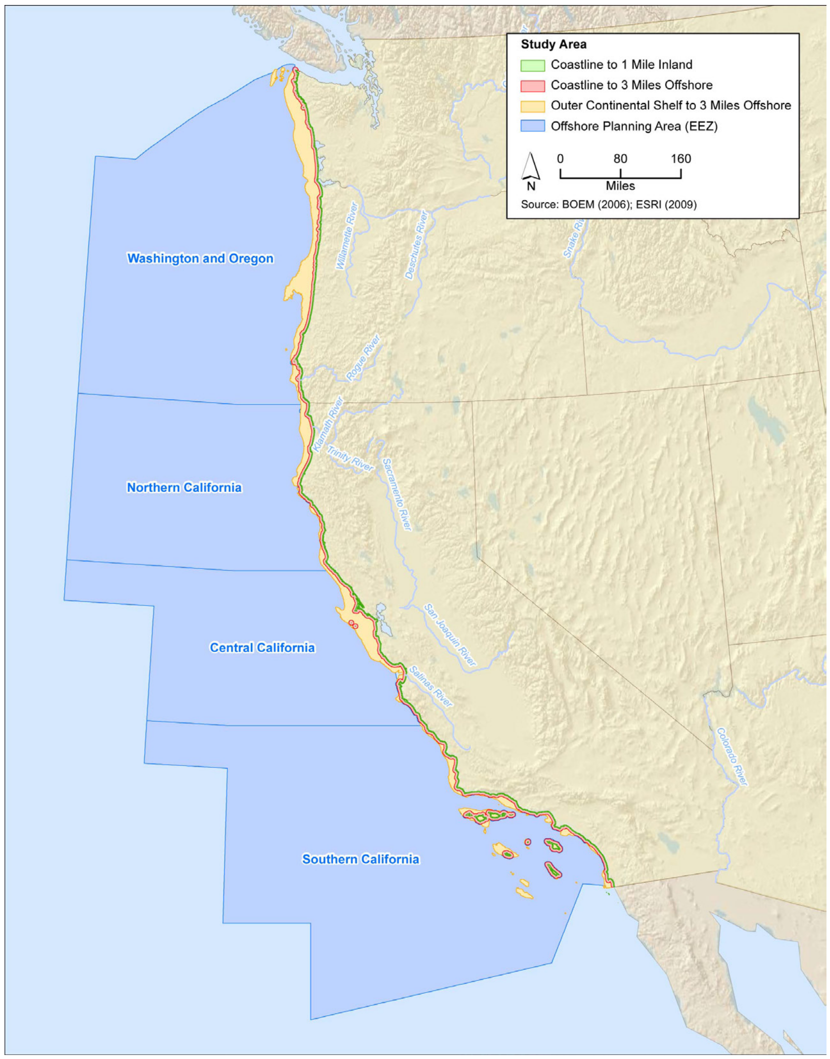
OCS Study
BOEM 2013-0115

# Inventory and Analysis of Coastal and Submerged Archaeological Site Occurrence on the Pacific Outer Continental Shelf





**U.S. Department of the Interior**
**Bureau of Ocean Energy Management**
**Pacific OCS Region**

OCS Study
BOEM 2013-0115

# Inventory and Analysis of Coastal and Submerged Archaeological Site Occurrence on the Pacific Outer Continental Shelf

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Prepared under BOEM Contract
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**U.S. Department of the Interior**
**Bureau of Ocean Energy Management**
**Pacific OCS Region**

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## REPORT AVAILABILITY

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> http://www.data.boem.gov/homepg/data_center/other/espis/espisfront.asp
> Search on OCS Study BOEM 2013-0115.

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> Pacific OCS Region
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# LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AUV | autonomous underwater vehicle |
| BOEM | Bureau of Ocean Energy Management |
| BOEMRE | Bureau of Ocean Energy Management, Regulation and Enforcement |
| BP | Before Present |
| BSEE | Bureau of Safety and Environmental Enforcement |
| C | centigrade |
| ca. | circa |
| CCC | Civilian Conservation Corps |
| CCR | California Code of Regulations |
| CEQA | California Environmental Quality Act |
| CFR | Code of Federal Regulations |
| CHRIS | California Historical Resources Information System |
| CIS | Committee on Indian Services |
| CRHR | California Register of Historical Resources |
| CSZ | Cascadia Subduction Zone |
| DAHP | Washington Department of Archaeology and Historic Preservation |
| DGR | Davis Geoarchaeological Research |
| DEM | digital elevation model |
| EEZ | Exclusive Economic Zone |
| ENSO | El Niño-Southern Oscillation |
| ESL | eustatic sea level |
| FM2 | full maritime migration |
| GGNRA | Golden Gate National Recreation Area |
| GIA | glacial isostatic adjustments |
| GIS | geographic information system |
| HABS | Historic American Building Survey |
| HAER | Historic American Engineering Record |
| HRI | historic resources inventory |
| ICF | ICF International |
| IFC | ice-free corridor migration |

| | |
|---|---|
| kW | kilowatt |
| LA&SP | Los Angeles & San Pedro Railroad |
| LCI | landing craft infantry |
| LCS | landing craft support |
| LGM | last glacial maximum |
| LMSL | local mean sea level |
| LP | late Pleistocene |
| LP-EH | late Pleistocene to early Holocene |
| MHW | mean high water |
| MIS | marine isotope stage |
| mm | millimeter |
| MMS | Minerals Management Service |
| MSL | mean sea level |
| MV-II | Monte Verde II |
| NAD | North American Datum |
| NAHC | Native American Heritage Commission |
| NARA | National Archives and Records Administration |
| NASNI | Naval Air Station North Island |
| NGDC | National Geophysical Data Center |
| NHPA | National Historic Preservation Act |
| NOAA | National Oceanic and Atmospheric Administration |
| NOS | National Ocean Service |
| NPS | National Park Service |
| NRHP | National Register of Historic Places |
| ONRR | Office of Natural Resource Revenues |
| ONRSP | Oregon National Register and Survey Program |
| PAM | partially amphibious migration |
| PG&E | Pacific Gas and Electric Company |
| POCS | Pacific Outer Continental Shelf |
| QA/QC | quality assurance/quality control |
| RCW | Revised Code of Washington |
| RY | radiocarbon years |

| | |
|---|---|
| RYBP | radiocarbon years before present |
| SHPO | State Historic Preservation Office |
| SQL | standardized query language |
| TCPs | traditional cultural properties |
| U.S. | United States |
| USACE | U.S. Army Corps of Engineers |
| UTM | Universal Transverse Mercator |
| WGS | world geodetic system |
| WHR | Washington Heritage Register |
| WPA | Works Progress Administration |

# 1. EXECUTIVE SUMMARY

In June 2011, the Pacific Outer Continental Shelf (POCS) Region of the Bureau of Ocean Energy Management (BOEM) contracted with ICF International (ICF) to conduct a study of coastal and submerged site potential in and adjacent to the POCS. This report is the latest in a series of similar baseline reports that evaluate the archaeological potential of the POCS and other regions managed by BOEM. For this study, the POCS study area consists of a 1-mile-wide strip of land along the coast stretching from the United States (U.S.)/Canadian border to the U.S./Mexican border and extending westward 200 miles to the end of the offshore planning area or the U.S. Exclusive Economic Zone (EEZ). This differs from most previous studies, which did not extend inland, and the Atlantic OCS study, which extended only 0.25 mile inland from the coast. Extending the width of the coastal resources study area is intended to capture a greater number of onshore historic archaeological and built properties, and traditional cultural properties (TCPs), that might be subject to direct or indirect impacts resulting from offshore development.

The results of this study will be used in the evaluation of future exploration, development, and transportation plans for offshore energy projects. The identification of significant archaeological sites, TCPs, built environment resources, shipwrecks, and potential culturally sensitive submerged landforms will assist BOEM in determining specific resources or areas of sensitivity that offshore development may directly or indirectly impact.

The ICF team implemented three approaches to identify sites and site potential on the POCS: (1) developed paleolandscape reconstructions to help predict submerged prehistoric site locations, (2) conducted research and outreach to identify significant coastal properties, and (3) conducted research and outreach to collect information on shipwrecks located in the POCS.

## 1.1. PALEOLANDSCAPE RECONSTRUCTIONS AND MODELING THE POTENTIAL FOR SUBMERGED PREHISTORIC SITES

Initial methods used to identify culturally sensitive submerged landforms and predict the potential distribution of submerged prehistoric sites on the POCS included the following: modeling modern bathymetry, calculating crustal deformation, modeling ancient stream systems, and analyzing eustatic sea level history and relative sea level. This information was used to construct a geographic information system (GIS)-based model for locating potential prehistoric site areas and suggesting areas most likely to have survived marine transgressive processes. This is a two-part process wherein coastal paleolandscape reconstructions are first created and then associated prehistoric site location predictions are made. The first part consists of creating a GIS-based paleolandscape model that shows the extent of emergent lands on the POCS during the last glacial maximum (LGM) (19,000 Before Present [BP]). The second part of the process projects the positions of eustatic shorelines at each millennium since the LGM onto this maximum paleolandscape extent model.

Although the predictions of potential submerged prehistoric site locations made by the GIS model can be used to make initial decisions about where ground disturbance activities associated with development projects could be conducted on the POCS, the model's predictions are not final assessments of whether submerged archaeological sites exist on or in the POCS. A final archaeological assessment of whether any particular location on the POCS is suitable for conducting developer-based ground disturbance activities can only be made from remotely sensed data and stratigraphic core samples. If pre-development remote sensing and coring studies reveal the presence of buried deposits containing cultural materials, the lateral and vertical extent of the archaeologically relevant stratigraphic units should be established in order to determine their geometric forms. Once the geometry of submerged prehistoric site-bearing deposits is known, the associated area can be excluded from development-related impacts. The information produced from this intensive assessment of submerged site-bearing deposit stratigraphy and geometry can be used to evaluate remote sensing and coring data collected from any future POCS development projects.

## 1.2. IDENTIFYING COASTAL PROPERTIES

The potential for offshore energy development to cause visual impacts on coastal historic properties has emerged as an increasing concern in the U.S. BOEM identified the need to develop a database of coastal historic properties that could be affected by alteration of the seascape. Additionally, having a database of coastal historic properties would allow BOEM to better understand the kinds of resources types that are located along the west coast of the continental U.S. This section describes the methods and results of a coastal property inventory that will provide BOEM with baseline information to be used and consulted during any future offshore energy development projects.

The identification of coastal properties included research undertaken to assemble a database of known archaeological sites, TCPs, and historic built resources along the coasts of California, Oregon, and Washington that have the potential to be adversely affected by future offshore development. These methods included the following: research at state repositories for archaeological and built environment cultural resources; and outreach efforts to Native American tribes and individuals, experts in the archaeology and ethnography of the Pacific coast, and historical interest and preservation groups. Online research was conducted to identify additional sensitive landscapes along the coast, such as state and national parks, preserves, national monuments, and tribal reservations. Locational and basic descriptive data for each identified resource was entered into a GIS-linked database to aid BOEM in future project planning.

The coastal properties research resulted in the identification of 2,383 coastal cultural resources with the potential to be impacted by future offshore development. Of these, 683 archaeological resources, 1,719 built environment resources, and 78 culturally significant properties were identified. Many of the identified cultural resources consist of multicomponent sites that contain two or more resources in each of these categories. Many archaeological resources and TCPs, however, may not be listed in a state or national register. The study also identified areas where sensitive property types are concentrated. No fieldwork was conducted; consequently, the ocean view from these resources has not been confirmed, their current condition has not been verified, and properties not previously determined to be historic have not been surveyed and evaluated. There also may be resources beyond the 1-mile study area that have ocean views for which the viewshed is a significant characteristic. When future offshore development projects are identified, it is recommended that BOEM initiate Section 106 and follow the guidelines set forth in Code of Federal Regulations (CFR), title 36, section 800 and consult with Native American tribes following the Department of the Interior Policy on Consultation with Indian Tribes. During the course of future projects, once the prehistoric sites, built environment resources, and TCPs that have been determined to be adversely affected are established, the resolution of the effects needs to be cooperatively agreed upon and memorialized in an agreement document between relevant agencies and interested parties.

## 1.3. IDENTIFYING SUBMERGED CULTURAL HERITAGE

Primary and secondary source research was completed to collect information on known, reported, and potential shipwrecks that occurred in the waters off California, Oregon, and Washington. Researchers also contacted maritime archaeologists, historians, shipwreck researchers, and other interested individuals. The data collected from this research were compiled into a database system of identified shipwrecks within the study area that could possibly be impacted by construction of offshore energy facilities.

The study identified 5,813 vessel records. Some duplication of records may exist due to multiple sources and variations in spelling. Duplicates should be addressed as quality control continues. As additional sources of information become available, the number of records will increase. Many data fields within records remain empty due to lack of available information during the research phase of the project. Continued research efforts and future information will populate some of these fields. There are 574 records (approximately 10 percent) that provide either verified or reported spatial data. Vessels without available spatial data are included in the database to facilitate future data entry should spatial information become available. This will negate the need to create and populate a new record, and only the additional spatial data will need to be appended. The POCS database is compatible with GIS applications. Those records that have available spatial data, whether it is verified or reported, can be integrated into a GIS application.

BOEM survey requirements call for the use of a marine magnetometer and a side-scan sonar to be towed at specific water depths (within 6 meters of the sea floor using magnetometer) within specified line spacing parameters (40 meters). Often on the POCS this tow depth requirement can be difficult to attain due to the ever-changing terrain. New autonomous underwater vehicle (AUV) technology that combines the AUV with a marine magnetometer and high-resolution side-scan sonar (Kozak 2013; Marine Magnetics 2013) can ensure that all BOEM survey requirements are met with every line of data. AUVs are recommended for historic surveys that meet the BOEM survey requirements.

A follow on study is recommended to identify high probability areas on the POCS and establish equipment requirements that would be most appropriate for identifying historic resources. Similar studies have been conducted by the Gulf of Mexico Region that resulted in the identification of archaeological high probability lease blocks (Pearson et al. 2004). A study of this nature would serve to continue to update and expand the POCS shipwreck database by identifying specific shipwrecks and high probability anomalies and would further refine the geographic positions in the database. Based on the results of the updated study a predictive model could be established on the POCS that would recommend survey instrumentation and strategies that would be most effective in identifying historic resources.

## 1.4. CONCLUSIONS

Models for the prehistoric POCS paleolandscape and its foraging potential can be used to make initial predictions of potential submerged prehistoric site location on the POCS, and can be used by BOEM to make initial decisions about where ground disturbance activities associated with development projects could be conducted on the POCS. The study also identified a total of 2,383 coastal cultural resources along the coast from the U.S./Canadian border to the U.S./Mexican border with the potential to be impacted by future offshore development. Further studies and Section 106 compliance would be required when specific undertakings are identified by BOEM. The study identified 5,813 vessel records located on the POCS, of which 574 records provide either verified or reported spatial data. A follow on study using AUVs is recommended for historic surveys that meet the BOEM survey requirements. This would identify high probability areas on the POCS and establish equipment requirements that would be most appropriate for identifying historic resources. Based on the results of the follow on study a predictive model could be established on the POCS that would recommend survey instrumentation and strategies that would be most effective in identifying submerged historic resources. It is important to remember, however, that although higher probability areas can be identified based upon remote-sensing data and research into historic shipping routes, past weather patterns, and port locations, vessels can wreck anywhere at any time. Low probability does not equate to a lack of cultural resources, but rather necessitates indepth review of project area environment, proposed activities, and potential impacts to determine proper investigative methodologies and resource management if warranted.

# 2. INTRODUCTION

## 2.1. BACKGROUND

BOEM is charged with considering what effects activities associated with energy (oil, gas, renewable) facilities and marine aggregate extraction on the POCS may have on cultural resources. While impacts on underwater cultural resources have traditionally been the primary focus of BOEM's historic preservation program, potential impacts on other cultural resources and properties are also of concern, including adverse visual and direct physical impacts on onshore historic and traditional cultural properties. BOEM concluded that identifying the location of known and reported submerged cultural resources, potential inundated prehistoric sites, coastal properties that are listed or eligible for listing on the National Register of Historic Places (NRHP), or traditional cultural properties is a critical step in the fulfillment of this responsibility. Coastal properties include built resources, historic and prehistoric archaeological sites, and historic districts. Traditional cultural properties are sites of significance that play a role in a community's historically-rooted beliefs, customs, and practices, and demonstrate the community's continuing relationship with that place.

## 2.2. PROPOSED APPROACH

To achieve this, BOEM contracted with ICF to accomplish multiple tasks. First, ICF was directed to assess areas of the POCS for submerged prehistoric site potential, to develop a GIS-based model for where submerged prehistoric sites might be expected, and to suggest areas most likely to have survived marine transgressive processes. Second, ICF was tasked with identifying coastal properties that could be adversely impacted by alteration of the adjacent seascape. Finally, ICF was directed to identify known, reported, and potential historic shipwrecks on the POCS.

The study area for this effort stretches in length from the U.S./Canadian border to the U.S./Mexican border and extends 200 miles west to the end of the offshore planning area or the U.S. EEZ (Figure 1). The study area for coastal resources includes land 1 mile inland from the coast. This differs from the Atlantic OCS study, which extended only .25 miles from the coast. Extending the width of the coastal resources study area is intended to capture a greater number of onshore historic properties and traditional cultural properties that might be subject to visual impacts by offshore development. BOEM's jurisdiction on the POCS begins 3 miles from shore and extends to the edge of the EEZ. The 3-mile width between the coast and BOEM's jurisdiction was included in the study area to take into account potential seafloor disturbance caused by the installation of infrastructure to support any offshore facilities.

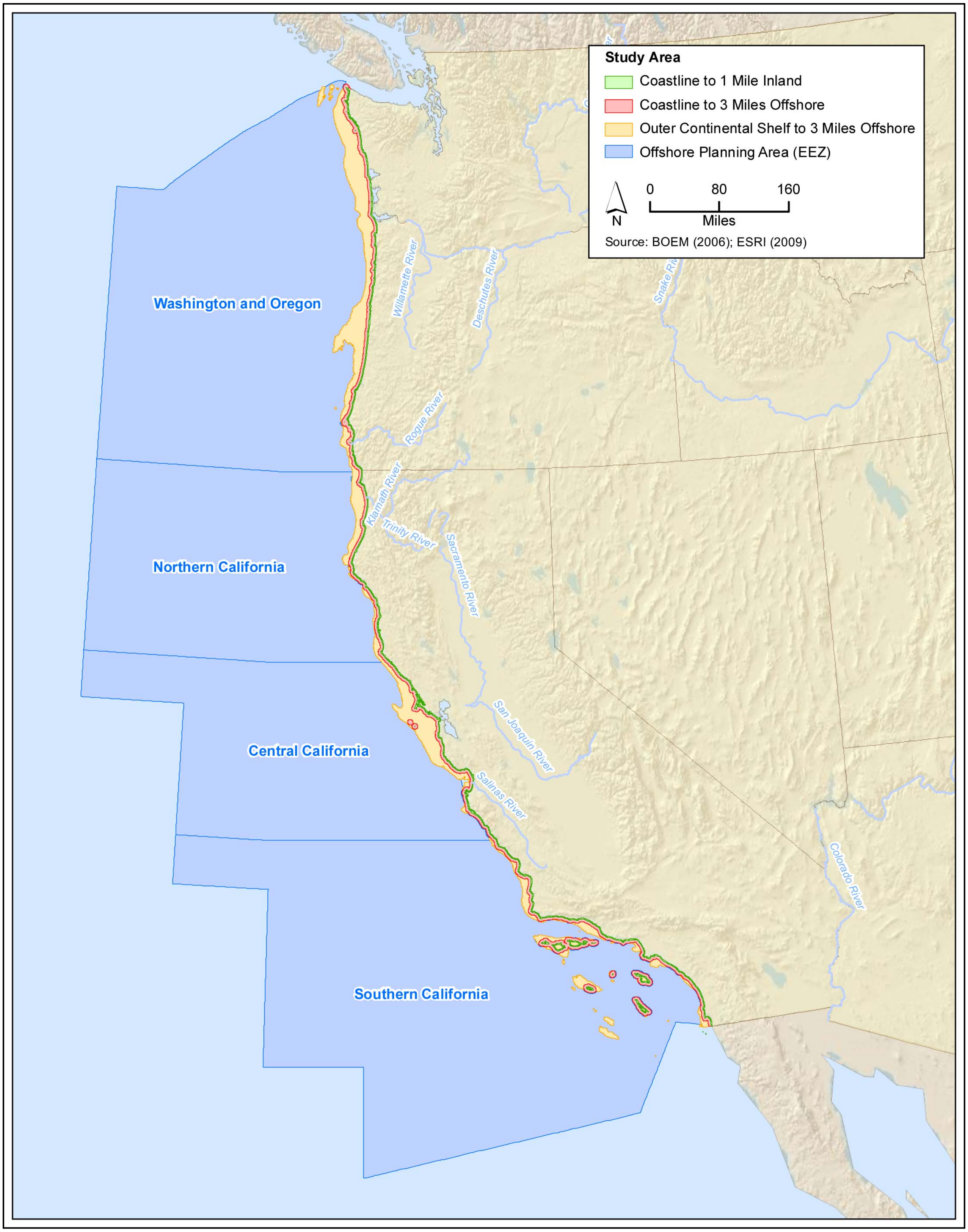


Figure 1. Study area for coastal resources.

As part of this study, the ICF team developed Microsoft Access databases, geo-referenced maps, and shape files indicating the study areas, coastal and submerged properties, and areas of potential cultural resources sensitivity. This study differs from previous studies in its technical approach to the question of where submerged landforms with the potential to contain prehistoric sites might be found on the POCS. Most notably, we employ a series of GIS methodologies to organize geospatial data related to the POCS bathymetry, create and apply new information about sea level histories to generate new models of coastal landscape evolution, and implement a quantitative GIS-based approach to the prediction of submerged site locations and their potential preservation along the POCS study area.

## 2.3. TEAM PARTICIPANTS

The ICF team consists of ICF, Southeastern Archaeological Research (SEARCH), Inc, and Davis Geoarchaeological Research (DGR). ICF cultural resources staff conducted archaeological and historic research and identified coastal properties subject to potential visual impacts from offshore development on the POCS. SEARCH, Inc.'s coastal and underwater archaeologists conducted maritime research and identified shipwrecks on the POCS. DGR examined early human settlement of western North America and developed a model of submerged site potential on the POCS.

## 2.4. TECHNICAL REPORT ORGANIZATION

This narrative report is the analysis and interpretation of all data collected during the course of this project. Chapter 1 presents the Executive Summary of this report. Chapter 2 describes the background of the project, the research and analysis approaches undertaken for the study, and the team participants who contributed to the study. Chapters 3 through 5 each focus on a separate aspect of the study.

