digitized by referencing volcano location data via a U.S. Fish and Wildlife Service for the Western Aleutian Islands (Kiska Island). Data and information pertinent to the volcano was added as text in the attribute table.

Description
Volcanism in the Aleutian Islands Arc is brought about by the ongoing subduction of the Pacific plate beneath the North American plate. As the oceanic crust of the Pacific plate migrates northwestward, it is overridden or subducted by the less dense crust of the North American plate. As the Pacific plate compresses, bends, and sinks beneath the North American plate, the pressure and temperatures increase greatly, converting solid rock into liquid magma. The magma, superheated and less dense than the material surrounding it, seeks a density equilibrium and rises towards the surface. These continuous tectonic processes have created the current assemblage of 89 Quaternary volcanoes distributed throughout the Aleutian chain. The natural and human development of each island in the chain has been and will continue to be affected by the eruptive capacity of these volcanoes. Evaluation of the risk posed by individual volcanoes must take into account complex relationships between the size of an eruptive event and probability. These relationships are beyond the scope of this atlas. Suffice to say that a highly improbable large scale eruption will obviously have greater numbers of potentially destructive processes associated with it but, by nature of its improbability, pose a lower over-all risk than more probable smaller scale eruptive events.

Current morphology for the Kiska Volcano is "Strato," meaning that it is composed of both volcanic flows and ejected tephra and pyroclastics. Pyroclastic flows and surges consist of extremely hot material traveling down the flanks of the volcano, pyroclastic flows are a risk only to those in their path. Like all gravity driven flow. They will seek the lowest ground, and hence, tend to concentrate in valleys. Typically, they travel no further than 10-15 km from the source. The majority of the Aleutian volcanoes are of this type. The Kiska Volcano is at an elevation of 1,220 meters, has had 6 events since 1760, and the geothermal potential is "fair."
Credits
Source: The United States Fish and Wildlife Service

Use limitations
There are no access and use limitations for this item.

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Wrecks_Confirmed
File Geodatabase Feature Class
Thumbnail Not Available

Tags
Kiska Island, Rat Islands, Aleutian Island chain, Alaska, Kiska Harbor, confirmed targets, wrecks, 1989

Summary
This feature class (point) was created by referencing historical data from a prior side scan sonar survey in Kiska Harbor in 1989. The feature class was created in ArcCatalog was then added as a layer to ArcMap and digitized by referencing the 1989 side scan survey data. Descriptions and other data for each individual point, were added as text in the attribute table.

Description
These locations from a 1989 side scan sonar survey of Kiska Harbor are unconfirmed targets. Coordinates are approximate.

Credits
Project Recover team

Use limitations
There are no access and use limitations for this item.

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