Chapter 3 presents a detailed assessment of potential submerged sites on the POCS. It describes the geological and environmental background of the study area, a discussion of current theories on early human migration, habitation patterns, and information of relative sea level rise and site formation processes. Additionally it presents the methodology for modeling submerged prehistoric site potential on the POCS and the results of that modeling. Recommendations are offered regarding improving and testing the model as well as detecting and avoiding impacts on potential submerged prehistoric sites in the study area.

Chapter 4 focuses on coastal properties in Washington, Oregon, and California along the POCS. A narrative discussion of the prehistoric, ethnographic, and historic contexts is included to provide background on the human presence along the coast of the continental United States. Chapter 4 also describes the research methodologies used to identify historic properties and traditional cultural properties in the study area. It includes a discussion of the resource selection process, literature and archaeological data repository review, and outreach to Native Americans and experts in west coast archaeology. It also describes the types of prehistoric archaeological sites, traditional cultural properties, and built environment resources that may be impacted by offshore energy development on the POCS. The results of the research are presented along with a description of the database created from the results of the identification process. The chapter closes with a discussion of recommendations for further identification of coastal properties that may be affected by offshore development.

Chapter 5 focuses on the inventory of historic underwater cultural heritage. A detailed maritime historical background is presented along with a discussion of maritime resource types. The methodology for identifying underwater maritime resources is described, which includes a literature search, archival primary sources, secondary source review, and outreach to individuals knowledgeable in west coast maritime history and archaeology. The results of the research are described, along with a discussion of the accompanying maritime database created from the results. Recommendations for further identification of maritime resources are presented at the end of the chapter.

Chapter 6 presents a brief discussion of the results of the study as a whole. Chapter 7 lists the bibliographic references of all material consulted for this study. Appendix A documents outreach efforts to tribes, individuals, organizations, and repositories associated with the inventory of coastal properties. Appendix B is a user guide developed for the use of the coastal properties database. Appendix C documents outreach efforts to individuals, organizations, and repositories associated with the inventory of submerged cultural heritage. Appendix D is a user guide developed for the use of the submerged cultural heritage database.

# 3. ASSESSMENT OF POTENTIAL SUBMERGED PREHISTORIC SITES

Our current study differs and builds upon previous cultural resource baseline studies provided by Pierson et al. (1987) and Gearhart et al. (1990) in many ways. The Pierson et al. (1987) and Snethkamp et al. (1990) reports provide reviews of coastal ethnographic and archaeological records known at the time they were written. Our current report expands on this archaeological information by describing several older sites that extend Pacific coast prehistory back into the late Pleistocene as well as emergent patterns of prehistory beyond the Pacific coast that have direct bearing on our present interpretation of the archaeological record.

In the third volume of the Gearhart et al. (1990) study, Snethkamp et al. (1990: III-106-108) present a site prediction model that considers the intersection of several landform-based factors relevant to the potential preservation of submerged archaeological sites on the POCS, including: the presence and absence of Quaternary-aged sedimentary deposits; ancient submerged landforms deemed unattractive to prehistoric occupation (i.e., "non-sensitive landforms"); paleoembayments; submarine channel systems; and island complexes. Snethkamp et al. (1990) apply their geomorphic approach to site prediction and emphasize areas of the POCS that would have offered embayments, river channels, and islands as most promising for the preservation of submerged prehistoric sites.

Previous studies present large scale (e.g., 1: 250,000 scale maps) spatial predictions about submerged prehistoric sites on POCS based on limited bathymetric data and non-digital analytical approaches. The paleolandscape maps included in the Pierson et al. (1987) and Gearhart et al. (1990) reports were based on more limited bathymetric information. Paleoshoreline projections in both models were informed by sea level models built from a combination of local information and also from extraregional models. Our new study brings together the most detailed bathymetric information yet and has applied a GIS-based model that makes predictions about potential site locations that rests on assumptions about resource distributions that attract prehistoric peoples to particular parts of the POCS and considers how these resource areas are differentially affected by marine transgression. The GIS study predicts that the highest potential site location areas will be found within alluvial drainages that have economically attractive resources and relatively high rates of sedimentary deposition that should serve to preserve prehistoric sites better than in the interfluve areas. While the prediction that remaining submerged archaeological sites will be most commonly found in close proximity to alluvial environments was also voiced in the Pierson et al. (1987) and Snethkamp et al. (1990) studies, our GIS model makes georeferenced predictions about where these alluvial environments exist on the POCS. Our current study also features the most detailed reconstructions of paleoshorelines and alluvial drainage networks yet produced for the POCS, adding new dimensions of resolution to our perceptions of coastal paleoenvironmental contexts.

## 3.1. Geological/Environmental Background

### 3.1.1. Modern Coastal Geography

#### *3.1.1.1. Washington Coast*

The modern environment of the Washington coast is marked by two contrasting physiographic zones. Along its northern boundary lies the southern portion of the Salish Sea—a complex system of islands and waterways Washington shares with neighboring British Columbia. The Salish Sea includes four major geographic elements: the Strait of Juan de Fuca, which lies along Washington's northwestern border and provides an outlet to the open Pacific Ocean; the San Juan Islands, which are an archipelago of 172 islands and rocks of various sizes separated by numerous protected waterways and inlets; Puget Sound, a complex inlet that extends southward from the Strait of Juan de Fuca to Olympia; and the Strait of Georgia, which extends from the northern San Juan Islands along the eastern edge of Vancouver Island. The elements of the Salish Sea represent the most spatially complex coastal environment of our current POCS study area due in large part to its glacial history. During the Wisconsinan glacial period between 14,500–14,000 radiocarbon years before present (RYBP), Cordilleran ice advanced southward along the Strait of Georgia, over the San Juan Islands, and into the Puget Sound area as far south as Olympia. In time with deglaciation, rising sea levels drowned the Salish Sea landscape and produced the largest estuarine system in the western United States. Compared to its interior waterways, Washington's modern west coast is a relatively homogeneous stretch of north–south trending open coastline. The large embayments of Gray's Harbor and Willapa Bay—produced as rising sea level drowned large incised river valleys—lie along Washington's southern coastline.

#### *3.1.1.2. Oregon Coast*

The division between the Washington and Oregon coasts lies at the mouth of the Columbia River, which forms Oregon's northwestern border. Lacking influence from Late Wisconsinan ice sheet glaciers, Oregon's coastline is similar to Washington's western margin and is dominated by narrow beaches and high rocky headlands backed by abruptly rising Coast Range Mountains. Larger embayments caused by rising sea levels drowning river basins are few, represented by Tillamook Bay, Netarts Bay, Siletz Bay, Yaquina Bay, Alsea Bay, and Coos Bay.

Coastal Washington, Oregon, and northern California lie to the east of the Cascadia Subduction Zone, a shallow reverse fault marking the convergent boundary between the Juan de Fuca oceanic plate and the North American continental plate (Figure 2) (Darienzo and Peterson 1990; McNeill et al. 1998). Subduction of the Juan de Fuca plate beneath the continent produces strain along part of the plate interface, the locked zone, which resists slip by frictional forces (Figure 3). Along the coast, strain accrues slowly between earthquakes causing gradual uplift of the land (0–5 millimeters [mm] per year) (Mitchell et al. 1994). When stresses caused by the subduction process overcome the frictional strength of the locked zone, slip on the plate interface releases elastic strain as an earthquake. Coastal regions that are raised between earthquake events suddenly subside downward during an earthquake, producing widespread coastal subsidence of as much as 2–3 meters (Witter et al. 2003). As the stress is reduced during a Cascadia Subduction Zone (CSZ) earthquake, the subducting Juan de Fuca plate becomes locked and begins to accumulate strain once again. The accumulation of interseismic strain along the CSZ causes the coastal margin of Washington, Oregon, and northern California to resume their various rates and motions of crustal deformation once again.

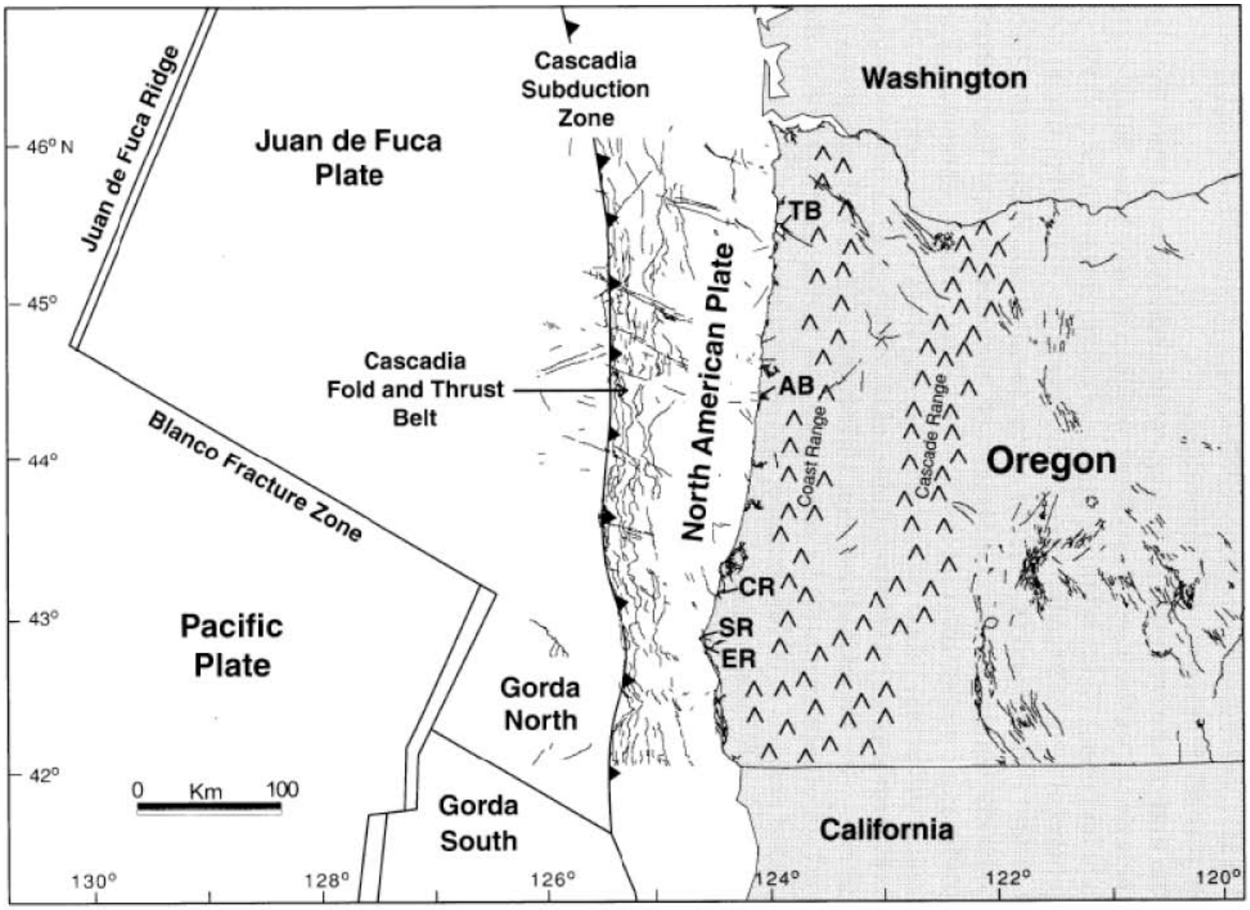


Figure 2. Map of the Cascadia Subduction Zone adjacent to southern Washington, Oregon, and northern California showing associated plates and Quaternary faults and folds. Oregon coastal landmarks indicated on the map include Tillamook Bay (TB), Alsea Bay (AB), Coquille River (CR), Sixes River (SR), and Elk River (ER). Quaternary fault and fold data from Personius et al. 2003.

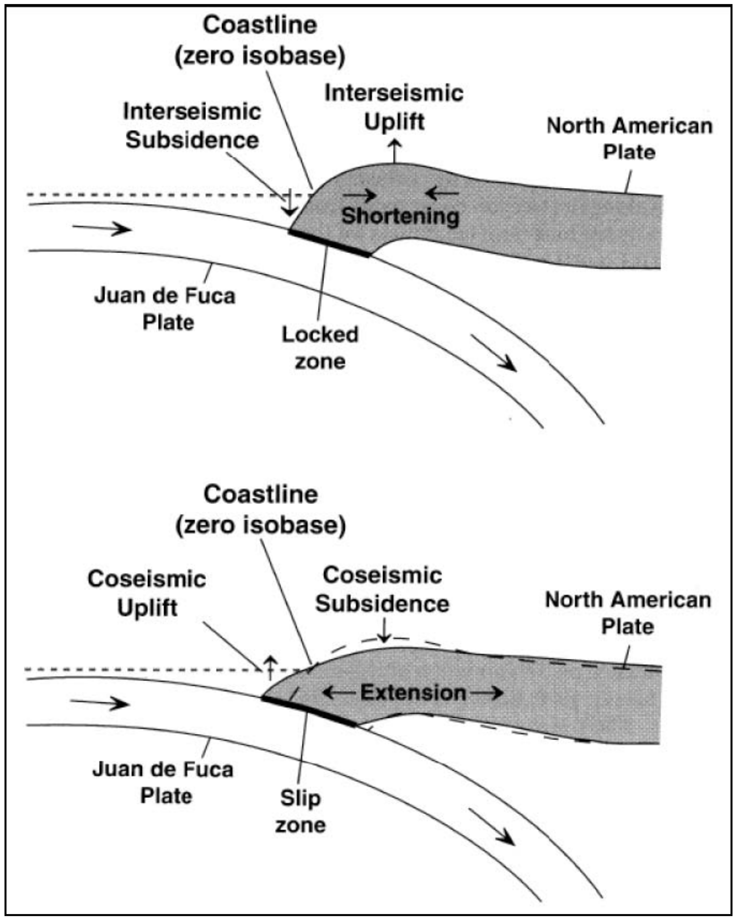


Figure 3. Deformation associated with the Cascadia Subduction Zone (Modified from Darienzo and Peterson 1990).

Small-scale, upper plate faults and folds associated with the CSZ also deform portions of the Oregon coast mainland (Figure 2) (Goldfinger et al. 1992, 1997; McNeill et al. 2000). Active folds and faults on the inner continental shelf generally trend parallel and perpendicular to the coastline and deformation front, respectively (Goldfinger et al. 1992; Goldfinger 1994) and have a significant influence on the formation of raised marine terraces, headlands, estuaries, and bays (Kelsey 1990; Kelsey et al. 1996; McNeill et al. 1998; Kelsey et al. 2002; Witter et al. 2003). Many prominent embayments along the Oregon coast are associated with synclinal folding or lie on the downthrown sides of high-angle faults or are submerged river valleys (e.g., Yaquina Bay), while headlands and differentially uplifted marine terraces generally correlate with anticlines or the upthrown side of high-angle faults (Muhs et al. 1990; Kelsey 1990; Kelsey et al. 1996; McNeill et al. 1998). The local behaviors of upper plate faults cause greater or lesser amounts of uplift, producing rocky headlands, bays, and dune-infilled lowlands. Greater or lesser degrees of coseismic subsidence may occur in any given area due to the nature and behavior of local geologic structures during great CSZ earthquakes.

#### *3.1.1.3. California Coast*

Starting just south of Brookings, Oregon, the northern California coastline has a physiographic appearance closely similar to Oregon's with the occasional addition of low relief coastal plains (e.g., at the bottom of the Smith River watershed; near the mouths of the Mad and Eel Rivers). South of Humboldt Bay, narrow beaches backed by steep headlands dominate the northern California coastline. Offshore of California's northern coast, the CSZ seafloor spreading along the Gorda Ridge causes the Gorda Plate to move beneath the North American Plate to its southern limit at Cape Mendocino. Neotectonic stresses cause relatively rapid uplift (ca. 4 mm/year) in the immediate vicinity of the Mendocino Fault—caused by frictional loading where the southern edge of the Gorda Plate moves westward past the eastward travelling Pacific Plate, along the Mendocino Fracture Zone. Uplift rates for the rest of the California coastline are similar to Oregon and Washington at less than 1 mm/year. The California coastline changes character near the mouth of San Francisco Bay. The effects of the San Andreas Fault are prominent in this zone, and its trace can be visualized as a northwest–southeast trending line that borders the eastern side of Point Reyes, runs through Tomales Bay and across the floor of the POCS, coming onshore again along the east side of San Francisco Bay where it continues inland to the southeast. As a right-hand lateral transform fault, tectonic motion along the central coast portion of the San Andreas Fault has moved parts of the California coastline away from the mainland, producing an otherwise unusual peninsular landscape at Point Reyes. The central coast zone begins south of San Francisco Bay and, apart from Monterey Bay with its deep submarine canyon, is dominated by rocky beaches with fewer sandy pocket beaches, both of which are backed by steep, incised headlands. At the southern end of the central California coastal zone, near Santa Barbara, laterally extensive but narrow (normal to the ocean) sandy beaches dominate the landscape. The southern California coastal zone begins at the boundary between Santa Barbara and Ventura Counties and is characterized by a nearly continuous stretch of concave (eastward) shaped sandy beach lines backed by low relief headlands and coastal plains—a region also known as the Southern California Bight. San Diego Bay is the region's largest embayment, and smaller lagoons and estuaries currently exist along the coast, including Batiquitos Lagoon, San Elijo Lagoon, Agua Hedionda Lagoon, Buena Vista Lagoon, and portions of now developed areas between Long Beach and Huntington Beach.

### 3.1.2. Paleoenvironmental Conditions and Prehistoric Human Ecology of the POCS

Late Quaternary period marine records are available from five sediment cores collected from offshore areas of British Columbia, Canada, to Baja California Sur, Mexico (Figure 4). Of these published marine records, some studies reveal proxy indicators of northeastern Pacific Ocean biological productivity covering the last glacial to Holocene period. These marine records were selected because they provide different yet convergent indicators of oceanic productivity that can be related to the human ecology of the northeastern Pacific margin during the Late Pleistocene to the early Holocene (LP-EH) (Figure 5). Each of the proxy records is described in turn below, followed by a discussion of their larger implications for early human ecology.

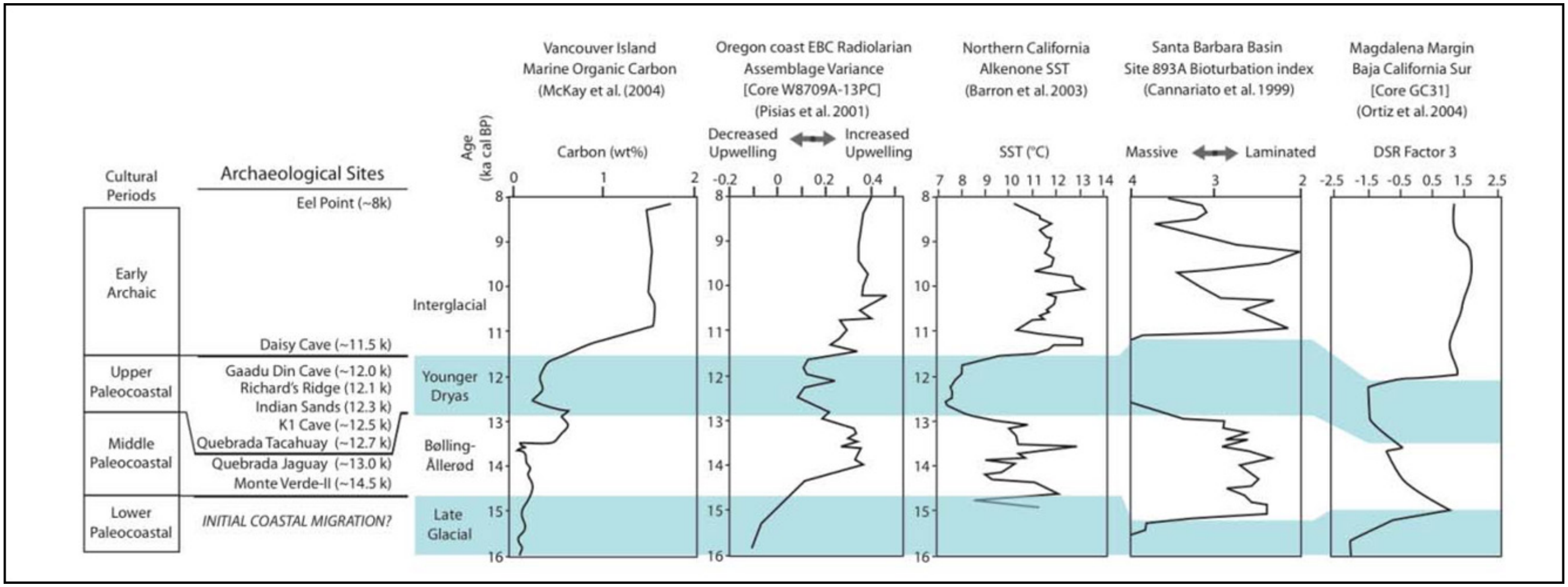


Figure 4. Correlation of northeastern Pacific paleooceanographic proxy records, early coastal sites, and proposed cultural periods for the period between 16,000 and 8,000 BP (From Davis 2011: Figure 1.2). Shaded portions mark periods with lower marine productivity.

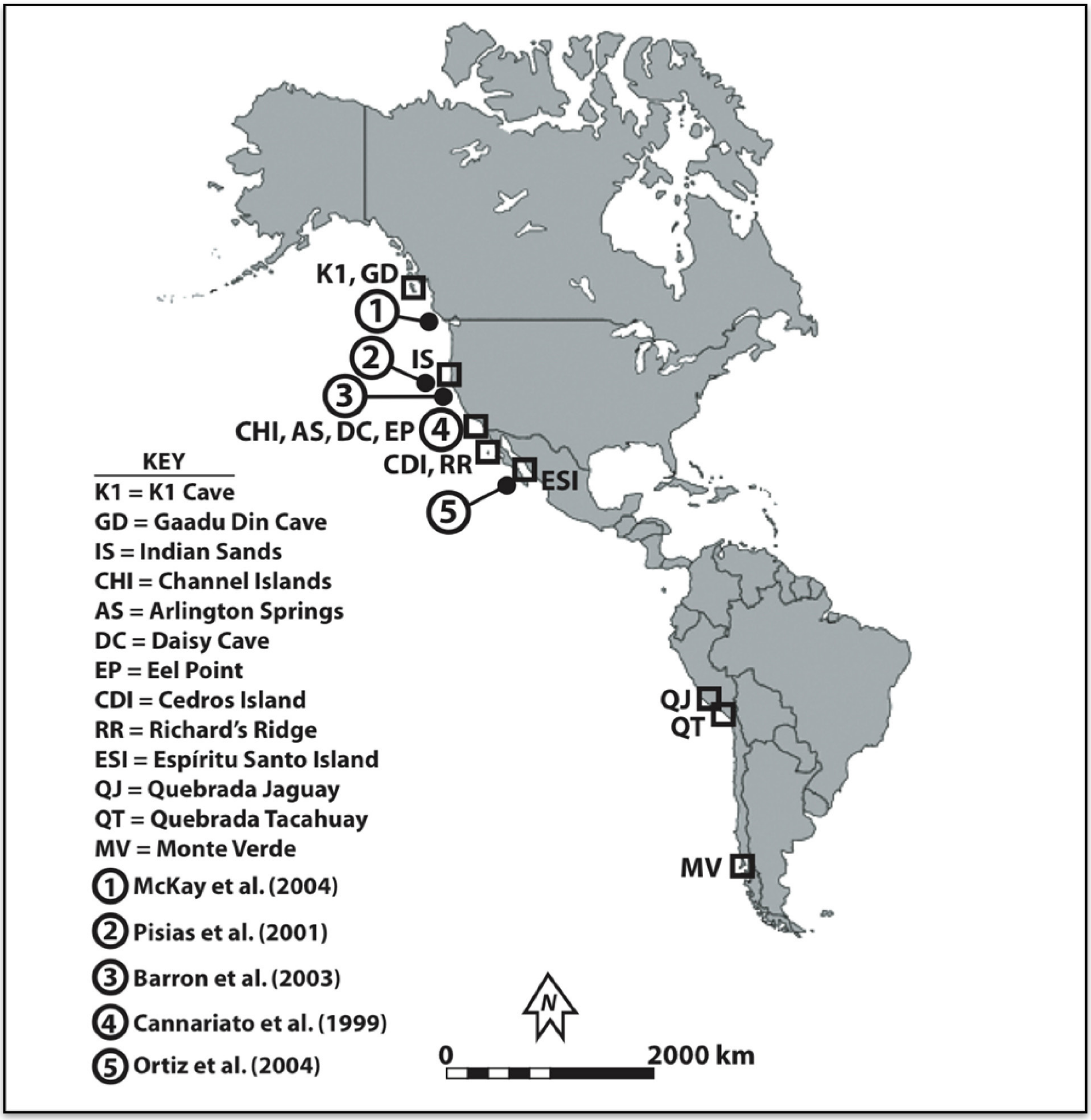


Figure 5. Map of North and South America showing archaeological sites (*squares*), marine cores (*closed circles*; numbers in *open circles* correspond with reference in key), and islands mentioned in text.

McKay et al. (2004) examined the deposition of terrestrial and marine organic matter in a core located offshore Vancouver Island. Accumulation of terrestrial organic matter was high during the late glacial period, but marine organic matter was relatively low before 14,300 BP, signaling greatly reduced primary production due to diminished upwelling effects. This pattern changed during the Bølling-Ållerød interval (14,700–12,900 BP), as a dramatic increase in marine organic matter marked an increase in marine productivity. Marine productivity returned to late glacial conditions during the Younger Dryas interval (12,900–11,500 BP). Indications of higher productivity levels marking interglacial marine conditions appeared by 11,000 BP.

Pisias et al. (2001) studied radiolaria and pollen frequencies in marine sediment cores collected along the Oregon coast, which led them to conclude that upwelling was significantly reduced prior to ca.15,000 BP and also during the Younger Dryas interval. Radiolaria assemblages reflecting modern upwelling conditions do not appear until after the Younger Dryas interval. Analysis of pollen assemblages reveals a strong correlation between the abundance of coastal redwood pollen and upwelling-sensitive radiolaria assemblages. This correlation is interpreted as revealing the operation of onshore fog produced during summer upwelling, upon which coastal redwoods depend.

The authors model offshore Ekman transport (i.e., upwelling) along the northeastern Pacific coast between 30° and 46° north latitude (Pisias et al. 2001) to understand the degree of change in summer and winter required to produce their observed biological proxy indicators. Their model shows that Ekman transport was only 33–50 percent of modern values from the last glacial maximum to the Younger Dryas period, whereas winter upwelling ceased (i.e., switched to downwelling) in coastal areas north of 42° latitude during the same late Pleistocene period.

In their examination of marine microfossil tracers (alkenones) and pollen assemblages from core ODP 1019, located offshore of the California–Oregon state border, Barron et al. (2003) established a proxy sea surface temperature record spanning the last 16,000 calendar years. This record indicates late glacial and Younger Dryas temperatures reached below 8° Centigrade (C), which are 3–4°C cooler than modern conditions. By 11,500 BP, temperatures had quickly risen back to warmer Bølling-Ållerød levels and achieved modern values by 11,400 BP.

Cannariato et al. (1999) related the occurrence of different sedimentological structures in a 60,000 year long sediment core sequence from southern California's Santa Barbara Basin to benthic biological activity. The presence of laminated sediments is linked to the presence of low-oxygen ($O_2$) concentrations in deep ocean waters that limit biological activity of burrowing animals. The cause of the low-$O_2$ conditions is attributed to three different processes: decreased mixing of oxygenated surface waters into deeper parts of the North Pacific region (i.e., ventilation) (e.g., Duplessy et al. 1989; Kennett and Ingram 1995; Ahagon et al. 2003), high respiration of organic carbon (and subsequent consumption of $O_2$) in the presence of intense upwelling (Mix et al. 1999; Stott et al. 2000), or, alternatively, by the presence of enhanced trophic productivity farther upcurrent in the northwest Pacific (Crusius et al. 2004), which contributed oxygen-depleted and nutrient-poor waters at intermediate depths along North America's western coast. Cannariato et al. (1999) interpret the Santa Barbara Basin sedimentary record to reflect patterns of north Pacific ventilation; however, following the conclusions of the Stott et al. (2000) study, which is based on direct historical observations of southern California marine conditions and their products in twentieth century Santa Barbara Basin sediments, the Santa Barbara Basin lamination record can be considered to reflect the differential operation of upwelling processes during the late Quaternary. Following the interpretations of Stott et al. (2000), weakened upwelling during late glacial and Younger Dryas conditions resulted in bioturbated sediments. This perspective also agrees with the record reported by Pisias et al. (2001) that suggests strengthened upwelling occurred along the southern Oregon coast during the Bølling-Ållerød and after the Younger Dryas. Keigwin and Jones (1990) identify a more complicated process that could involve multiple, seemingly contradictory interpretations, but ultimately point to reduced marine productivity: upwelling of deep, nutrient-poor waters would produce laminated sediments and low productivity as well.

Ortiz et al. (2004) studied a high-resolution marine core spanning the last 52,000 calendar years taken from the Magdalena Margin, which is located near the southern tip of the Baja California peninsula to the west of La Paz, Baja California Sur, Mexico. Their analysis revealed a strong correlation between the diffuse spectral reflectance and marine carbon content of cored marine sediments. Ortiz et al. (2004: 523) argue that this record reveals a history of marine productivity that was "drastically lower during past cool stadials and the Last Glacial Maximum than it was during the Holocene and past warm episodes."

These marine records indicate exceptionally low marine productivity during the late glacial and Younger Dryas periods, relatively increased productivity levels during the Bølling-Ållerød interval, and a shift to modern levels during the post-Younger Dryas interglacial period in environments stretching along the northeastern Pacific Ocean region from British Columbia to Baja California Sur. Although the proxy indicators of low marine productivity during cold periods of the late Pleistocene are described above, these indicators do not explain the systemic factors that contribute to the onset of this ecological state. In their review of the history of eastern Pacific coast geoecological and evolutionary processes since the Miocene, Jacobs et al. (2004: 5) provide an answer:

> Despite the higher wind regime characteristic of maximum glacial conditions, productivity associated with upwelling was commonly reduced during glacial times. Regional and more distant factors that influence upwelling intensity (e.g., Palmer and Pearson 2003) as well as the variable nutrient content of feedstock waters (e.g., Berger and Lange 1998; Loubere 2002) have been implicated as the causes of this difference between glacial and interglacial times. Arguments invoked to explain this phenomenon provide a set of plausible mechanisms that modulate upwelling and can be used to infer causes of changes in the upwelling regime at other times in the Neogene. It seems reasonable that the high-pressure regime and upwelling intensity along the West Coast would be influenced by the glacial conditions on the North American continent. Ice sheets extended as far south as southern Washington and Idaho, displacing the track of the polar front southward and extending its activity through more of the year (e.g., Kutzbach 1988). Glaciers were present in the Sierra Nevada, and there was substantial lake area in the West during the Pleistocene. All of these factors would have limited the summertime differences in temperature between land and sea, and/or the placement and stability of the summertime high pressure.

Observed reductions in upwelling during the late glacial to Younger Dryas period would affect the marine ecology of the northeastern Pacific Ocean. Because the significant biological effects associated with El Niño-Southern Oscillation (ENSO) climate events are due in large part to a reduction in the upwelling of cold, nutrient-rich water along the eastern Pacific coast, they provide an analogy useful for our current discussion. The following quote from Pearcy and Schoener provides quantitative estimates of the effects of reduced eastern Pacific Ocean upwelling associated with the 1983 ENSO event on eastern Pacific Ocean primary productivity:

> The average density of zooplankton off Newport, Oregon, during the spring and summer of 1983 showed a 70 percent reduction compared with non El Niño years (Miller et al. 1985). Zooplankton biomass was reduced by roughly half off Vancouver Island, British Columbia, during July 1983 (Seften et al. 1984). (Pearcy and Schoener 1987: 14,421.)

Although warmer waters and northward movement of southern species also contributed to lower overall biological productivity during 1983, Pearcy and Schoener (1987) note significant reductions in the populations of marine fishes and seabirds along Oregon's coast, and "disastrous" declines in anadromous fisheries due to negative changes in primary marine productivity. If the reduction in upwelling strength and nutrient delivery to the upper water column observed along the North American Pacific coast by Pisias et al. (2001) was accompanied by biotic effects more or less similar to that of historically observed ENSO events, then the northeastern Pacific Ocean probably exhibited a significantly different ecology during the LP-EH, compared to its modern (i.e., post-Younger Dryas) state.

Considering the complex history of eastern Pacific Ocean environmental conditions described here, the assumption that cold water represents the only requisite conditions for the development of a "kelp highway" appears to oversimplify the actual situation. Kelp require both cold and nutrient-rich waters (Hernandez-Carmona et al. 2001), the latter not present in the northeastern Pacific during the last glacial and Younger Dryas periods due to an interruption of the Ekman transport process (Jacobs et al. 2004). By contrast, the great expansion of kelp forests envisioned by Erlandson et al. (2007a) appears only to be possible during warmer periods of the late Quaternary associated with stronger upwelling cycles, including marine isotope stage (MIS) 5e (ca.125,000 years ago), perhaps at a more reduced level during the Bølling-Ållerød (14,700–12,900 BP), and most clearly during the post-Younger Dryas interglacial period (12,900–11,500 BP) (Jacobs et al. 2004). Since the end of MIS 5e, oceanographic conditions analogous to those seen during the modern period, which support extensive northeastern Pacific kelp forests, are limited to the post-Younger Dryas period. As Figure 4 illustrates, the northeastern Pacific Ocean was cold but nutrient poor during long periods of time between 16,000 and 11,500 BP (except for the Bølling-Ållerød oscillations), which contributed to diminished levels of trophic productivity in marine ecosystems during some parts of the late Pleistocene period.

These five marine studies suggest that the levels of upwelling required to support highly productive northeastern Pacific Ocean kelp forests did not exist until after Clovis peoples spread into North America. Kelp forests may have been present in some form during part of or the entire Bølling-Ållerød interval, but it appears very unlikely that the ancestors of the peoples who created the Monte Verde II component and the earliest occupation evidence at Paisley Five Mile Rockshelter ever saw, much less travelled along, a "kelp highway."

Exactly how these different oceanographic conditions of the Late Glacial, Bølling-Ållerød, and Younger Dryas intervals affected a maritime-based cultural adaptation in North America's Pacific coastal region is unclear, largely because our preinterglacial (>11,500 BP) archaeological record mainly comprises sites with hunting-oriented components (K1 Cave, Gaadu Din Cave, Indian Sands) and only a single example of marine resource use (Richard's Ridge) (Figure 5). The emphasis on hunting reflected in most North American coastal sites dating to the Younger Dryas interval should not be taken at face value and interpreted to mean that marine resource use was an unimportant economic pursuit prior to the interglacial period; pericoastal and coastal hunting activities are assumed to be an integral aspect of early coastal adaptations, but not exclusively so (Des Lauriers 2006) and are arguably easier to discover in the modern coastal landscape, which typically lacks late Pleistocene-aged shorelines and their associated littoral focused archaeological sites. Moreover, sites reflecting early use of what were previously interior coastal environments should be preserved in the modern coastal environment and more readily found than late Pleistocene (LP)-aged littoral exploitation sites (Waters 1992; Davis et al. 2009). The current view of Younger Dryas interval marine exploitation from the Richard's Ridge site provides unequivocal evidence that early North American coastal foragers were well adapted to their marine environments, while the other sites from this period clearly indicate hunting proficiency. Together, these sites reveal a more complete perspective on early coastal adaptations.

The presence of humans at the Monte Verde site in coastal Chile by 14,500 BP (Dillehay 1989) sets a benchmark for considering the timing and contextual implications of an initial migration into the Americas. If humans arrived at the Monte Verde site by way of a Pacific coastal migration that began 1,000 years or so earlier than the age of the Monte Verde II (MV-II) occupation, then the first coastal migrants may have trekked southward under Late Glacial conditions at ca. 15,500 BP. If the MV-II occupants took only 500 years to move from Beringia to Chile, then their migration occurred close to the onset of oceanographic changes associated with the Bølling-Ållerød interval after ca. 15,000 BP, but before 14,500 BP. If an initial coastal migration began during the Late Glacial period, the First Americans would have encountered Pacific Ocean environments with greatly reduced upwelling cycles and subsequently lower marine productivity, relative to conditions present after ca. 11,500 BP. Coastal migration that occurred during the Bølling-Ållerød interval probably encountered conditions of somewhat higher marine productivity not precisely the same as seen during Holocene interglacial times but improved from the Late Glacial period. Following Erlandson et al. (1996), if a New World coastal entry occurred "a millennia or more prior to the initial occupation of Daisy Cave," then humans would be forced to contend with a return to marine environmental conditions bearing dramatically lower productivity during the Younger Dryas period. Regardless, if humans entered and spread throughout the New World by way of a Pacific coastal migration route, then they did so during times when the northeastern Pacific Ocean's environments were quite different than those associated with the post-Younger Dryas Interglacial Period—the time in which we know the most about coastal adaptations.

Although archaeological sites in coastal North America that predate the Younger Dryas interval have not yet been identified, paleoenvironmental data are available from the period between ca. 15,500 and 12,500 BP and enable us to consider the human ecological context of earlier LP-aged marine environments. Working from an evolutionary framework that assumes the LP archaeological record of economic, logistical, and technological aspects will, at some level, reflect human behaviors conducted to address opportunities and constraints that were present in their contemporaneous marine ecosystems, we can expect that because the pre-11,500 BP ecological context of the eastern Pacific Ocean was significantly different than the post-11,500 BP period, its associated archaeological record will also be different than that seen during the Interglacial Period. Thus, we require better information about the paleoenvironmental context of marine and coastal environments and the prehistoric resource economies they might have supported through time. Because of this divergent ecological context, evidence from interglacial period coastal sites cannot be expected to directly inform us about the exact manner in which the First Americans used marine environments and their resources. Though we have not yet seen New World coastal sites that date to the Late Glacial period (>14,500 BP), we should expect to find them if the MV-II peoples traveled to Chile by way of a coastal migration route. As discussed above, paleoenvironmental records show greatly reduced levels of marine productivity along the northeastern Pacific during the Late Glacial period, similar to conditions present during the Younger Dryas interval. Because marine conditions were significantly different during the later Bølling-Ållerød interval, at the time of the MV-II occupation, the adaptive patterns expressed in the MV-II component may not necessarily reflect those employed in the context of the Late Glacial Period and should not be considered illustrative of potential Late Glacial Period cultural occupations. A review of the earliest New World Pacific coastal sites shows a range of adaptive patterns at different times, all of which diverge from the general post-Younger Dryas record of marine exploitation.

The earliest archaeological record of the New World Pacific coast dates to the Bølling-Ållerød interval (14,500–12,900 BP) in the South American sites of Quebrada Jaguay, Quebrada Tacahuay, and Monte Verde (Keefer et al. 1998; Sandweiss et al. 1998; Dillehay 1989; Dillehay et al. 2009). These sites show the use of a very limited set of marine resources, including anchovy, drum fish, crustaceans, some mollusks, and seaweeds, which is atypical to the post-Younger Dryas period pattern of marine zone use that generally includes a much broader resource base with a diverse set of shellfish and fish species. The discovery of cordage in these South American sites may point to the earliest use of fishing nets in the New World, an application of a specialized technology, to be sure. The MV-II component shows a more limited use of marine resources but notably includes the remains of seaweed that were procured from the Pacific Ocean, which is considered to indicate a deep traditional ecological knowledge of marine environments and their products (Dillehay et al. 2009). The Younger Dryas period (12,900–11,500 BP) includes the Quebrada Tacahuay and the Richard's Ridge sites, which demonstrate clear but divergent orientations to marine resource exploitation, along with the more pericoastal K1 Cave, Gaadu Din Cave, and Indian Sands sites. Whereas the Quebrada Tacahuay site shows a more specialized use of the marine environment, probably involving the use of nets to capture anchovy (which may also reflect a task-specific pattern in an otherwise richer marine setting), Richard's Ridge includes the remains of a broad range of invertebrate and fish species along with a well-developed non-fluted/non-Paleoindian foliate projectile point industry that was probably used to hunt marine mammals and sea turtles. Although northeastern Pacific proxy records indicate a significant reduction in upwelling-driven marine productivity during the Younger Dryas interval, the record from Richard's Ridge does not clearly indicate foraging in the context of a productivity downturn but may instead demonstrate that a greater degree of local environmental variability, caused by the operation of localized factors (e.g., the interplay of local bathymetry, terrestrial physiography, and marine currents during lower sea level), worked to buffer negative effects of Younger Dryas climatic conditions across the northeastern Pacific at this time. Certain areas of the New World Pacific coast, by virtue of inherent local characteristics, may have exhibited higher productivity marine environments during times when other coastal areas of the northeastern Pacific were suffering the effects of reduced marine productivity (Yesner 1987). If so, then these "marine oases" were probably most attractive to the coastal peoples of the eastern Pacific and might ultimately retain the earliest evidence (i.e., Late Glacial) of coastal adaptations in the New World. Given its unique oceanographic setting, the discovery of intact Younger Dryas-aged and earlier period sites from the Channel Islands may ultimately reflect this pattern as well. Finally, early coastal sites postdating the Younger Dryas (ca. 11,500 BP) exhibit technological, environmental, and subsistence aspects that persist unchanged much longer into the Holocene and appear to reflect the initial development of an Archaic coastal pattern (e.g., Ames and Maschner 1999).

### 3.1.3. Sea Level Rise/Site Formation Processes

#### *3.1.3.1. Summary of Sea Level History*

According to the Peltier and Fairbanks (2006) Barbados coral record, eustatic sea level raised an average of 6.3 mm/year (6.3 meters/1,000 years) over the 19,000 year period since the LGM (Figure 6). During this time, the rate of eustatic sea level increased at three different times: from 19,000–18,000 BP (8.8 meter rise), 14,000–13,000 BP (23.6 meter rise), and between 12,000 and 11,000 BP (17.0 meter rise). While these vertical movements in sea level served to deepen the ocean relative to the POCS, they did not always translate into significant periods of inundation. Our study indicates that the greatest amount of coastal inundation due to rising eustatic sea level occurred over a period between 11,000 and 8,000 BP. After 11,000 BP, the rate of marine transgression began to slow: between 11,000 and 9,000 BP, the rate of marine transgression reached 17.5 meters; from 9,000–7,000 BP, sea level rose 11.9 meters; from 7,000–5,000 BP, rates of sea level rise fell to 7.7 meters; from 5,000–0 BP, rates of marine transgression were at their lowest (7.5 meters over 5,000 years). Although rates of sea level rise vary throughout the 19,000-year history since the LGM, at no time do we see a still-stand in eustatic marine transgression.

#### *3.1.3.2. Prehistoric Site Formation on the POCS*

We expect that prehistoric coastal foragers used a range of natural resources latitudinally distributed across the POCS and into areas of the modern North American coast. Marine transgression undoubtedly affected the position of these natural resources on the POCS and the archaeological sites related to their use (Figure 7; cf. Waters 1992). As sea levels rose after the LGM, landward compression of the POCS coastal landscape forced prehistoric foragers to move farther and farther inland to stay above shifting shorelines and to access shifting resource areas. Prehistoric sites on the POCS may hold evidence of foraging activities related to the proximal location of different kinds of environmental zones at different points in time. For example, parts of the POCS paleolandscape that are farther inland at any point in time might hold sites related to interior resource use. In time, rising sea levels cause outer coast environments (e.g., estuarine, littoral) to shift inland.

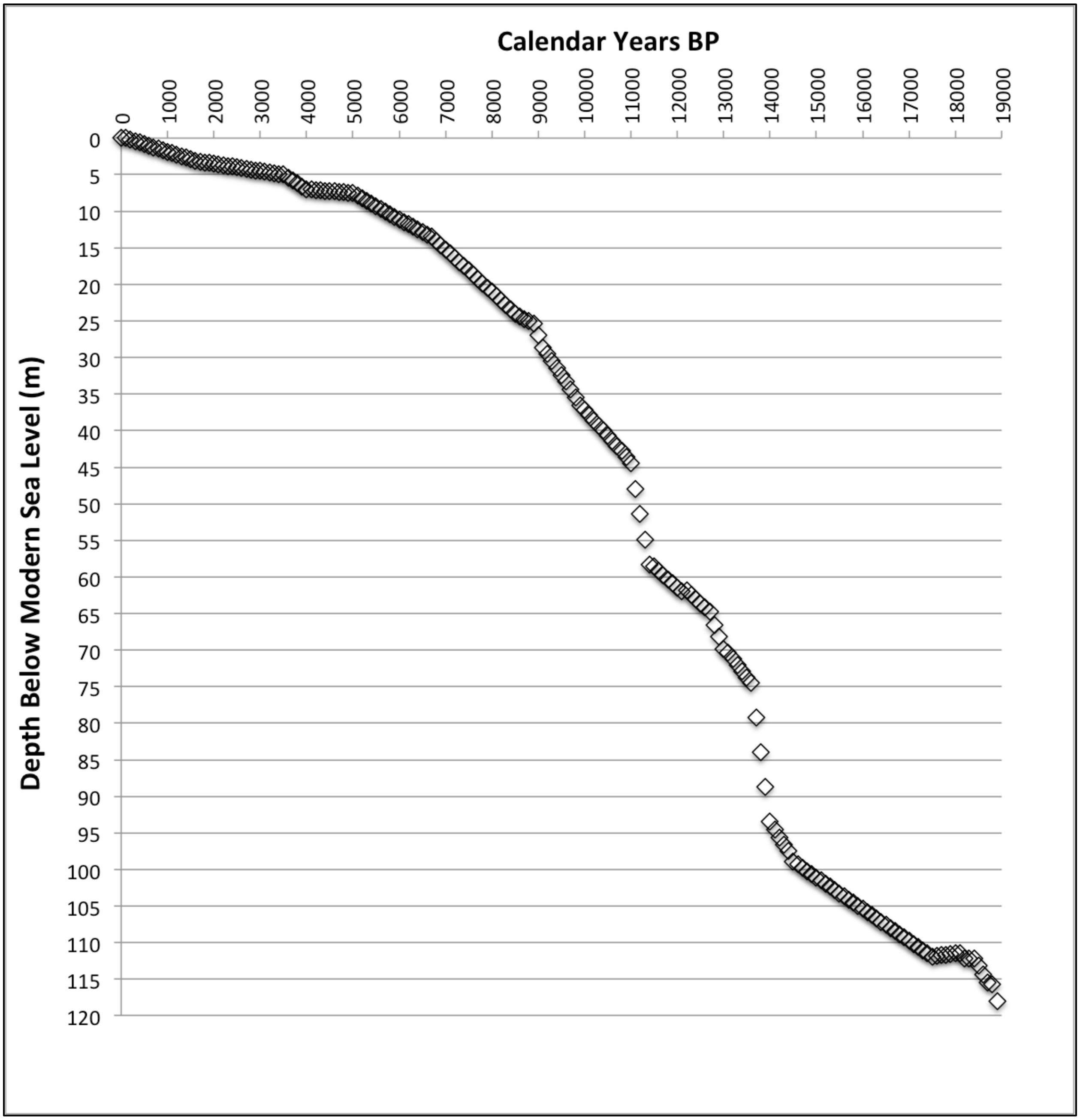


Figure 6. Interpolated eustatic sea level curve from the Barbados coral records reported by Fairbanks (1989) and Peltier and Fairbanks (2006).

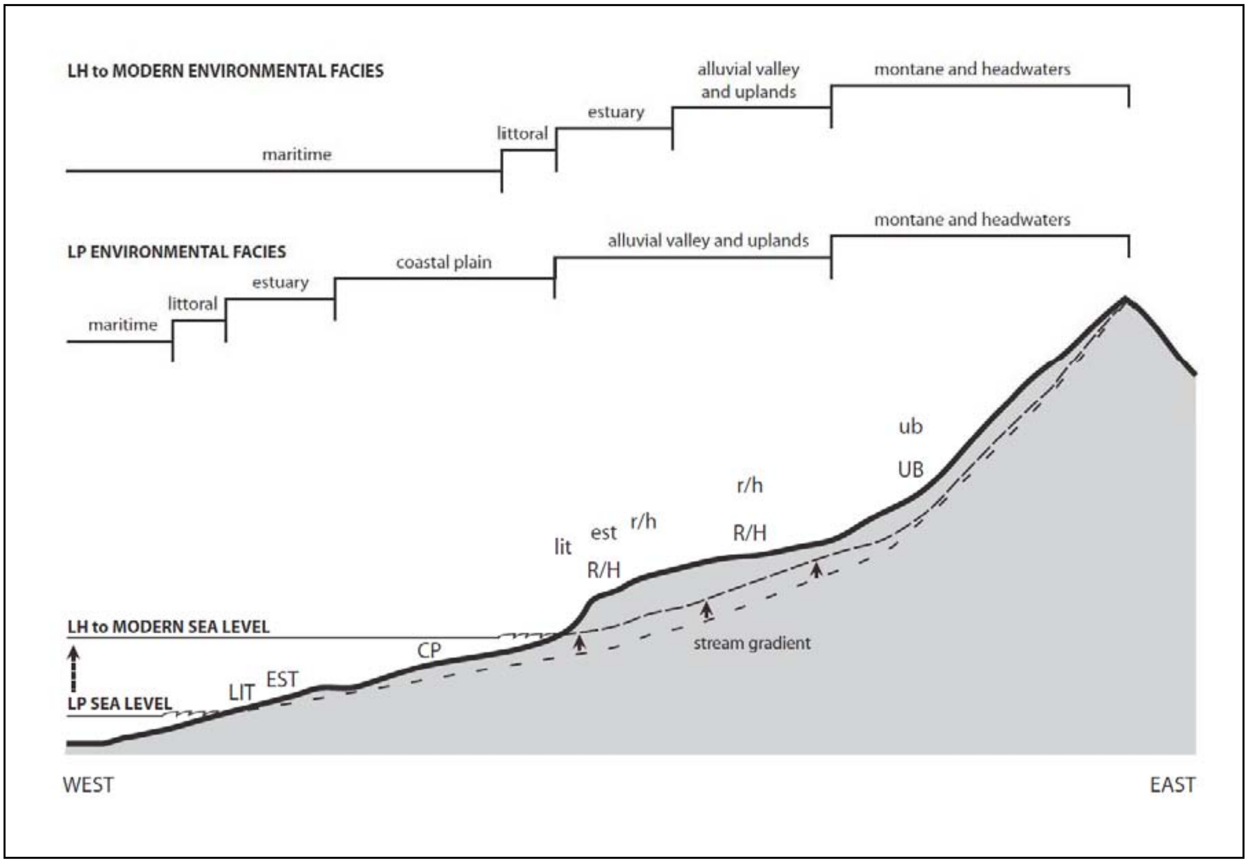


Figure 7. Model of coastal environments and expected site locations (From Davis et al. 2009). Abbreviated terms in all caps relate to LP-aged landscapes, while lower-case terms relate to modern coastal environments and include: LIT, lit = littoral; EST, est = estuarine; R/H, r/H = riverine/headland; UB, ub = upland basin.

Where site formation processes promote the development of stratified geological records and where prehistoric peoples continued using the same sites through time, we should expect to see situations where earlier archaeological components related to inland terrestrial and riverine resource use are buried by younger deposits bearing archaeological evidence of people using estuarine or littoral ecosystems at the same location. In this way, the vertical order of site functions recorded in stratified archaeological sequences should not only reflect the transgressive sequence of post-LGM environmental change but also the original lateral distribution of cultural activities in the coastal landscape. Archaeological evidence of this phenomenon has been reported from stratified sites found on Oregon's modern shoreline, examples of which include Neptune (Lyman and Ross 1988a; Ross 1976; Jenevein 2010), Devils Kitchen (Hall et al. 2005; Davis et al. 2006), and Indian Sands (Davis et al. 2004; Davis 2006; Davis 2008; Davis et al. 2008; Davis 2009a, 2009b; Davis and Willis 2011). At these three sites, older basal archaeological components contain higher quantities of lithic debitage and tools, and fire cracked rock; and lack marine shells. Younger overlying components include shell midden layers.

Any prehistoric sites created on the paleolandscape of the POCS would be subject to the effects of marine inundation as rising sea levels advanced the shoreline of the Pacific Ocean farther to the east. Opinions vary on how marine inundation would have affected the formation and preservation of archaeological sites. Kraft et al. (1983) suggest that rapid marine transgression might quickly inundate sites on the continental shelf without significant erosive effects, whereas Inman (1983) argues that erosion should be widespread, and sites are unlikely to be preserved but in exceptional still-stand circumstances where protective ecological and geomorphic contexts associated with lagoons and terraces are created. In their previous review of POCS submerged site potential, Snethkamp et al. (1990: III–102) offer several insights:

> In general, the same classes of physiographic locations that have a high potential for site preservation on land offer the highest potential for preservation during and following the process of inundation. For example, sites that are buried by a protective covering of sediments are much less likely to have been impacted by wave erosion during inundation than are exposed sites. At least three factors affect the degree of wave erosion likely to impact a site: burial prior to inundation, the duration of exposure in the intertidal zone, and the intensity of wave energy. Burial of terrestrial sites is one of the best mechanisms for increasing the chances of survival during inundation. Sites that are most likely to become buried in a terrestrial setting occur in alluvial environments such as river floodplains and terraces. As a result, submerged riverine meander belts have been judged to be one of the most likely settings to contain preserved prehistoric sites on the continental shelf.

Alluvial burial of prehistoric sites on the POCS prior to marine transgression seems probable, given what we know about sedimentation histories from Oregon's coastal rivers and bays. Stratigraphic evidence from Alsea Bay, located on Oregon's central coast, shows about 55 meters of sediment accumulation occurred during the Holocene (Peterson et al. 1984). From 10,000 to 7,500 RYBP, sedimentation rates ranged between 4 and 7 mm/year. An average of 11 mm of sediment accumulated in the bay between 7,500 and 5,000 RYBP. After 5,000 RYBP, sedimentation rates in Alsea Bay fell to ca. 2.1 mm/year, reflecting a decline in the rate of eustatic sea-level rise and corresponding alluvial aggradation. To the north, stratigraphic records from Oregon's Tillamook Bay indicate that about 32 meters of sediment accumulated during the Holocene (Glenn 1978), with depositional rates at 20 mm/year seen before 7,000 RYBP and ca. 2 mm/year after 7,000 RYBP. Punke and Davis (2006) report details of Holocene depositional patterns from a 27-meter-long core recovered from the Sixes River valley, which is located on Oregon's southern coast, just north of Cape Blanco. Wood charcoal found at the base of the core in organic-bearing marsh sediments returned a radiocarbon age of 10,190 ± 60 RYBP. Kelsey et al. (2002) reported dated cores extending 7 meters into the Sixes River floodplain, which revealed a stratigraphic record spanning the last 6,000 radiocarbon years. Taken together, the Kelsey et al. (2002) and the Punke and Davis (2006) cores indicate that the Sixes River aggraded 21 meters of sediment between 10,190 and 6,000 RYBP, at a rate of 5 mm/year. After 6,000 RYBP, Sixes River sedimentation rates slowed considerably to 1 mm/year. Punke and Davis (2006: 336) state, "The rates and amount of sedimentation recorded at the Sixes River since the Late Pleistocene appear to be typical of Oregon coastal river valleys."

The Oregon studies of riverine and bay sedimentation rates are also expected to be representative of coastal alluvial settings along the Washington and California shorelines as well, and similar geomorphic responses to rising sea level undoubtedly occurred on the paleolandscape of the POCS during the late Pleistocene to Holocene periods. Coastal streams accumulate sediments in their lower reaches where sediment-laden river discharge meets an opposing influx of tidal waters or the stream enters a lower gradient, less constrained embayment. In such a context, the physical competency of coastal streams is greatly reduced, causing most of their sediment load to fall out of suspension or traction and become deposited. Past stream systems on the paleolandscapes of the POCS would also respond to marine transgression by accumulating sediment in their lower reaches. As marine transgression moved shorelines farther inland, this sedimentation zone would translate farther and farther upstream in advance of the littoral zone. The rate of co-transgressive riverine aggradation for any particular stream system is expected to maintain a steady-state with sea level rise: all other factors being equal, riverine systems will respond to high rates of marine transgression by accumulating greater amounts of sediment over shorter periods of time; periods of slow sea level rise will be matched by relatively lower rates of alluvial aggradation. Ultimately, we may find that the total amount of stream aggradation that occurred in such a co-transgressive relationship might be the same across the POCS; only the amount of time represented by the accumulation of riverine sediments might change from place to place.

Those parts of the POCS that lie outside of the influence of stream deposition, including open coastlines and adjacent headlands, are subject to different kinds of site formation processes before and after inundation. Numerous uplifted marine-cut terraces and coastal plains are seen along the modern coastlines of Washington, Oregon, and California. Based on the stratigraphy of several headland sites from the Oregon coast, Davis et al. (2008) describe different site formation scenarios that create distinct patterns of archaeological resolution in non-riverine coastal sites. At one end of the continuum, Davis et al. (2008) describe sites that are largely cut off from receiving significant quantities of sediment through time, and, as a result, appear as time-averaged archaeological deposits at or just beneath the surface. At the other extreme are sites bearing one or more cultural components that are entombed as discrete archaeological deposits within rapidly aggrading aeolian dunes. In terrestrial settings, the relative degree to which a coastal or headland site is buried and remains buried over time is expected to play an important role in determining whether it might survive any erosive effects of initial inundation. The accumulation of sediment over an archaeological component will offer a protective buffer against erosion, to some degree at least. Because open coastal and headland sites are associated with topographic projections, they may receive a much greater degree of erosional damage than sites buried in alluvial floodplains, which lie in topographically depressed portions of the landscape. Whether or not open coastal and headland sites could ever accumulate enough sediment to mediate the erosive effects of marine transgression is unknown; however, it seems reasonable to expect that the relative degree of burial prior to inundation could play a greater or lesser role in promoting site preservation in a context of rising sea levels. In sum, we expect that sites associated with riverine settings, including bays and estuaries, will have a far greater chance of surviving the erosional effects of coastline advance; sites located along the open coastline and on adjacent headlands will probably receive greater erosional effects as rising sea levels apply the full force of the Pacific Ocean's littoral zone.

Ultimately, marine transgression submerged nearly all parts of the POCS landscape that were once connected to the North American mainland. We might expect that surficial sites or shallow buried sites might have been destroyed as the highest energy portion of the Pacific littoral zone passed over the POCS paleolandscape; however, the erosional effects of the Pacific's wave actions are expected to be reduced through time, as archaeological sites become inundated and submerged beneath ever deeper waters. To this point, Snethkamp et al. (1990: III-105) offer several key insights:

> The subtidal zone includes all of the seafloor below the normal reach of high wave energy, and thus offers a mechanically stable environment for inundated sites. All of the continental shelf within the study area now is located within the subtidal zone. As sea level rose, the intertidal zone migrated landward, leaving behind a basal transgressive sand layer in the subtidal zone. Once having "arrived" in the subtidal zone, buried sites would be relatively safe from additional mechanical degradation. As is true of sites in the intertidal zone, burial beneath sediments prior to inundation would play a significant factor in the survival of sites in the subtidal zone. A considerable number and variety of prehistoric sites undoubtedly would have survived the transition from terrestrial to subtidal setting.

## 3.2. EARLY MIGRATION AND HABITATION PATTERNS

At the end of the Pleistocene, reorganization of global environments followed a complex feedback system involving terrestrial and oceanic components, examples of which are seen in the suspected links between deep ocean circulation, atmospheric conditions, and the timing of continental ice melting during the decline of glacial conditions after ca. 15,000 BP (e.g., Ruddiman 1987; Broecker et al. 1989; Broecker and Denton 1990). Biotic responses to these global changes resulted in the expansion, movement, or extinction of many floral and faunal species within newly reorganized ecosystems (e.g., Graham and Lundelius 1984; Graham 1985, 1986, 1990; Grayson 1976, 1977 1989, 1998; Graham and Grimm 1990; Pielou 1991). This period of ecological change is also associated with important events in global archaeological records, including human migration into the New World.

### 3.2.1. Early Migration Routes and Timing of Entry

The Late Wisconsinan glacial history of North America provided critical opportunities at different stages during the late Pleistocene that may have allowed Paleoarchaic and Paleoindian peoples to migrate south of the ice sheets at different times, in different ways. Close examination of the Dyke et al. (2003) reconstructions of late Wisconsinan glacial ice sheets indicates the presence of a hypothetical coastal route by at least 16,000 BP and that a hypothetical ice-free corridor had opened by 14,675 BP or was perhaps delayed until 13,350 BP. Within the context of these late Pleistocene environmental conditions, Davis et al. (2012) consider the process of early human migration along coastal and interior routes of entry and offer a possible explanation for the Paleoarchaic/Paleoindian co-tradition problem. These processes of early human migration into the Americas include Full Maritime Migration, Partially Amphibious Migration, and Ice-Free Corridor Migration.

Early peoples bearing a fully maritime adaptation that enabled long-distance oceangoing travel and broad use of coastal economic resources, including areas along extensive glacial ice margins, could easily negotiate movement across the Bering Strait and continue along the eastern Pacific coast at or before 16,000 BP. Whether a full-fledged maritime orientation was an adaptive aspect of the first Americans is not clear; however, others have argued for its existence based on global patterns of human migration in coastal regions (e.g., Dixon 1999, 2001; Erlandson 2002). Under a Full Maritime Migration (FM2) strategy, migrants could be expected to create fewer sites with highly ephemeral traces and may not have colonized all or any of the available coastal areas. If FM2 migrants traveled great distances along the eastern Pacific coast in short time intervals, perhaps in the process of following migratory waterfowl or some other marine animals, then their transit time from Beringia to the Olympic Peninsula could have been relatively brief. If the FM2 strategy was employed, we would expect the Alaskan and British Columbian coastlines to hold the earliest sites in the Americas; however, a highly mobile population that was focused on nearshore ecosystems would be expected to leave little to no archaeological evidence in most of today's modern coastal environment. Conversely, some early FM2 migrants could have stopped their voyage at different points along the unglaciated Alaskan and British Columbian coast, colonizing New World coastal regions, while others continued on to points south. If this occurred, then we should expect that the earliest New World sites should be found along the northeastern Pacific Rim.

Dyke et al. (2003) indicate that the Copper River Basin was deglaciated by 16,000 BP, opening a route for human migration from southeastern Beringia to the Pacific Ocean. South of the Copper River's mouth, large, scattered areas of coastal Alaska and British Columbia were never glaciated, or were deglaciated by 16,000 BP, providing a mosaic of terrestrial environments extending to Washington State's Olympic Peninsula (Dixon 1999, 2001; Fedje et al. 2004a; Mandryk et al. 2001), from which early human migrants could easily move into mid latitude North America and beyond. This particular scenario considers coastal migration as an "amphibious" process involving a mix of terrestrial and maritime movements and adaptations within coastal and pericoastal environments (see Dixon 1999, 2001; Fedje et al. 2004a), perhaps only requiring relatively limited seafaring efforts. If the initial peopling of the Americas occurred via a Partially Amphibious Migration (PAM) strategy, we should see the earliest New World sites occurring between the Copper River and Vancouver Island, dating as early as 16,000 BP. In contrast to the FM2 model, early human migrants who employed a PAM approach would undoubtedly produce a greater number of sites in more places along the coastal route. If PAM settlers left behind colonizing populations as they moved south along the coast, early human occupation of the coastal landscape might limit the ability of later migrants to follow the PAM route south of the ice sheets. If this indeed occurred, and if the early coastal colonizers competed to deny outsiders access to their territorial resources, such a settlement process could close a PAM route to other, later migrants within a few generations after becoming settled. Such a process might cause pronounced cultural and genetic divergence between Pacific coastal and Beringian peoples. As well, the presence of FM2 settlers along the northeastern Pacific Rim prior to 16,000 BP could have limited or excluded others from later employing a PAM model.

According to Dyke et al. (2003), Late Wisconsinan deglaciation produced an ice-free corridor between the Cordilleran and Laurentide ice sheets as early as 14,675 BP; however, Duk-Rodkin and Hughes (1991, 1992) argue that the Mackenzie Mountains' glacial ice did not retreat until 13,350 BP, delaying the full opening of the corridor. Mandryk et al. (2001) argue that the initial opening of the ice-free corridor was accompanied by the simultaneous growth of an inland sea, which persisted until 13,350 BP and initially impeded human migration; however, Haynes (2005) has speculated that Clovis migrants could have solved this problem by building boats to cross the water obstacle. If boats were used to cross water bodies within the ice-free corridor, then the Ice-Free Corridor Migration (IFC) route could hypothetically have been traversed by 14,675 BP. A fully terrestrial IFC route was apparently open by 13,350 BP. The opening of the corridor by 14,675 BP or 13,350 BP could have offered an alternative interior route of southward migration at least a thousand years after a PAM strategy could have been pursued along the Pacific coast. Moreover, the IFC could have offered an alternative to an earlier but already occupied coastal route of entry for Beringian populations. Although it fails to account for evidence of pre-Clovis-aged human occupation at sites like Monte Verde (Dillehay 1989) and Paisley Five Mile Rockshelter (Jenkins 2007; Jenkins et al. 2012), the traditional Clovis First model of entry via an IFC route is another potential route of early migration.

#### 3.2.1.1. Clovis First Model

The longest-lived paradigm of New World peopling asserts that humans migrated from northeast Asia in the closing millennia of the Pleistocene, sometime after 12,000 RYBP, by walking across the Bering Land Bridge and southward through an unglaciated corridor between continental Late Wisconsinan glacial ice sheets. Archaeological evidence of these initial human migrants, who are called "Clovis People," is known from a number of sites from the Great Plains and American Southwest regions that date between 11,050 and 10,800 RYBP. According to the "Clovis First" model, Clovis Paleoindian foragers represent the initial human settlers of the Americas, and all other early cultural traditions are their direct descendants.

#### 3.2.1.2. Early Paleoindian Lithic Technology

Wilke et al. (1991), Collins (1999), and Morrow (1995) provide examples of early Paleoindian lithic reduction sequences from beyond the far west. In general, fluted biface site assemblages include evidence for bifacial reduction and formal conical and wedge-shaped core and blade reduction. The production of finished bifaces is nearly always seen to be a result of extended bifacial reduction from larger bifacial preforms. While Collins (1999) notes that fluted biface technology largely included tools made from bifacial reduction and conical and wedge-shaped cores, tools made on core-struck macroflakes are also present, albeit rarely. Moreover, macroflakes used for tool manufacture are typically attributed to debitage produced during extensive bifacial reduction, rather than through a formal core and flake reduction process (Collins 1999). A further distinction of the Paleoindian technological sequence model is the presence of the blade industry as a reduction “subsystem.” Formal unidirectional conical and wedge-shaped cores were used to make true blades. These blades were not used for bifaces but instead served as special purpose tools apart from the biface. The existence of this highly formalized core and blade industry also serves to further distinguish Paleoindian technology from Paleoarchaic technology. That is, fluted biface manufacture is extremely limited to direct biface reduction, which is not a diverse use of core technology or tool production. Instead, early Paleoindian lithic assemblages are quite standardized and restrictive. As is commonly understood, the defining characteristic of early Paleoindian technology is the removal of fluting flakes, which were typically driven off the biface before completion of the point, suggesting an implicit and integrated reduction and design strategy (Callahan 1979; Collins 1999). However, unlike in regions farther east, the far west manifestation of fluted Clovis technology does not share a diversity of fluted forms (e.g., Suwanee, Cumberland, Redstone) and is commonly considered to be “different” from Clovis elsewhere (Beck and Jones 2007, 2009; Beck et al. 2004), based on its shape form, degree of basal indentation, and variation in fluting (i.e., absent to “basally thinned”). Moreover, the nature of technological variability inherent in the Western Fluted tradition is mainly understood from basic morphometric comparisons (e.g., Beck and Jones 2010: Table 4). While diagnostic biface characteristics are commonly used to separate early site types in the far west (i.e., fluted = Paleoindian, and stemmed/foliate = Paleoarchaic), we feel that the morphological end product of the bifaces was probably less important than the reduction sequence behind their production. We believe that close examination of fluted and non-fluted stemmed/foliate site assemblages reveals vastly different reduction methods, core strategies, tool forms, and raw material preferences. Until better chronometric dating control on early sites is available, this technological evidence of distinctly separate lithic reduction sequences is perhaps the strongest indication for the presence of two contemporaneous cultures or co-traditions during the late Pleistocene–early Holocene period in the far west.

### *3.2.1.3. Paleoindian and Paleoarchaic*

Over 20 years ago, Alan Bryan challenged the idea that Clovis should lie at the base of all far western culture histories. His main claim and associated hypothesis on this topic are as follows (Bryan 1988: 59):

> It has generally been assumed that fluted points should everywhere precede stemmed and notched points as they do on the High Plains. However, this assumption has never been properly demonstrated, either stratigraphically or by independent means of dating. An alternative hypothesis, which should be tested, is that the Stemmed Point Tradition developed in the Great Basin, perhaps even before the Fluted Point Tradition appeared in the area.

Bryan's arguments against the uncritical acceptance of a Paleoindian–Archaic culture history model in the far west accurately reflect a problem still unresolved. Progress toward the accumulation of hard facts that might allow us to assess Bryan's Stemmed Point Tradition hypothesis has been relatively slow; however, available information collected since 1988 can be used to discuss what seems to be an emerging pattern of far western, late Pleistocene prehistory. Most important, evidence indicating a co-occurrence of fluted and non-fluted point and lithic traditions in the far west continues to accumulate. Many terms have been advanced through the years to account for early but distinctly non-Clovis patterns in the far west region, including the Desert Culture (Jennings 1957, 1964), the Western Pluvial Lakes Tradition (Bedwell 1973), the Old Cordilleran Complex (Butler 1961), the Western Lithic Co-Tradition (Davis et al. 1969), the Paleo-Coastal (Davis et al. 1969), the Western Stemmed Tradition (Bryan 1980, 1988, 1991), and most recently, the Paleoarchaic Tradition (cf. "paleo-Archaic" [Beck and Jones 1997; Jennings 1957, 1964; Willig 1988]). More recently, Beck and Jones (1997) revived the term Paleoarchaic in a more expansive manner to signify this early non-fluted point-bearing cultural pattern in order to highlight what they argue is a late Pleistocene–early Holocene cultural pattern with distinctly non-Clovis technological attributes. This has not been accepted by all and has recently been the topic of debate (e.g., Haynes 2007).

Davis et al. (2012) argue that the conceptual elements associated with the term Paleoindian fall short of explaining the early archaeological record of the far west. According to the authors, the use of the Paleoarchaic concept indicates a hypothetical perspective that questions the assumption that Clovis was an ancestor to all far western cultural groups. In contrast, to use the term Paleoindian as a universal, one-size-fits-all label implies knowledge of a clear evolutionary relationship between fluted and non-fluted technologies in the far west, which has not been demonstrated to any degree. To simply subsume all Pleistocene-age cultural components into a Paleoindian category in the absence of proof of an evolutionary relationship with fluted traditions is thought to be incorrect because it inappropriately generalizes the archaeological record. Evolutionary relationships between Paleoindian and Paleoarchaic traditions are most commonly discussed in relation to supposed technological similarities or dissimilarities. In their review of the prehistory of the southern Columbia River Plateau, Ames et al. (1998: 103) succinctly summarize a commonly held view about the place Clovis holds in the cultural-historical sequence of the interior Pacific Northwest:

> Rare surface finds of Clovis points occur throughout the region (Galm et al. 1981; Hollenbeck 1987). The similarity of these finds to dated sites in other regions implies an early link to areas south and possibly east of the Plateau. Less evident is the nature of relationships between Clovis and succeeding phases of prehistory. There is little evidence of a cultural continuum from Clovis to later-dating cultural manifestations in this area, though Aikens (1984) describes what may be transitional artifact forms in Oregon. Thus, while a Clovis presence is documented, it is unknown whether this culture had any bearing on subsequent cultural development in the Plateau region.

Taking an alternative view, Willig and Aikens (1988: 20) provide a summary of a long-standing argument for evolutionary continuity between fluted and non-fluted technologies in the far west based on the simple application of a Plains-style early Paleoindian–late Paleoindian culture-history model to all early far western sites:

> The typology of early western assemblages could be interpreted as representing a complete temporal continuum of forms, with fluted Clovis grading into fluted and non-fluted basally thinned, concave based and stemmed and shouldered styles of later Archaic periods (Willig [1989]). As pointed out by Aikens (1978), this "continuum" of gradual blending from fluted into stemmed points and later forms is well documented from dated sequences in the Plains and Southwest (Frison 1978; Frison and Stanford 1982; Haynes 1964, 1980), where Clovis gives rise to Folsom and Plano forms.

Early Paleoarchaic lithic assemblages are known from excavated contexts and include the hallmark stemmed and/or foliate (i.e., willow leaf–shaped) finished biface forms. The presence of Paleoindian cultural traditions in the far west is inferred almost entirely from isolated surficial finds of fluted and unfluted bifaces that lack original contextual and stratigraphic integrity. Exceptions to this are seen in the discovery of the Simon, Fenn, and Richey-Roberts "Clovis caches" in the far west (Frison 1991; Gramly 1993; Mehringer 1988; Mehringer and Foit 1990; Woods and Titmus 1985). Of these, only the Richey-Roberts site was systematically excavated by archaeologists. Because bifacial tools dominate these "caches" and lithic debitage either is absent or was not recovered, they do not provide a detailed view of an entire Paleoindian lithic assemblage. In the absence of direct knowledge about Paleoindian lithic technology from far western sites, studies made on Plains Paleoindian assemblages must be used to make a comparison with Paleoarchaic lithic technology. Although the environmental contexts of the Great Plains and the POCS are significantly different and surely influenced the choices early peoples made in designing and using their lithic technologies, the absence of far western Clovis assemblages and their associated operational sequences forces us to make more distant comparisons of early lithic technologies. Far western Paleoarchaic and Plains Paleoindian lithic technologies differ in two fundamental ways. First, fluted bifaces and stemmed and foliate bifaces consistently use separate hafting elements. Second, the lithic reduction sequence models (*sensu* Bleed 2001) for Paleoindian and Paleoarchaic technological assemblages are different and readily distinguishable from several perspectives (cf. Fagan 1988).

Paleoarchaic lithic reduction strategies consistently include the following elements: raw material use is diverse and often focused on local sources of varying quality; reduction of macroflakes struck from cores provides the primary means for all tool production; core forms are diverse (centripetal, unidirectional, multidirectional) and appear to be a key characteristic of the Paleoarchaic technological sequence model; some stemmed and foliate finished bifaces are made on macroblades; most stemmed and foliate finished bifaces are made on macroflakes; direct, multistage reduction of large bifacial preforms to smaller finished biface forms is relatively uncommon but present in some instances. The diversity of raw material use patterns and core forms and the presence of biface production directly from macroblades and macroflakes may offer the best evidence for conceptualizing Paleoarchaic lithic technology as distinctly separate from Paleoindian lithic technology. Paleoarchaic core diversity promotes use of the widest variety of raw material types and forms. The ability to create a tool kit from igneous, metamorphic, and sedimentary rocks in both nodule and rounded cobble form—the latter being ubiquitous in the far western landscape—undoubtedly enhanced knappers' ability to use the broadest range of regional environments and reduced the need for exotic, distant lithic sources. This approach directly contrasts with fluted biface site assemblages based on far-ranging, high-quality toolstone sources: namely, fine-grain cherts, quartz, and obsidians. Core forms include formal centripetal and unidirectional designs as well as nonformal amorphous or multidirectional forms. The presence of a centripetal core reduction strategy is notable and likely a distinct behavioral adaptation for producing macroflakes and blade-like flakes of predetermined sizes from rounded cobbles of varying quality. In the far west, the early use of centripetal cores includes similar reductive elements to Old World Levallois technology. A distinct Levallois-like lithic technology has been documented for early Holocene lithic assemblages in the Pacific Northwest by Muto (1976) and can be applied to other far western sites where centripetal core forms are present. Crescents are rare in the Columbia River Plateau, seen elsewhere at the Lind Coulee site (Daugherty 1956), but are commonly associated with Great Basin Paleoarchaic lithic assemblages (e.g., Beck and Jones 1997, 2010).

Formal unidirectional core forms are an additional design found in Paleoarchaic assemblages throughout the far western region. Many of these cores have been ascribed to categories such as "scraper planes," "domed scrapers," or "discoidal scrapers," suggesting use as steep-edged tools (Fedje et al. 2004b; Rogers 1966; Warren 1967). While it is clear that some of these artifacts were used as scraping implements, it is very apparent that these artifacts served as highly formalized cores. These unidirectional core tools include a single prepared platform with faceted blade-like flake removals. Flake removals from the single core edge were serially driven off downward along the entire circumference of the core edge. Amorphous or multidirectional core forms were also used to produce blanks for direct modification into tools or for direct use as unmodified flake tools. While the indistinct morphology of these cores is synchronically and diachronically ubiquitous in the far west, they represent yet another way in which the more generalized Paleoarchaic core and flake reduction pattern is applied to virtually any kind of toolstone.

### 3.2.1.4. *Divergent Technologies*

Variation in core design and their reduction strategies represents a major difference between Paleoarchaic and Paleoindian lithic technological organization. Paleoarchaic core strategy is highly variable, with a reliance on multidirectional and amorphous core designs. There also exists a patterned use of formal centripetal and unidirectional core forms in multiple Paleoarchaic assemblages, yet these strategies are not as prevalent as the multidirectional forms. While prepared unidirectional core and flake strategies are common in the Paleoarchaic lithic reduction trajectory, so are core and blade approaches. Paleoarchaic core and blade technology is in no manner morphologically or technologically cognate to the hallmark large, cylindrical wedge-shaped unidirectional blade cores recovered at numerous Paleoindian sites (Collins 1999). In contrast, Paleoarchaic unidirectional cores are typically smaller, due to both exhaustion and original nodule size, and are typically used for macroflake production. In many cases, Paleoarchaic core forms serve additional functions as scraping implements and are commonly referred to as scraper planes, domed scrapers, steep-edged unifacially retouched tools, or core scrapers (e.g., Des Lauriers 2006). The patterned use of this unidirectional core tool type is associated with early sites from the northern northwest coast of British Columbia (Fedje et al. 2004b), the Great Basin (Warren 1967), and the Baja California peninsula (Des Lauriers 2006). We may further distinguish the use of the unidirectional core form by the different traditions and their respective by-products.

Macroblade production is present within Paleoarchaic and Paleoindian site assemblages; however, where this specialized reductive technique is present at a few Paleoarchaic sites, including Cooper's Ferry (Davis 2001) and Connley Caves (Bedwell 1973)—and probably Marmes (Hicks 2004), Lind Coulee (Daugherty 1956), and Buhl (Green et al. 1998)—a formal core and macroblade strategy does not appear to be a consistent part of Paleoarchaic technological organization. Paleoarchaic macroblade production also includes centripetal core technology similar to the Old World Levallois technique (Muto 1976). Not only is there an apparent absence of the larger, formal cylindrical/wedge-shaped cores (*sensu* Collins 1999) at Paleoarchaic sites, but the dimensions of the macroblades are significantly smaller when compared with the Paleoindian forms. Comparatively, the use of the core and macroblade strategy, or blade making strategy (*sensu* Boldurian and Cotter 1999), has been highlighted at Paleoindian sites in the far west and greater North American continent, exemplified at sites like Richey-Roberts (Mehringer 1988), Blackwater Draw, and Kevin Davis (Collins 1999). Describing northern Plains Clovis technology, Bradley states "Most Clovis tools are either bifaces or are made from flakes that resulted from the biface manufacturing process" (1991: 370). Bifacial core use is present in both Paleoarchaic and Paleoindian core reductive strategies; however, while Paleoarchaic bifacial core use is inconsistent—likely reflecting an opportunistic core strategy—Paleoindian use of bifacial cores is a fundamental aspect of its technological organization.

Generally held notions of the Paleoarchaic tool kit as an evolutionary descendant of fluted point technology are untested assumptions based largely on adaptations of technological evolutionary models from neighboring regions. To understand the basis for this assumption one need only look farther east to the Rocky Mountain region, where Frison (1991), Bradley (1991), and Boldurian and Cotter (1999) offer a more substantial example of the evolution from fluted point technology to unfluted stemmed and lanceolate forms. The Plains model of Paleoindian technological evolution differs from archaeological patterns seen in the far west in two significant ways. First, unlike the far west, the Rocky Mountain region possesses a substantial chronological record that clearly demonstrates fluted point assemblages occurring earlier than cultural components associated with what Bradley (1991) terms the Collateral Point Complex. Projectile points associated with the Collateral Point Complex include well known Goshen, Plainview, Eden, Scottsbluff, and Cody types. Because the reduction sequence of fluted and non-fluted Collateral Point Complex projectile point technologies is based on the same processes of raw material selection, core production, and bifacial reduction (Bradley 1991), a clear case is made for technological continuity between Paleoindian fluted and Collateral Point Complex traditions (i.e., the Llano–Plano continuum).

Bifacial core reduction remains as the most prevalent core strategy associated with the Collateral Point Complex, further indicating a connection with earlier Clovis technology; however, the Collateral Point Complex also shows the discontinuation of fluting and the serial production of macroblades that is incorrectly applied in the far west to link fluted technological traditions with the Western Stemmed Tradition in an ancestor-descendant evolutionary relationship (e.g., Willig and Aikens 1988). Although it is reasonable to assume that the evolution of early far western lithic technologies followed the same unilinear trajectory embodied in the Llano–Plano continuum, this model has not been borne out by the facts of the archaeological record. It is possible to identify far western sites that bear artifacts that could be easily classified within the Collateral Point Complex; however, these are quite rare (e.g., Sentinel Gap [Galm and Gough 2008]). Instead, evidence suggests that non-fluted, non–Collateral Point Complex, stemmed projectile point traditions are widespread in the far west. Whereas a technological continuum is plausible between fluted and non-fluted Collateral Point Complex point traditions based on their shared technological elements, the same cannot be said for Paleoarchaic and Paleoindian technologies. The majority of Paleoarchaic stemmed and foliate finished bifaces are manufactured from core-struck macroflakes. This reduction process is commonly indicated by the retention of original macroflake landmarks such as portions of the dorsal ridge, distal striking platform, and planoconvex cross section. This different approach to projectile point manufacture is, we believe, tremendously significant because of its place within the Paleoarchaic sequence model and given the fact that point manufacture from core-struck macroflakes is not a normal part of fluted biface assemblages. Morrow (1995) provides a rare exception to this last statement as she interprets the presence of a macroflake-to-finished fluted Clovis point trajectory in the Clovis technological sequence model from the Ready/Lincoln Hills site in Illinois.

One hallmark of the Paleoindian fluted biface is the patterned use of overshot and collateral flaking applied in the final stages of biface manufacture. Like their fluted predecessor, stemmed and lanceolate bifaces of the Collateral Point Complex include a consistent collateral flaking pattern as well as many instances of overshot flaking. This is not the case for the majority of Paleoarchaic stemmed and foliate bifaces, which often exhibit relatively unpatterned flaking. Although rare examples of collateral and overshot flaking patterns can be found on some Paleoarchaic stemmed and foliate bifaces (e.g., Lind Coulee [Daugherty 1956], Hatwai I [Ames et al. 1981]), these techniques do not seem to be significant or consistent aspects of Paleoarchaic biface shaping strategy.

### 3.2.2. Pleistocene Prehistory of North America's Pacific Coast

#### *3.2.2.1. Early Sites*

North American Pacific coastal sites are younger than North America's earliest interior Paleoindian sites (i.e., Clovis cultural components) and other key pre-Clovis contenders of the New World's western margin, including South America's Quebrada Jaguay, Quebrada Tacahuay, and Monte Verde sites (Keefer et al. 1998; Sandweiss et al. 1998; Dillehay 1989; Dillehay et al. 2009), and the Paisley Five Mile Rockshelter site in southern Oregon (Gilbert et al. 2009; Jenkins et al. 2012). The reason for this archaeological pattern is likely due in part to post-glacial marine transgression that assumedly submerged earlier sites on the POCS, and because of geoarchaeological processes that occurred along the Pacific coast, which probably destroyed and deeply buried late Pleistocene-aged sites (Punke and Davis 2006; Davis et al. 2008; Davis et al. 2009). Although the route of initial human entry into the Americas was traditionally assumed to include a pedestrian migration from eastern Beringia southward through a gap between the Laurentide and Cordilleran ice sheets, this path may not have been available or viable in time to allow humans to arrive at pre-Clovis sites before 12,400 RYBP (14,500 BP) (Dyke et al. 2003; Mandryk et al. 2001). In this context, a Pacific coastal route of initial entry is given considerable attention because it contains no clear restrictions to pre-Clovis human migration (Mandryk et al. 2001). If the First Americans initially moved south of Beringia by skirting the edge of Late Wisconsinan ice along the shores of modern-day Alaska, British Columbia, Washington, and Oregon, we should expect that the region will hold archaeological sites that predate 12,400 RYBP (14,500 BP). If the hypothesis that the initial peopling of the Americas included an aspect of coastal migration is correct, then the northeastern Pacific coast is a critical area of archaeological concern (Fladmark 1979; Gruhn 1988; Dixon 1999; Erlandson 2002; Mandryk et al. 2001; Goebel et al. 2008); however, at this time, nothing is known about North American Pacific coastal sites dating between 12,400 and 10,700 RYBP (14,500–12,800 BP)—the period contemporaneous with the earliest evidence of New World human occupation.

Currently accepted archaeological evidence indicates that prehistoric humans entered the Americas some time before 14,500 BP (Dillehay 1989; Jenkins et al. 2012). Although the exact route of entry is not clear, many archaeologists consider the ancient Pacific coastline as a potential migration path (e.g., Fladmark 1979; Gruhn 1988; Mandryk et al. 2001; Erlandson 2002; Davis et al. 2012). Since the height of the late Wisconsinan glaciation at 18,000 BP, global sea levels have risen approximately 130 meters and stabilized near modern sea levels after ca. 3,000 BP (Fairbanks 1989; Peltier and Fairbanks 2006). Although the physiographic nature of the New World Pacific continental shelf varies from place to place, postglacial marine transgression worked to submerge previously exposed coastal landscapes that may have been occupied since marine lowstand corresponding with the LGM at ca. 19,800 BP (Peltier and Fairbanks 2006) and 3,000 BP.

Late Pleistocene–aged (i.e., chronometrically dated in excess of 11,500 BP) archaeological components are known from a relatively small number of sites in far western North America, including K1 Cave on British Columbia's Haida Gwaii (Fedje et al. 2004b), Indian Sands (Davis 2006, 2008; Davis et al. 2004; Willis 2005; Willis and Davis 2007), Newberry Crater (Connolly 1999), Lind Coulee (Daugherty 1956; Irwin and Moody 1978), Marmes Rockshelter (Hicks 2004), Hatwai (Ames et al. 1981; Sanders 1982), Wewukiyepuh (Schuknecht 2000), Connley Caves (Bedwell 1973), Paisley Five Mile Rockshelter (Jenkins 2006; Jenkins et al. 2012), Cooper's Ferry (Butler 1969; Davis and Schweger 2004), Smith Creek Cave (Bryan 1979), the Sunshine Locality (Beck and Jones 1997), Bonneville Estates Rockshelter (Goebel 2007; Graf 2007), Cerro Pedregroso on Baja California's Cedros Island (Des Lauriers 2006), and Covacha Babisuri on Espíritu Santo Island in Baja California Sur (Fujita 2006). On California's northern Channel Islands, the Daisy Cave (Erlandson et al. 1996) and Cardwell Bluffs (Erlandson et al. 2011) sites have also produced radiocarbon dates in excess of 10,000 BP. Of these sites, only Indian Sands, K1 Cave, Daisy Cave and Cardwell Bluffs are located in coastal settings; and only Cooper's Ferry, Paisley Five Mile Rockshelter, and Smith Creek Cave include cultural components with non-fluted lanceolate projectile points dated beyond the lower limit of Clovis, in excess of 12,900 BP. Although Clovis points have been identified from all far western states and from the Baja California peninsula, Clovis artifacts have not yet been found in association with "Clovis-aged" radiocarbon ages (13,350–12,870 BP [Haynes 1980, 1982, 1987; Haynes et al. 1984]; 13,125–12,925 BP [Waters and Stafford 2007]). The Richey-Roberts Clovis site of eastern Washington includes fluted points reportedly in contact with grains of Glacier Peak tephra (which initially erupted at 13,120 BP [Mehringer and Foit 1990]); however, this can only be considered a relative, maximum age, not a chronometric age estimate. The absence of chronometric ages for Clovis archaeological components in the far west means that we also lack empirical proof that the age of the Plains Clovis cultural tradition will be the same in the far west. That said, the best, most current information indicates that Paleoarchaic components are earliest in the far west and has led some researchers to reject the hypothesis that a Clovis Paleoindian cultural tradition gave rise to the Paleoarchaic tradition (Beck and Jones 2010; Davis et al. 2012; Jenkins et al. 2012).

#### *3.2.2.2. Paleocoastal Tradition*

Davis et al. (1969) provide the first comprehensive use of the Paleocoastal concept in North American archaeology, which they define as a coastal variant of their larger "Western Lithic Co-Tradition" concept. The Western Lithic Co-Tradition concept provides a synthesis of shared lithic industries seen in late Pleistocene to early Holocene-aged sites in western North America that notably include the following: non-fluted stemmed and foliate projectile points, domed scraper planes, unifaces, crescents, utilitarian ovate bifaces, and informal flake tools produced on macroflakes struck from unidirectional, multidirectional (i.e., amorphous), and centripetal cores, and the use of lower quality locally abundant raw materials present in cobble form (Davis et al. 1969). Economic variability expressed in these early sites is considered to reflect the range of cultural activities performed in different environments, extending from the Pacific coast to the interior desert regions. Davis et al. (1969) describe the early Holocene-aged San Dieguito cultural component from the Harris Site in San Diego County as part of a "Paleo-coastal Tradition," not only in part due to its technological patterns but also apparently due to its age and its proximity (approximately 10 kilometers) to the Pacific Ocean.

To Moratto (1984), the Paleocoastal Tradition is primarily defined on the basis of an economic orientation toward the use of marine resources as evidenced by late Pleistocene to early Holocene-aged midden sites along the California coastal zone. Following Davis et al. (1969), Moratto (1984: 104) suspects that the Paleocoastal Tradition shares cultural affinities with the contemporaneous inland-oriented Western Pluvial Lakes Tradition—an archaeological construct that is similar to Bedwell's (1970) Western Lithic Co-Tradition concept due to "[c]omparable flaked stone tool inventories, found throughout southern California between

11,000 and 8,000 BP, [that] evince widespread technological relationships. The coastal manifestations are set apart mainly with respect to exploitative practices, settlement patterns, apparent degree of sedentism (although this has been defined only tenuously), and artifacts other than flaked stone."

Erlandson (2009) considers Paleocoastal to mean "seafaring Paleoindian" peoples, based on the interpretation of terminal Pleistocene to early Holocene-aged (8,600 to approximately 11,500 BP [Erlandson and Jew 2009]) maritime resource use at Daisy Cave, which is located on San Miguel Island in the Northern Channel Islands of southern California. Erlandson et al. (1996: 370) elaborate on this particular use of the term:

> Thus, the terminal Pleistocene component at Daisy Cave currently represents the earliest known Paleocoastal occupation on the California coast. Currently, it seems most likely that these early maritime peoples were descended from even earlier Paleoindian peoples who appear to have left Clovis-like fluted points on the southern California coast (see Erlandson et al. 1987) a millennium or more prior to the initial occupation of Daisy Cave. Nonetheless, the data from Daisy Cave provide additional evidence for the relatively early diversification of Paleoindian economies in western North America.

In this particular approach to definition, the adaptive aspect of seafaring can be measured simply by considering the location of late Pleistocene-aged sites on islands that were never connected to mainland North America; however, the Paleoindian aspect is not demonstrated and is in clear contrast to other descriptions of early Pacific coast cultural patterns. What is meant by the use of "Paleoindian" in a coastal context? To use a standard definition of the Paleoindian technological pattern, we should expect to see a distinctive toolkit marked by the presence of fluted bifacial projectile points, unfluted Llano- and Plano-style lanceolate projectile points (e.g., Clovis, Folsom, Goshen/Plainview, Agate Basin, Hell Gap, Cody), extensive lithic reduction of bifacial preforms to produce formal bifaces, limited use of informal flake tools, and/or prepared macroblade cores and blades, all of which are typically created on high-quality toolstone materials. In comparison, the Arlington Springs skeleton dated to ca. 10,590 RYBP (12,685 BP; Erlandson et al. 2008) represents the earliest dated evidence of human occupation on the Channel Islands; however, we know nearly nothing about the technological patterns associated with this individual and cannot otherwise assign a Paleoindian cultural affiliation. Investigations at the Cardwell Bluffs site by Erlandson et al. (2011) produced several stemmed projectile points, which are very similar to types associated with the Western Stemmed Tradition. These discoveries provide the clearest link between the early archaeological record of the Channel Islands and the Paleoarchaic/Western Stemmed Tradition. Other younger sites such as Daisy Cave and Eel Point contain lithic assemblages with bifacial preforms made on macroflakes, gravers, unifaces, reamers, wedges, abraders, flake drills, and multidirectional, unidirectional, boat-shaped, and microlithic cores (e.g., Erlandson and Jew 2009; Cassidy et al. 2004). Nothing in these early Channel Islands lithic assemblages clearly indicates the presence of a Paleoindian technological tradition. The process of invoking a direct evolutionary relationship between Clovis Paleoindian and later LP-aged coastal cultural components requires a tacit assumption that an ancestor-descendant relationship exists between the bearers of fluted and non-fluted technologies; a fact that has not been demonstrated to any degree in early North American Pacific coastal sites.

Turning beyond California's Channel Islands, true Paleoindian lithic technologies are also absent in other early North American Pacific coastal sites, including K1 Cave (approximately 12,500 BP) and Gaadu Din Cave in British Columbia (approximately 12,000 BP; Fedje and Mathewes 2005), Indian Sands in southern Oregon (12,255 BP; Davis et al. 2004; Davis 2009a, 2009b), and Richard's Ridge on Cedros Island (12,100 BP; Des Lauriers 2006). Instead, these sites bear lithic assemblages that relate to cultural-historical frameworks reserved for early non-fluted technological traditions that lack clear evolutionary links to the Paleoindian Tradition (e.g., Western Stemmed Tradition [Bryan 1980, 1988, 1991; Bryan and Tuohy 1999]) and are more recently argued to represent a larger Paleoarchaic Tradition in western North America (Beck and Jones 2010). While a small number of fluted Clovis projectile points are known from some parts of the North American Pacific coast, they have not yet been found in an intact archaeological context. Regardless, the discovery of a fluted point in any of the aforementioned early coastal sites would not change the fact that their lithic assemblages lack technological patterns commonly associated with a classic Paleoindian chaîne operatoíre (cf. Des Lauriers 2006). The presence of fluted Clovis projectile points in North American Pacific coastal zones reflects a poorly understood aspect of early coastal prehistory involving the co-occurrence of Paleoindians and unrelated Paleoarchaic peoples. The rarity of fluted points along North America's Pacific coast may indicate that Paleoindians played a minor role in the region's initial settlement. For example, if the distribution of fluted projectile points in the coastal landscape represents a proxy indicator of Clovis settlement patterns, the low number of fluted points found along the Pacific coast indicates an extremely limited regional presence, relative to other areas of North America (Anderson and Faught 2000). The rare discovery of fluted points could also represent the curation of these items that were obtained elsewhere and transported to the coast during the LP or afterward or that only the technological ideas, not the Paleoindian peoples themselves, spread along the Pacific coast. Thus, the presence of Clovis Paleoindian-style artifacts along the North American Pacific coast is difficult to fully interpret and explain, and contrasts sharply with our current understanding of early coastal prehistory.

## 3.3. Methodology for Modeling Submerged Prehistoric Site Potential on the POCS

### 3.3.1. Building a Model of Submerged Site Potential on the POCS

Our approach to predicting the location of submerged prehistoric sites on the POCS rests heavily on basic assumptions about human behavior within coastal paleolandscapes: prehistoric foragers survived by using natural food resources that were distributed within past landscapes, and, as a result, archaeological evidence of their survival might be held in proximity to the location of these natural resources. Accepting these assumptions, we might use information about the distribution of different resource patches projected to have once existed on the POCS as a proxy indicator of potential site locations. Therefore, to predict the distribution of submerged prehistoric sites on the POCS we must build models that consider the spatial distribution of past subsistence resource productivity on paleolandscapes that once existed on the POCS. To do this, we must first establish the physiographic form of emergent coastal terrains, how the shape of these terrains may have changed due to movements of bedrock units and changes in sea level, and how these changing physiographic conditions may have influenced the ecological context of coastal paleolandscapes through time. We approach this modeling process by describing the different kinds of requisite data and how these data are combined to build a series of GIS based models that predict the distribution of submerged sites on the POCS. Below, we describe the sources of data and the assumptions we make about the data used to build the larger model.

### 3.3.2. Hardware and Software Used to Create GIS Models

The paleolandscape and site location predictive models were created on a Microsoft Windows 7 x 64 sp1 personal computer with an Intel I7-2600 @ 3.4 gigahertz (ghz) and 16 gigabytes (GB) of RAM. GIS analysis was performed via ESRI ArcGIS version 10.1 sp1 and Hydro Tools for ArcGIS 10.1. Vertical datum re-projection was performed via VDATUM 3.0 to convert from mean high water (MHW) to local mean sea level (LMSL). Interpolation of relative sea level was calculated in Excel 2008 v.12.1.7.

### 3.3.3. Modeling Modern Bathymetry

Digital data of modern bathymetry used as a platform for this project include an integrated bathymetric-topographic digital elevation model (DEM) developed by National Geophysical Data Center (NGDC) for the Washington, Oregon, and California coastlines (http://nctr.pmel.noaa.gov/). The NGDC DEMs were supplemented with hydrographic survey data obtained from the NGDC online National Ocean Service (NOS) hydrographic database (http://www.ngdc.noaa.gov/mgg/bathymetry/hydro.html). All data were projected to the North American Datum (NAD) 83 UTM Zones 10N and 11N in meters. Vertical datum of the NGDC DEM was converted from MHW to mean sea level (MSL) in meters from a tide station centrally located in each DEM.

In our approach, modern bathymetry is the primary physiographic basis for modeling emergent coastal paleolandscapes, despite the fact that we cannot adequately address the effect that post-inundation deposition of terrigenous sediment had upon the shelf's bathymetry. Anderson et al. (1990: II-18) report inner shelf (that area of the POCS that lies in water depths of 40 to 70 meters) sediment thicknesses of 5 to 10 meters with even greater thicknesses seen near the mouth of rivers. Post-inundation sediment cover on the outer shelf (found on the POCS from 60- to 130-meter depth) is estimated to be 10 to 20 meters thick and up to 50 meters thick adjacent to rivers; however, the limited spatial extent of these studies renders them somewhat anecdotal, and the actual amount of sedimentary deposition since inundation has not been verified by the widespread collection of dated coring samples from the POCS sea floor. Regardless, we assume that some amount of sedimentation—probably similar to that described by Anderson et al. (1990: II-18)—did accumulate on the POCS since inundation. We also assume that modern bathymetric variation on the POCS reflects the underlying physiographic expression of the pre-inundation coastal paleolandscape to a significant degree. Therefore, we are comfortable in our assumption that modern bathymetric DEMs can be employed to model ancient coastal landscapes.

### 3.3.4. Calculating Crustal Deformation

Uplift and subsidence of the continental crust that is driven by the actions of tectonic systems, isostatic loading and unloading of glacial ice, and sedimentary deposition at the mouth of large rivers will cause the POCS to vary relative to eustatic sea level. Correcting for crustal movements is critical for establishing a more accurate history of relative sea level rise since the LGM. To address the degree to which crustal deformation altered POCS bathymetry since the

LGM, we assessed published information on tectonic and isostatic crustal displacement rates from the geological literature. While crustal deformation produced by subduction zone neotectonic stress accumulation along the edge of the North American continental shelf has generated well-documented geomorphic products in the form of uplifted marine terraces along western North America, the rates of uplift along the POCS typically measure in tenths of mm/year (e.g. Kern and Rockwell 1992; Grant et al. 1999; Meigs et al. 1999). Higher rates of uplift are known from the location of fault lines, such as the Mendocino Triple Junction, which moves upward at ca. 3 mm/year (Merritts and Bull 1989); however, the vertical deformation associated with these faults diminishes rapidly away from the fault site. In sum, rates of uplift on the POCS are modest, approximating 0.15 mm/year, which translates to 2.9 meters of uplift since the LGM (19,000 years ago).

Glacial isostatic adjustments (GIA) for the POCS study area are provided by Peltier (1998, 2004, 2005; Table 1). Along the U.S. west coast, crustal deformation rates attributed to GIA are highest (average modern uplift rates of 1.29 to 1.09 mm/year) in the north, between Washington's Willipa Bay and Oregon's South Beach and drop progressively to the south into California (as low as 0.2 mm/year). Extrapolating these higher rates backwards to the LGM produces up to 24 meters of total uplift since the LGM; however, because the GIA history of western North America is not known with precision, and is expected to have performed in a nonlinear fashion through time, we cannot simply apply modern GIA rates as crustal deformation constants. While local GIA-induced uplift may have occurred along the POCS near southern Washington and northern Oregon, we do not know its rate since the LGM. Given that Peltier's GIA model extends backwards only 250 years, we cannot apply its numbers to our modeling. As such, we do not apply GIA-based elevation adjustments to POCS DEMs in any of our GIS models.

Table 1
Glacial Isostatic Adjustment Rates Projected for the Past 250 Years, Next 250 Years, and Today from Tidal Stations along the Washington, Oregon, and California Coastlines

| Latitude | Longitude | Station # | Station ID | Station Name | Past 250 Years | Next 250 Years | Today |
|---|---|---|---|---|---|---|---|
| 50.400 | 234.033 | 1826 | 822127 | Kelsey Bay | -0.72 | -0.7 | -0.71 |
| 48.367 | 235.388 | 385 | 823001 | Neah Bay | 0.84 | 0.79 | 0.82 |
| 48.125 | 236.56 | 2127 | 823003 | Port Angeles | 0.66 | 0.62 | 0.64 |
| 48.863 | 237.243 | 1633 | 823005 | Cherry Point | -0.04 | -0.05 | -0.05 |
| 48.547 | 236.99 | 384 | 823006 | Friday Harbor | 0.26 | 0.24 | 0.25 |
| 46.707 | 236.033 | 1354 | 823009 | Toke Point, Willipa Bay | 1.33 | 1.26 | 1.29 |
| 47.602 | 237.662 | 127 | 823011 | Seattle | 0.72 | 0.68 | 0.7 |
| 48.112 | 237.243 | 1325 | 823012 | Port Townsend | 0.52 | 0.49 | 0.5 |
| 46.207 | 236.232 | 265 | 823013 | Astoria (Tongue Point) | 1.29 | 1.22 | 1.25 |
| 45.553 | 236.082 | 1285 | 823014 | Garibaldi | 1.27 | 1.2 | 1.23 |
| 44.810 | 235.943 | 1541 | 823015 | Depoe Bay | 1.17 | 1.1 | 1.13 |
| 44.625 | 235.958 | 1196 | 823016 | South Beach | 1.12 | 1.06 | 1.09 |
| 43.345 | 235.678 | 1269 | 823019 | Charleston II | 0.94 | 0.88 | 0.91 |

Table 1. Glacial Isostatic Adjustment Rates Projected for the Past 250 Years, Next 250 Years, and Today from Tidal Stations along the Washington, Oregon, and California Coastlines (continued)

| Latitude | Longitude | Station # | Station ID | Station Name | Past 250 Years | Next 250 Years | Today |
|---|---|---|---|---|---|---|---|
| 42.738 | 235.502 | 1640 | 823020 | Port Orford | 0.88 | 0.83 | 0.85 |
| 41.745 | 235.818 | 378 | 823021 | Crescent City | 0.71 | 0.66 | 0.69 |
| 41.057 | 235.853 | 1980 | 823022 | Trinidad | 0.66 | 0.62 | 0.64 |
| 40.767 | 235.783 | 1639 | 823024 | N. Spit, Humboldt Bay | 0.66 | 0.62 | 0.64 |
| 38.913 | 236.293 | 2125 | 823026 | Arena Cove, California | 0.6 | 0.56 | 0.58 |
| 37.995 | 237.023 | 1394 | 823030 | Point Reyes | 0.52 | 0.49 | 0.5 |
| 37.807 | 237.535 | 10 | 823031 | San Francisco | 0.44 | 0.41 | 0.42 |
| 37.772 | 237.702 | 437 | 823032 | Alameda | 0.41 | 0.38 | 0.4 |
| 37.583 | 237.75 | 1663 | 823034 | San Mateo | 0.41 | 0.39 | 0.4 |
| 36.605 | 238.113 | 1352 | 823036 | Monterey | 0.41 | 0.39 | 0.4 |
| 35.177 | 239.24 | 508 | 823042 | Port San Luis | 0.34 | 0.32 | 0.33 |
| 34.348 | 240.558 | 1013 | 823044 | Rincon Island | 0.25 | 0.24 | 0.25 |
| 34.468 | 239.328 | 2124 | 823046 | Oil Platform Harvest | 0.4 | 0.38 | 0.39 |
| 34.408 | 240.315 | 2126 | 823048 | Santa Barbara | 0.27 | 0.26 | 0.27 |
| 34.008 | 241.5 | 377 | 823049 | Santa Monica | 0.21 | 0.2 | 0.2 |
| 33.833 | 241.667 | 1205 | 823050 | Marina Del Ray | 0.22 | 0.21 | 0.21 |
| 33.720 | 241.728 | 245 | 823051 | Los Angeles | 0.23 | 0.22 | 0.22 |
| 33.752 | 241.773 | 1045 | 823055 | Long Beach | 0.22 | 0.21 | 0.21 |
| 33.750 | 241.883 | 717 | 823056 | Alamitos Bay Entrance | 0.21 | 0.2 | 0.21 |
| 33.603 | 242.118 | 766 | 823057 | Newport Bay | 0.21 | 0.2 | 0.21 |
| 33.450 | 241.517 | 1487 | 823059 | Catalina A | 0.28 | 0.27 | 0.28 |
| 33.450 | 241.517 | 1518 | 823060 | Catalina B | 0.28 | 0.27 | 0.28 |
| 33.000 | 241.45 | 883 | 823061 | San Clemente Island | 0.35 | 0.33 | 0.34 |
| 32.867 | 242.743 | 256 | 823071 | La Jolla (Scripps Pier) | 0.24 | 0.22 | 0.23 |
| 32.713 | 242.827 | 158 | 823081 | San Diego | 0.24 | 0.23 | 0.24 |

Source: Peltier 2012.

#### 3.3.4.1. Modeling Ancient Stream Systems

Using ArcGIS 10.1, a fill sink function is performed on the base bathymetric DEMs to eliminate small topographic irregularities that would otherwise interrupt flow direction. Next, a flow direction grid was calculated from the sink filled bathymetric DEMs. Then, a flow accumulation grid is generated. Based on this accumulation grid, a stream definition raster is created using the Hydro Tools extension, which produces stream networks across the POCS landscape.

### *3.3.4.2. Eustatic Sea Level History*

Eustacy is the measure of oceanic elevation that is controlled by net additions and subtractions from the Earth's marine hydrological budget (Masselink et al. 2011). Changing volumes in glacial ice and their meltwater inputs to oceans caused global eustatic sea level rise over the past 19,000 years (Fairbanks 1989; Peltier and Fairbanks 2006). For this study, we combined the Fairbanks (1989) eustatic sea level data with the uplift corrected Barbados Acropora palmata coral record reported by Peltier and Fairbanks (2006) to create a more complete proxy record for global eustatic sea level (Table 2; Figure 6).

Table 2
Global Eustatic Sea Level (ESL) Model

| Cal BP | ESL Benchmarks (depth in meters) | ESL Interpolation (depth in meters) |
|---|---|---|
| 0 | 0 | 0.00 |
| 100 | | 0.00 |
| 200 | | 0.21 |
| 300 | | 0.41 |
| 400 | | 0.62 |
| 500 | | 0.83 |
| 600 | | 1.03 |
| 700 | | 1.24 |
| 800 | | 1.45 |
| 900 | | 1.65 |
| 1,000 | | 1.86 |
| 1,100 | | 2.07 |
| 1,200 | | 2.27 |
| 1,300 | | 2.48 |
| 1,400 | | 2.69 |
| 1,500 | | 2.89 |
| 1,600 | 3.10 | 3.10 |
| 1,700 | | 3.20 |
| 1,800 | | 3.30 |
| 1,900 | | 3.40 |
| 2,000 | | 3.50 |
| 2,100 | | 3.60 |
| 2,200 | | 3.70 |
| 2,300 | | 3.80 |
| 2,400 | | 3.90 |

Table 2. Global Eustatic Sea Level (ESL) Mode (continued)

| Cal BP | ESL Benchmarks (Depth in meters) | ESL Interpolation (Depth in meters) |
|---|---|---|
| 2,200 | | 3.70 |
| 2,300 | | 3.80 |
| 2,400 | | 3.90 |
| 2,500 | | 4.00 |
| 2,600 | | 4.10 |
| 2,700 | | 4.20 |
| 2,800 | | 4.30 |
| 2,900 | | 4.40 |
| 3,000 | | 4.50 |
| 3,100 | | 4.60 |
| 3,200 | | 4.70 |
| 3,300 | | 4.80 |
| 3,400 | | 4.90 |
| 3,500 | 5.00 | 5.00 |
| 3,600 | | 5.40 |
| 3,700 | | 5.80 |
| 3,800 | | 6.20 |
| 3,900 | | 6.60 |
| 4,000 | 7.00 | 7.00 |
| 4,100 | | 7.05 |
| 4,200 | | 7.10 |
| 4,300 | | 7.15 |
| 4,400 | | 7.20 |
| 4,500 | | 7.25 |
| 4,600 | | 7.30 |
| 4,700 | | 7.35 |
| 4,800 | | 7.40 |
| 4,900 | | 7.45 |
| 5,000 | 7.50 | 7.50 |
| 5,100 | | 7.87 |
| 5,200 | | 8.24 |
| 5,300 | | 8.61 |
| 5,400 | | 8.99 |
| 5,500 | | 9.36 |

Table 2. Global Eustatic Sea Level (ESL) Mode (continued)

| Cal BP | ESL Benchmarks (Depth in meters) | ESL Interpolation (Depth in meters) |
|---|---|---|
| 5,600 | | 9.73 |
| 5,700 | 10.10 | 10.10 |
| 5,800 | | 10.44 |
| 5,900 | | 10.78 |
| 6,000 | | 11.12 |
| 6,100 | | 11.46 |
| 6,200 | | 11.80 |
| 6,300 | | 12.14 |
| 6,400 | | 12.48 |
| 6,500 | | 12.82 |
| 6,600 | | 13.16 |
| 6,700 | 13.50 | 13.50 |
| 6,800 | | 14.07 |
| 6,900 | | 14.64 |
| 7,000 | | 15.21 |
| 7,100 | | 15.79 |
| 7,200 | | 16.36 |
| 7,300 | | 16.93 |
| 7,400 | 17.50 | 17.50 |
| 7,500 | | 18.09 |
| 7,600 | | 18.68 |
| 7,700 | | 19.27 |
| 7,800 | | 19.86 |
| 7,900 | | 20.45 |
| 8,000 | | 21.05 |
| 8,100 | | 21.64 |
| 8,200 | | 22.23 |
| 8,300 | | 22.82 |
| 8,400 | | 23.41 |
| 8,500 | 24.00 | 24.00 |
| 8,600 | | 24.35 |
| 8,700 | | 24.70 |
| 8,800 | | 25.05 |
| 8,900 | 25.40 | 25.40 |

Table 2. Global Eustatic Sea Level (ESL) Mode (continued)

| Cal BP | ESL Benchmarks (Depth in meters) | ESL Interpolation (Depth in meters) |
|---|---|---|
| 9,000 | | 27.00 |
| 9,100 | 28.60 | 28.60 |
| 9,200 | | 29.54 |
| 9,300 | | 30.48 |
| 9,400 | | 31.42 |
| 9,500 | | 32.36 |
| 9,600 | 33.30 | 33.30 |
| 9,700 | | 34.37 |
| 9,800 | | 35.43 |
| 9,900 | 36.50 | 36.50 |
| 10,000 | | 37.20 |
| 10,100 | | 37.90 |
| 10,200 | | 38.60 |
| 10,300 | | 39.30 |
| 10,400 | | 40.00 |
| 10,500 | | 40.70 |
| 10,600 | | 41.40 |
| 10,700 | | 42.10 |
| 10,800 | 42.80 | 42.80 |
| 10,900 | | 43.65 |
| 11,000 | 44.50 | 44.50 |
| 11,100 | | 47.95 |
| 11,200 | | 51.40 |
| 11,300 | | 54.85 |
| 11,400 | 58.30 | 58.30 |
| 11,500 | 58.60 | 58.60 |
| 11,600 | | 59.18 |
| 11,700 | | 59.76 |
| 11,800 | | 60.34 |
| 11,900 | | 60.92 |
| 12,000 | 61.50 | 61.50 |
| 12,100 | 61.90 | 61.90 |
| 12,200 | 61.80 | 61.80 |
| 12,300 | | 62.40 |

Table 2. Global Eustatic Sea Level (ESL) Mode (continued)

| Cal BP | ESL Benchmarks (Depth in meters) | ESL Interpolation (Depth in meters) |
|---|---|---|
| 12,400 | | 63.00 |
| 12,500 | | 63.60 |
| 12,600 | | 64.20 |
| 12,700 | 64.80 | 64.80 |
| 12,800 | 66.60 | 66.60 |
| 12,900 | 68.20 | 68.20 |
| 13,000 | 69.80 | 69.80 |
| 13,100 | 70.30 | 70.30 |
| 13,200 | | 71.15 |
| 13,300 | | 72.00 |
| 13,400 | | 72.85 |
| 13,500 | 73.70 | 73.70 |
| 13,600 | 74.50 | 74.50 |
| 13,700 | | 79.23 |
| 13,800 | | 83.95 |
| 13,900 | | 88.68 |
| 14,000 | 93.40 | 93.40 |
| 14,100 | | 94.50 |
| 14,200 | 95.60 | 95.60 |
| 14,300 | | 96.55 |
| 14,400 | 97.50 | 97.50 |
| 14,500 | 98.90 | 98.90 |
| 14,600 | | 99.33 |
| 14,700 | | 99.77 |
| 14,800 | | 100.20 |
| 14,900 | | 100.63 |
| 15,000 | | 101.07 |
| 15,100 | | 101.50 |
| 15,200 | | 101.93 |
| 15,300 | | 102.37 |
| 15,400 | | 102.80 |
| 15,500 | | 103.23 |
| 15,600 | | 103.67 |
| 15,700 | | 104.10 |

Table 2. Global Eustatic Sea Level (ESL) Mode (continued)

| Cal BP | ESL Benchmarks (Depth in meters) | ESL Interpolation (Depth in meters) |
|---|---|---|
| 15,800 | | 104.53 |
| 15,900 | | 104.97 |
| 16,000 | | 105.40 |
| 16,100 | | 105.83 |
| 16,200 | | 106.27 |
| 16,300 | | 106.70 |
| 16,400 | | 107.13 |
| 16,500 | | 107.57 |
| 16,600 | | 108.00 |
| 16,700 | | 108.43 |
| 16,800 | | 108.87 |
| 16,900 | | 109.30 |
| 17,000 | | 109.73 |
| 17,100 | | 110.17 |
| 17,200 | | 110.60 |
| 17,300 | | 111.03 |
| 17,400 | | 111.47 |
| 17,500 | 111.90 | 111.90 |
| 17,600 | | 111.82 |
| 17,700 | | 111.73 |
| 17,800 | | 111.65 |
| 17,900 | | 111.57 |
| 18,000 | | 111.48 |
| 18,100 | 111.40 | 111.40 |
| 18,200 | 112.20 | 112.20 |
| 18,300 | | 112.20 |
| 18,400 | 112.20 | 112.20 |
| 18,500 | 113.20 | 113.20 |
| 18,600 | | 114.35 |
| 18,700 | 115.50 | 115.50 |
| 18,800 | 115.70 | 115.70 |
| 18,900 | | 118.00 |
| 19,000 | 120.30 | 120.30 |
| 19,100 | | 117.30 |

Table 2. Global Eustatic Sea Level (ESL) Mode (continued)

| Cal BP | ESL Benchmarks (Depth in meters) | ESL Interpolation (Depth in meters) |
|---|---|---|
| 19,200 | | 114.30 |
| 19,300 | | 111.30 |
| 19,400 | 108.30 | 108.30 |
| 19,500 | 109.90 | 109.90 |
| 19,600 | | 110.10 |
| 19,700 | 110.30 | 110.30 |

Based on Fairbanks (1989) and Peltier and Fairbanks (2006). Linear extrapolation distributes depth intervals between reported ESL benchmarks. All depths are in meters.

#### *3.3.4.3. Relative Sea Level*

Relative sea level is the measured difference between the surface of the ocean and a fixed datum on the land or the sea floor (Masselink et al. 2011). Tectonic or glacial isostatic uplift or a lowering of eustatic sea level will cause a negative movement of relative sea level. Tectonic subsidence or a rise in eustatic sea level will result in a positive movement of relative sea level (i.e., the local height of the ocean's surface relative to the continental shelf or shoreline). Since our study is concerned with reconstructing past coastal landscapes, we must account for relative sea level histories. Along our POCS study area, tectonic and glacioisostatic movements are the potential drivers of crustal deformation that have the potential to influence local relative sea level histories.

Previous studies along the POCS have employed local sea level curves. Nardin et al. (1981) report a record of sea level fluctuations for the Santa Monica, California, area based on radiocarbon dated marine mollusk shells recovered from vibracore borings. These shell samples were found at the bottom of different transgressive marine deposits and were taken to reflect the timing of sea level rise. Pierson et al. (1987) provide a composite summary of data on sea level positions since the LGM based on records from California (Nardin et al. 1981; Inman 1983) and Texas (Curray 1965). Peterson et al. (2010) report a composite local sea level curve for the area between Grays Harbor, Washington, and the mouth of the Columbia River, based on radiocarbon dated peat and macrobotanical samples collected from cored stratigraphic sequences and cutbank exposures of wetland deposits. These local POCS records are plotted against the Barbados eustatic sea level curve in Figure 8 for comparison. When viewed together, the Nardin et al. (1981) curves and the Pierson et al. (1987) composite curve is more dissimilar to the Barbados record than is the Peterson et al. (2010) curve. Although the exact reasons for these differences are not known, issues related to the strength of geochronometric frameworks applied to each local sea level curve are of primary concern. The Nardin et al. (1981) sea level chronologies are based on few dates from uncalibrated (i.e., for marine reservoir effect) mollusk shells, and the portion of the sea level record from Pierson et al. (1987) that extends before 10,500 BP is based on extrapolated sea level data from the Texas Gulf Coast (Curray 1965). The longest local sea level record for the POCS comes from Peterson et al. (2010), which consistently shows higher sea level positions at earlier times than the Barbados record. This offset is most probably due to the local effects of Cascadia Subduction Zone neotectonics and post-glacial isostacy on the vertical position of the coastline through time. The degree to which the Peterson et al. (2010)

record extends beyond the modern coastal landscape of southern Washington and northern Oregon is unclear. Because of this uncertainty, we cannot be certain that this sea level record is appropriate beyond its localized extent. Other regional support for the use of global eustatic sea level models is seen in the research of Anima et al. (2002) who apply the Barbados sea level curve to their marine geology study in Monterey Bay.

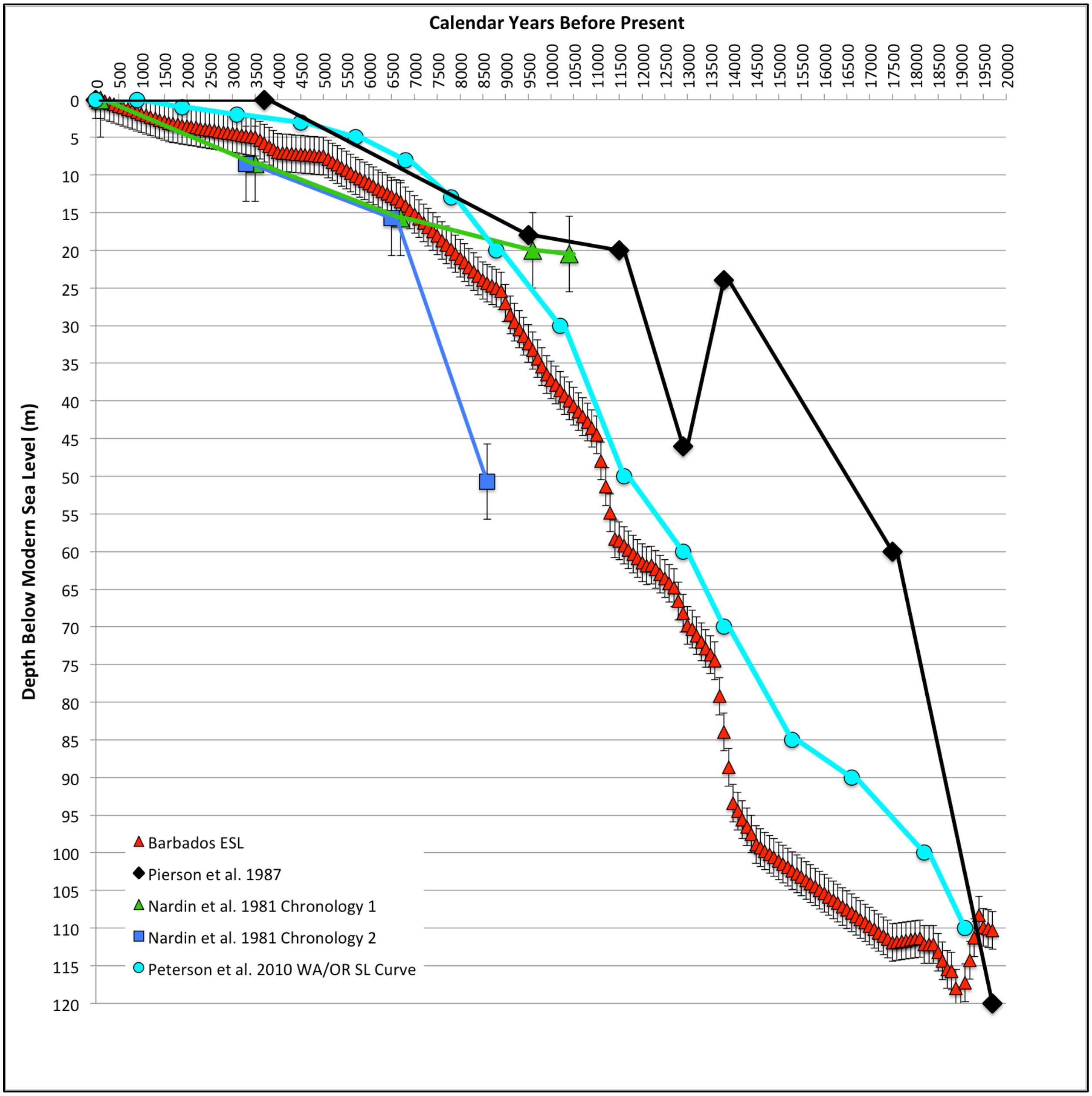


Figure 8. Comparison of the interpolated Barbados global eustatic sea level curve (based on Fairbanks 1989 and Peltier and Fairbanks 2006) and local sea level records from south-central California (Nardin et al. 1981; Pierson et al. 1987) and southern Washington (Peterson et al. 2010). Vertical error bars denote reported uncertainties in the position of sea level relative to dated samples. The Pierson et al. (1987), Nardin et al. (1981), and Peterson et al. (2010) datasets were converted to BP using Calib v5.0.1 (Stuiver and Reimer 1993).

Given that the statistical error associated with eustatic sea level history is plus or minus 5 meters (Peltier and Fairbanks 2006), and that modeled rates of glacial isostacy are generally low, have an uncertain history, or have uncertain spatial extents, we cannot quantitatively separate the effects of the regionally low uplift rates (i.e., ca. 2.9 meters since LGM) from the numerical uncertainty of eustatic sea level rise since the LGM. For that reason, we have chosen not to model these low and/or uncertain rates of crustal deformation along the POCS but instead simply apply global eustatic rates of sea level transgression to reconstruct paleolandscapes and shorelines along the POCS. We understand that local crustal deformation histories may have produced patterns of uplift or down warping greater than the regional average, resulting in divergent relative sea level histories; however, we do not know of any information that would allow us to accurately model such situations. In the absence of this information, we can only model eustatic sea level with confidence and thus employ the Barbados global eustatic sea level curve in our GIS calculations.

### 3.3.5. Modeling Coastal Paleolandscapes and Potential Site Location on the POCS

Our GIS approach to modeling is a two-part process wherein coastal paleolandscape reconstructions are first created, and associated prehistoric site location predictions are then made. For the first part, we create a GIS-based paleolandscape model that shows the extent of emergent lands on the POCS during the LGM (19,000 BP). We then project the positions of eustatic shorelines at each millennium since the LGM onto this maximum paleolandscape extent model. This POCS paleolandscape and paleoshoreline model was delivered separately to BOEM as part of this study.

To generate the potential site preservation models, we assign numerical values to 10-meter DEM grid squares imposed on the POCS, which allows us to establish a quantitative basis for making predictions about where past coastal sites were probably distributed on now-submerged coastal landscapes. These numerical values are arbitrary but relate to different environmental aspects of the paleolandscape that Snethkamp et al. (1990: Table III-1) correlate with different frequencies of prehistoric coastal settlement patterns along the Washington, Oregon, and California coastlines. In their study, the greatest number of prehistoric terrestrial coastal sites were found along the outer coast, followed by aquatic environments (bays, estuaries, rivers, lakes), and finally by sites located on islands and on coastal bluffs (Table 3). For ease of modeling potential site locations in GIS, we collapsed these subenvironmental types into four categories: outer coast, estuary (which includes embayments), streams (fluvial reaches of all sizes), and interfluve areas (i.e., in the areas between all other environmental categories). We model potential site location across the POCS through a process by which numerical values associated with grid squares are summed; higher values are interpreted to reflect more favorable locations for prehistoric site placement than grid squares with lower numerical values. Coastline rasters were buffered to 200 meters, extending landward, and were assigned a value of 75. Stream rasters were buffered to 100 meters (50 meters to each side of stream) and given a value of 75. A background value of 25 was given to the entire POCS to assign a fundamental numerical value to areas away from coastlines and streams.

Table 3
Frequency of Prehistoric Site Types along Modern Coastline Subenvironments of Washington, Oregon, and California

| Site Type | Outer Coast | Bay | Estuary | Coastal Bluffs | Lower River | Islands | Nearbeach Lakes | Subtotal |
|---|---|---|---|---|---|---|---|---|
| Shell Midden | 100 | 47 | 46 | 62 | 11 | 6 | 4 | **276** |
| Shell Midden with House Features | 14 | 1 | 4 | 7 | 4 | 0 | 2 | **32** |
| Lithic Site | 14 | 2 | 1 | 2 | 3 | 0 | 1 | **23** |
| Rock Art | 7 | 0 | 0 | 0 | 0 | 0 | 0 | **7** |
| Burial Ground | 2 | 2 | 2 | 3 | 0 | 0 | 0 | **9** |
| Cave/Rockshelter | 1 | 0 | 0 | 1 | 0 | 0 | 0 | **2** |
| Wet Site | 0 | 3 | 0 | 0 | 1 | 0 | 0 | **4** |
| Shell Midden w/Burials | 4 | 4 | 5 | 4 | 1 | 2 | 0 | **20** |
| Shell Midden/ Wet Site | 1 | 3 | 0 | 0 | 0 | 0 | 0 | **4** |
| Culturally Modified Tree | 1 | 0 | 0 | 0 | 0 | 0 | 0 | **1** |
| Cache | 1 | 0 | 0 | 0 | 0 | 0 | 0 | **1** |
| **Totals** | **145** | **62** | **58** | **79** | **20** | **8** | **7** | **379** |
| **Percent** | **38.3** | **16.4** | **15.3** | **20.8** | **5.3** | **2.1** | **1.8** | **100.0** |

Source: Snethkamp et al. 1990: Table III-1.

To simulate the environmental variance of the POCS paleolandscape in greater detail, we applied slope and aspect/insolation raster modifiers following Jenevein's (2010: 56–57) method:

> A slope raster in degrees was created from the DEM using the slope function of the Spatial Analyst extension in ArcGIS. The slope raster was reclassified to reflect desired slope values to equal 0 - 2° = 50, 2° - 5° = 30, and >5° = 5. The solar radiation analysis tool within the Spatial Analyst extension of ArcGIS was then used to determine the amount of radiant energy that was received from the sun for each grid square included within the DEM. This function was used in place of the "aspect" function that calculates the downslope direction of grid squares where a value is assigned by the operator, which corresponds to the expected amount of radiant energy that particular aspect would receive. Before running the solar radiation analysis tool, the integrated DEM was re-sampled to a grid cell size of 100 m to reduce the file size and processing time. Solar insolation was calculated for the winter solstice and classified into seven standard deviation (STD) levels to include: STD 1 = 408 - 476, STD 2 = 476 - 481, STD 3 = 481 - 487, STD 4 = 487 - 492, STD 5 = 492 - 497, STD 6 = 497 - 503, STD 7 = 503 - 568 (values rounded to the nearest whole number). Winter solstice was used to represent the low end of values expected within an annual insolation pattern of each cell being sampled. The seven classes were then reclassified into grid values equaling STD 1 = 0, STD 2 = 5, STD 3 = 25, STD 4 = 40, STD 5 = 65, STD 6 = 80, STD 7 = 100. The 100 m grid was then resampled back to a 10 m cell size for analysis.

We purposely removed the categories of bay/estuary, river/stream mouth, and coastal bluff from our calculation matrix because these areas would receive numerical modifiers simply on the account that they represented zones of overlap between buffered coastline and stream rasters. We envisioned difficulty in correctly identifying headlands within modeled paleolandscapes on the POCS and simply increased the coastline buffer inland by 200 meters to capture its heightened site location potential value to such areas as well. The summed values of POCS rasters produced quantitative variance across space that symbolizes hypothetical patterns of coastal site location.

The POCS became inundated as sea level rose after the LGM, steadily moving the coastline and its buffered raster values farther eastward through time, resulting in a complete distribution of coastline raster values. This reflects an important post-LGM marine inundation—the Pacific shoreline and its associated settlement potential stood at thousands of different positions during the past 19,000 years, moving the higher productivity shoreline and estuary zones inland through time. When viewed from a modern perspective, this complete distribution of raster values across the POCS provides a realistic model of potential site locations given that every grid square was either coastline or estuarine habitat at some point during the history of marine transgression.

Knowing the degree to which marine transgression affected site preservation along the coastline requires data about the geomorphic effects on the POCS during sea level rise, which we currently lack. A more theoretical resolution to this problem is found in the results of the potential site location model. Stream systems and their proximity buffers are the highest value grid squares among all other paleoenvironmental aspects. The reason for this lies in the way that inland-migrating estuaries give stream systems the highest values (calculated as stream buffer value plus stream buffer value) on the landscape. Given our aforementioned assumption that synchronous aggradation of alluvial and lacustrine sediments would occur in advance of shoreline encroachment during marine transgression, we expect that sites buried in stream settings experienced little to no post-inundation effects. In contrast, areas outside of stream and lake contexts would not likely receive the same sedimentary cover prior to the arrival of rising sea level and, as a consequence, might be partially or entirely eroded by wave action in the littoral zone. Although it was initially designed to predict areas that were more and less attractive to early coastal foragers, the potential site location model can also be considered to show the relative taphonomic effects of marine transgression: high grid values can be seen as signaling those areas where sites are more likely to have escaped the destructive effects of marine transgression and low value grid squares are less likely to contain intact archaeological sites.

## 3.4. RESULTS OF OFFSHORE MODELING

### 3.4.1. Coastal Paleolandscape and Paleoenvironmental Context Through Time

During the LGM, the Pacific Ocean stood at an elevation of ca. 120 meters below modern sea level (Peltier and Fairbanks 2006). Due to regional variations in its bathymetric form, the POCS was exposed to greater or lesser degrees along the Washington, Oregon, and California coastlines under this state of maximum marine regression. At the LGM, Washington's coast expanded ca. 39 kilometers west of its modern coast; Oregon's coast broadened more than 61 kilometers at its central area, and California's coastline expanded westward nearly 68 kilometers offshore of San Francisco Bay. On a state-by-state basis, marine regression at LGM time exposed the greatest amount of coastal terrain along Washington's coastline, followed by Oregon. Despite its longer coastline, the steeper gradient of the POCS along California's coastline yielded less terrain at the LGM lowstand.

According to the Peltier and Fairbanks (2006) eustatic sea level record, the fastest period of marine transgression occurred between 14,000 and 13,000 BP, resulting in 23.6 meters of sea level rise (Figure 9). The next fastest period occurred between 12,000 and 11,000 BP, corresponding to 17.0 meters of sea level rise. As might be expected, these two periods of rapid marine transgression also produce substantial horizontal shoreline movements. Between 14,000 and 13,000 BP, shoreline moves inland roughly 10 kilometers in Washington, as much as 22 kilometers in Oregon, and up to 16 kilometers in California proximal to San Francisco Bay. Between 12,000 and 11,000 BP, up to 27 kilometers of shoreline displacement occurs in California (south of Point Reyes), more than 5 kilometers of horizontal movement in shoreline position occurs in Oregon, and as much as 10 kilometers of shoreline advance is seen in Washington. The greatest amount of horizontal shoreline movement occurs at different times along the POCS: ancient coastlines moved the most along Washington between 13,000 and 12,000 and 12,000 and 11,000 BP (ca. 10 kilometers; 10-meter/year advance); in Oregon, the greatest period of shoreline advance occurred earlier, between 14,000 and 13,000 BP (ca. 22 kilometers; 22-meter/year advance); the most substantial horizontal shoreline movement in California took place west of the San Francisco Bay Area between 12,000 and 11,000 BP (up to 27 kilometers; 27-meter/year advance). Although representing only 15.7 percent of elapsed time since the LGM, the greatest advances in shoreline movement occur over the 3,000 years between 14,000 and 11,000 BP, submerging roughly 75 percent of the total width of exposed POCS terrain. These rates of shoreline movement would have been noticeable to prehistoric inhabitants of the POCS. Within a single generation lasting 20 years, prehistoric coastal foragers might expect to see shorelines move eastward 0.5–1.35 meters/year.

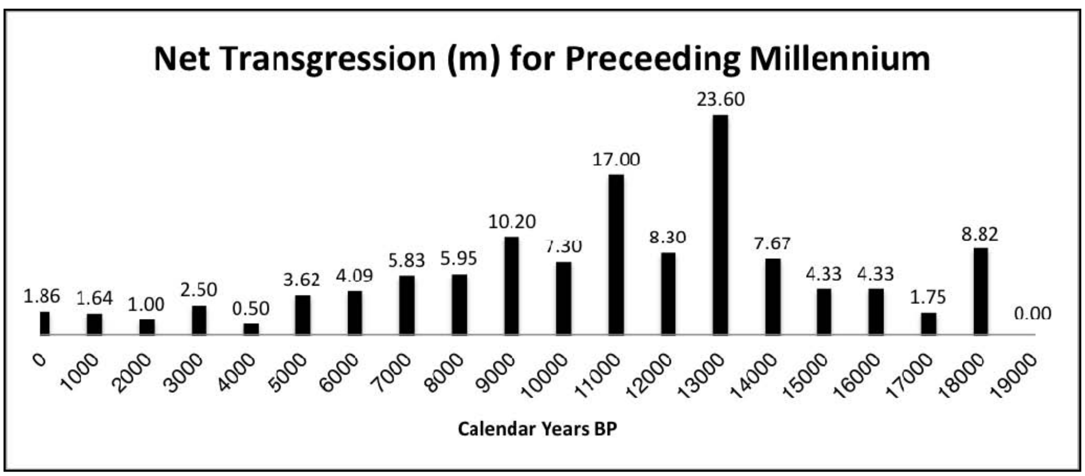


Figure 9. Rate of eustatic sea level change (in meters) per millennia since the LGM (calculated from Peltier and Fairbanks 2006 data).

The reason for this particular pattern of sea level rise is directly related to the bathymetric form of the POCS: generally speaking, the western 10 percent and eastern 15 percent of the continental shelf have steeper gradients than the interior 75 percent. As the transgressive Pacific coastline passed over the shelf's central portion, relatively small amounts of vertical rise translated into far greater horizontal shoreline movements.

### 3.4.2. Paleolandscape Change by Subdivision

To facilitate discussion of the GIS model, we divided the study area into seven different subdivisions based on natural transitions in the width and character of the emergent POCS landscape at LGM time (Figure 10). Figure 10 shows the location of subdivision frames across the POCS; Figures 11 through 17 show mesoscale overviews. Readers are advised to view the associated project GIS file for the highest resolution perspectives on paleolandscape change on the POCS. Please note that GIS data within state waters are not part of this study and therefore are not included in the GIS model and also are not displayed on Figures 10 through 17.

#### *3.4.2.1. Subdivision 1: San Juan Islands-Greater Puget Sound Region, Washington*

This area contains the most complex coastal geometry within the study area due to the presence of the San Juan Island archipelago and the morphology of the Puget Sound.

The Puget Lobe of the Cordilleran Ice Sheet extended into northwest Washington between 14,500 and 14,000 BP (Dyke et al. 2003), overrunning the San Juan Islands and expanding into the Puget Sound (Figure 11). Steep bathymetry produced a narrow POCS landscape, up to 6 kilometers wide at the LGM, along the northern edge of the Olympic Peninsula.

#### *3.4.2.2. Subdivision 2: Neah Bay, WA to Pacific City, Oregon*

This portion of the GIS model includes the entire outer coast of Washington and extends past the mouth of the Columbia River roughly to the transition from Oregon's northern and central coastal zones. This subdivision is characterized by its broad shelf, which would have appeared as a topographically homogeneous coastal plain during the LGM (Figure 12). Portions of the POCS emerged as islands in the area west of the Olympic Peninsula between 19,000 and 13,000 BP.

#### *3.4.2.3. Subdivision 3: Pacific City, Oregon, to Winchester Bay, Oregon*

This subdivision includes an irregular terrain bounded to the west by a chain of rocky headlands, which appear today as submerged banks, and to the south by a large south-facing embayment (Figure 13). In contrast to its northern neighbor, Subdivision 3 possesses greater topographic complexity that served to produce considerable variation in landscape form at different stages of marine transgression. From 19,000 to 13,000 BP, the now-submerged Stonewall, Perpetua, and Heceta Banks were prominent terrestrial features on the ancient POCS landscape. Between 19,000 and 16,000 BP, the banks formed a northeast–southwest trending ridge that connected with lower-relief portions of the POCS, creating a large bay. At the LGM, this bay measured ca. 39 kilometers wide (east–west) and ca. 24 kilometers deep (north–south). By 16,000 BP, rising ocean waters caused this bay to expand in size, growing to nearly 44 kilometers wide and 30 kilometers deep. After 16,000 BP, marine transgression breached the western edge of this embayment, turning the bounding ridge into a series of islands by 13,000 BP. Rising sea level caused the embayment to shrink and retreat northward between 16,000 and 14,000 BP and to finally disappear by 13,000 BP. By 12,000 BP, the coastline had taken on a linear form. Emergent remnants of the Stonewall Bank stood as an island at 12,000 BP, dividing into two islands by 11,000 BP and into ever smaller and numerous islands until rising sea levels fully submerged the bank at 9,000 BP.

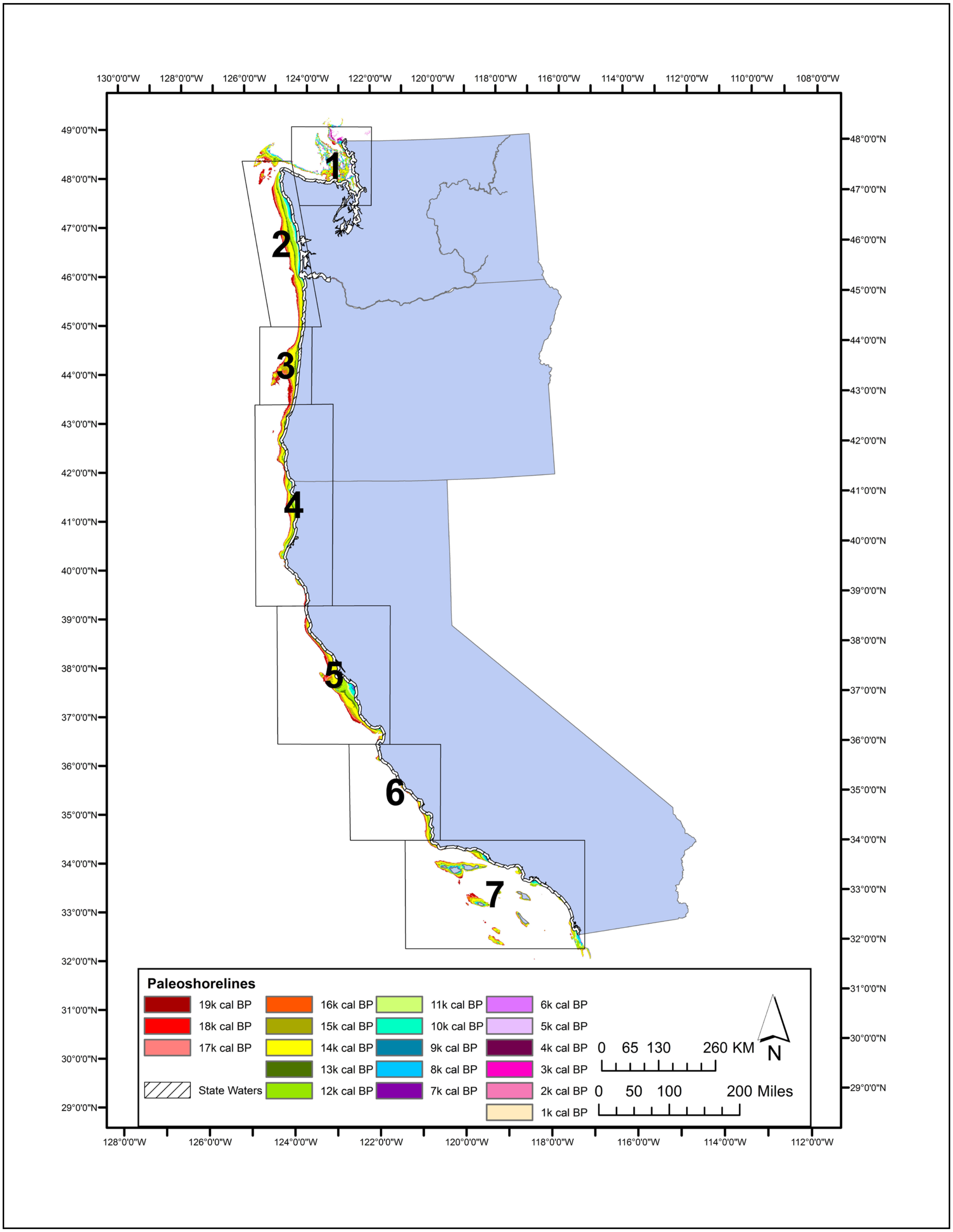


Figure 10. Seven subdivisions of the POCS GIS site location potential model.

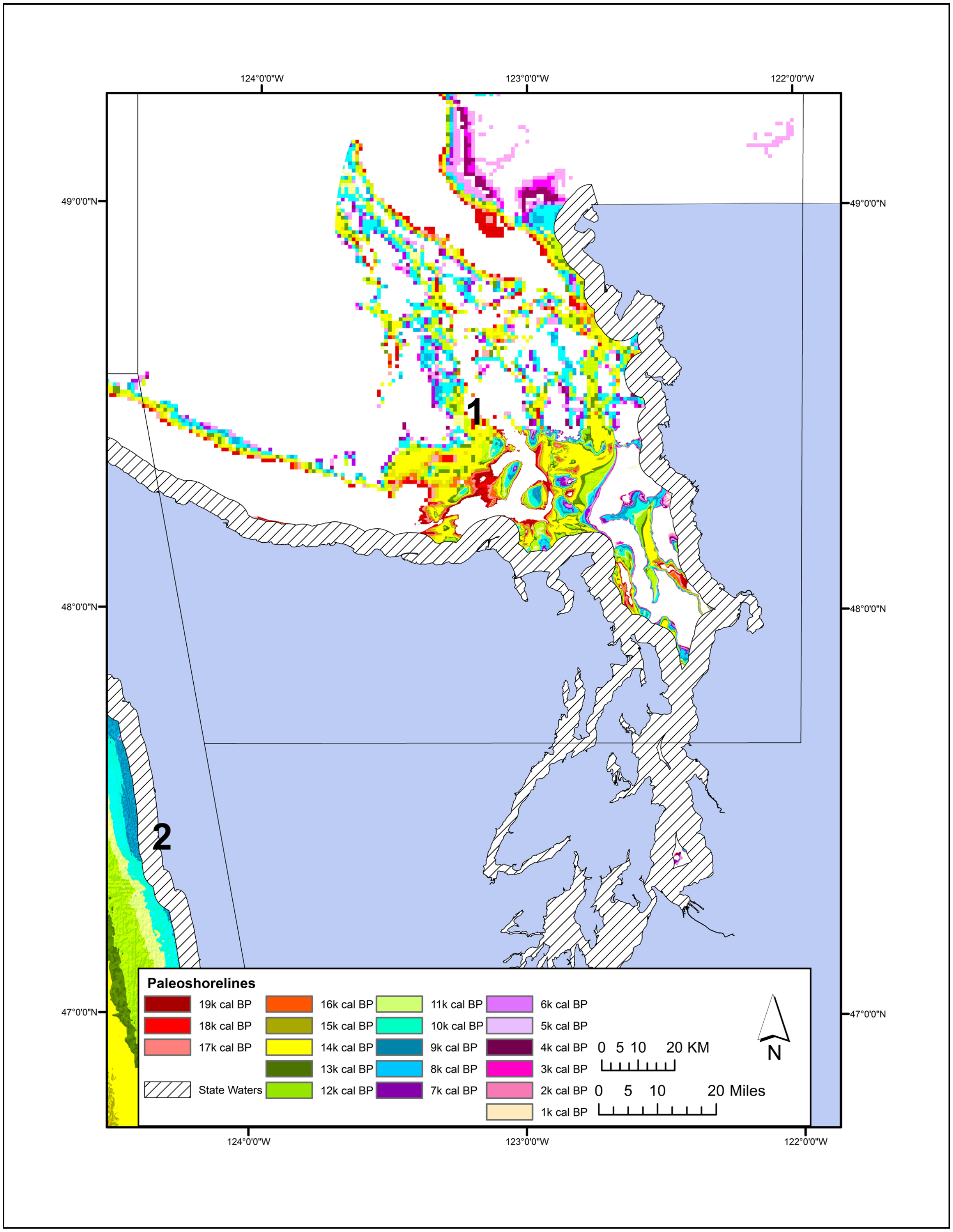


Figure 11. Inset map of Subdivision 1 showing shoreline contours present on exposed POCS coastal landscape during LGM time.

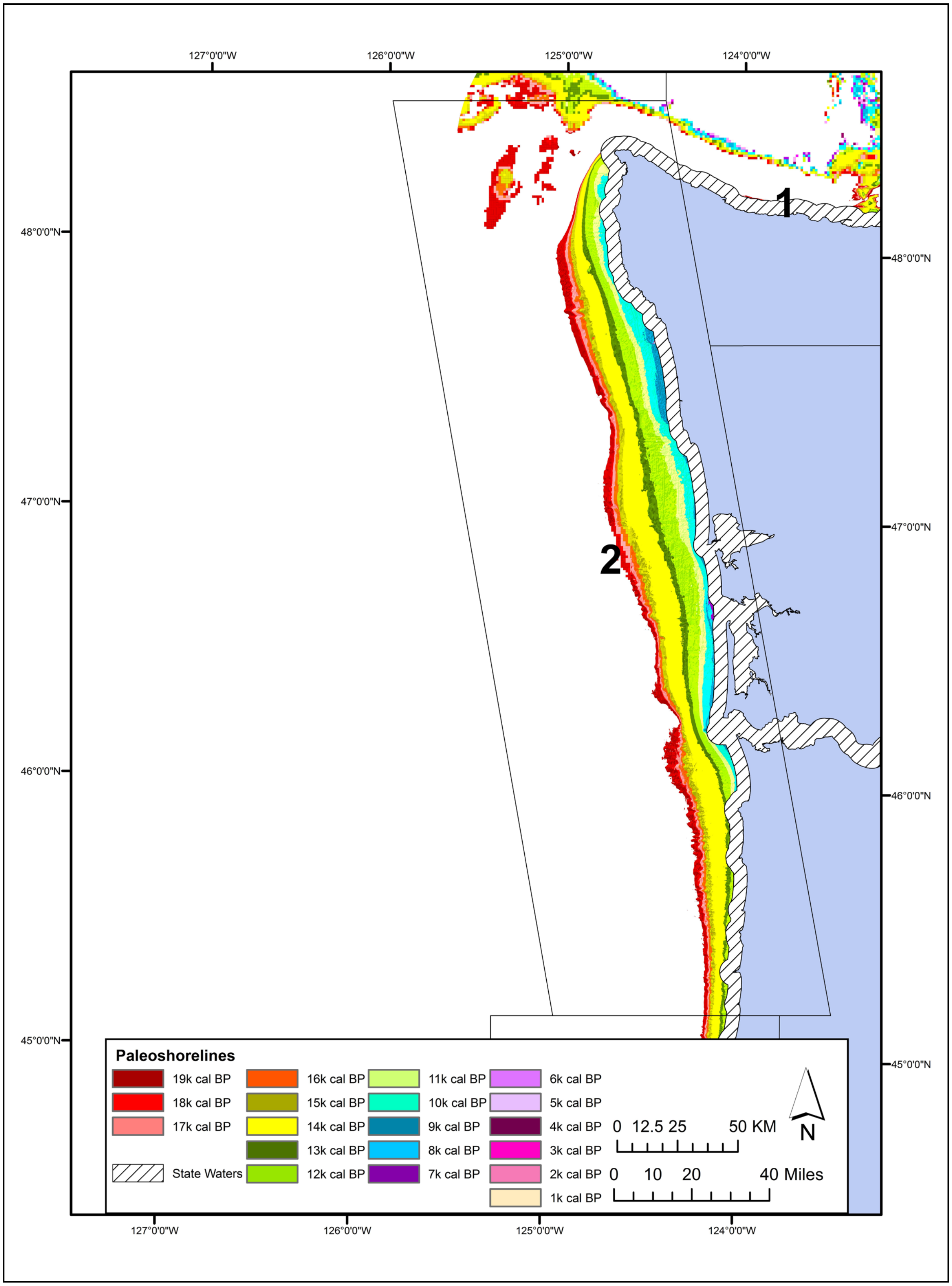


Figure 12. Inset map of Subdivision 2 showing shoreline contours present on exposed POCS coastal landscape during LGM time.

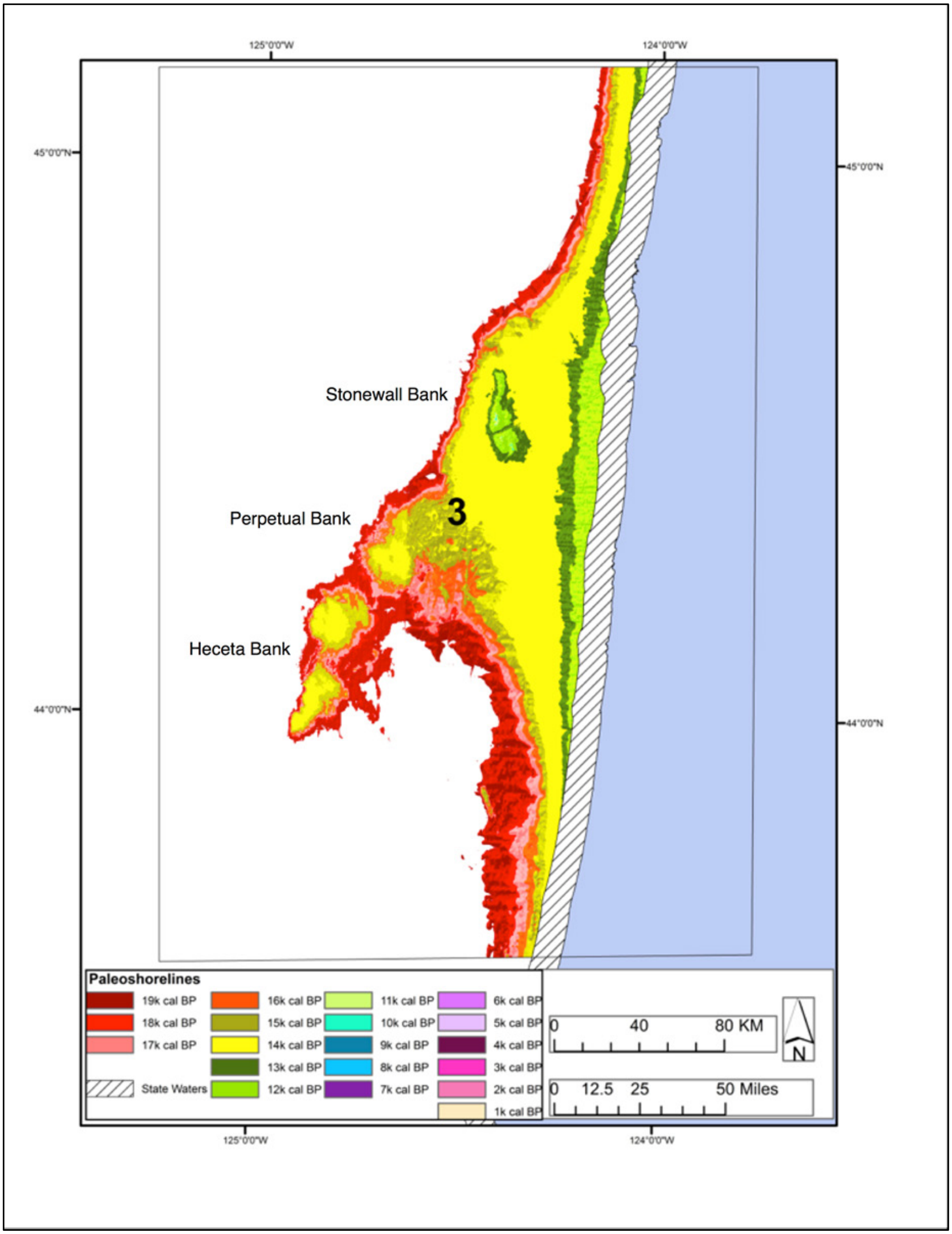


Figure 13. Inset map of Subdivision 3 showing shoreline contours present on exposed POCS coastal landscape during LGM time.

#### 3.4.2.4. Subdivision 4: Winchester Bay, Oregon, to Fort Bragg, California

This subdivision includes a longitudinally extensive portion of the study area bearing moderately narrow coastal landscapes marked by steeply sloping surface gradients (Figure 14). This portion of the POCS is characterized by consistent paleoshoreline contours that primarily parallel the modern coastline. South of Eureka, California, the POCS paleolandscape narrows considerably, lying just within and a short distance beyond the California state water limit.

#### 3.4.2.5. Subdivision 5: Fort Bragg, California, to Cypress Point, California

Subdivision 5 contains the model's broadest, lowest-relief POCS landscapes with greater topographic complexity along its western margin (Figure 15). Between 19,000 and 17,000 BP, this area held a north-facing embayment at the same latitude as Point Reyes. After 17,000 BP, rising sea level changed the shape of the coastline, producing a series of bights that receded to the south and east of Point Reyes. The Cordell Bank, which lies due east of Point Reyes, was exposed as a peninsula and the western margin of the north-facing embayment. By 16,000 BP, rising sea levels had cut off the bank from the mainland, and it stood as an island until just after 11,000 BP. By 10,000 BP, the coastline of Subdivision 5 began to take on its modern northwest–southeast trend. At the southern end of this subdivision, near the modern position of Monterey Bay, the POCS landscape changed through time, due to the compressed bathymetric nature of the areas surrounding the Monterey Submarine Canyon.

#### 3.4.2.6. Subdivision 6: Cypress Point, California, to Point Conception, California

Subdivision 6 includes some of the narrowest portions of the POCS; some of which do not extend westward beyond the limits of California state waters (Figure 16). In these cases, steep bathymetric gradients formed short coastal reaches that underwent more limited landscape change than broader and flatter coastal terrains elsewhere. More extensive coastal landscapes, extending westward as much as 21 kilometers, were present in the reach between modern-day Morro Bay to Point Conception.

#### 3.4.2.7. Subdivision 7: Point Conception, California, to Imperial Beach, California

This subdivision contains some of the narrowest sections of continental shelf as well as the Channel Islands (Figure 17). Before 10,000 BP, San Miguel, Santa Rosa, Santa Cruz, and Ancapa Islands were connected as a larger landmass known as Santa Rosae Island. From 19,000 BP to 10,000 BP, lower sea levels expanded the limits of Santa Rosae to more than 16 kilometers away from the modern-day shoreline of Santa Rosa Island. Between 19,000 and 13,000 BP, the eastern edge of Santa Rosae was separated from the California mainland by only 7.5 to 8 kilometers. To the south of the Northern Channel Islands, lower sea levels exposed more limited portions of the POCS surrounding San Nicolas, Santa Barbara, San Clemente, and Santa Catalina Islands. Of these, San Nicolas Island expands its territory the most, gaining more than 31 kilometers from its modern northwest shore. Islands not present today emerged from submerged highpoints on the ocean floor at and around Tanner Bank, Bishop Rock, portions of Dall Bank and Nidever Bank, Fortymile Bank, and Osborne Bank.

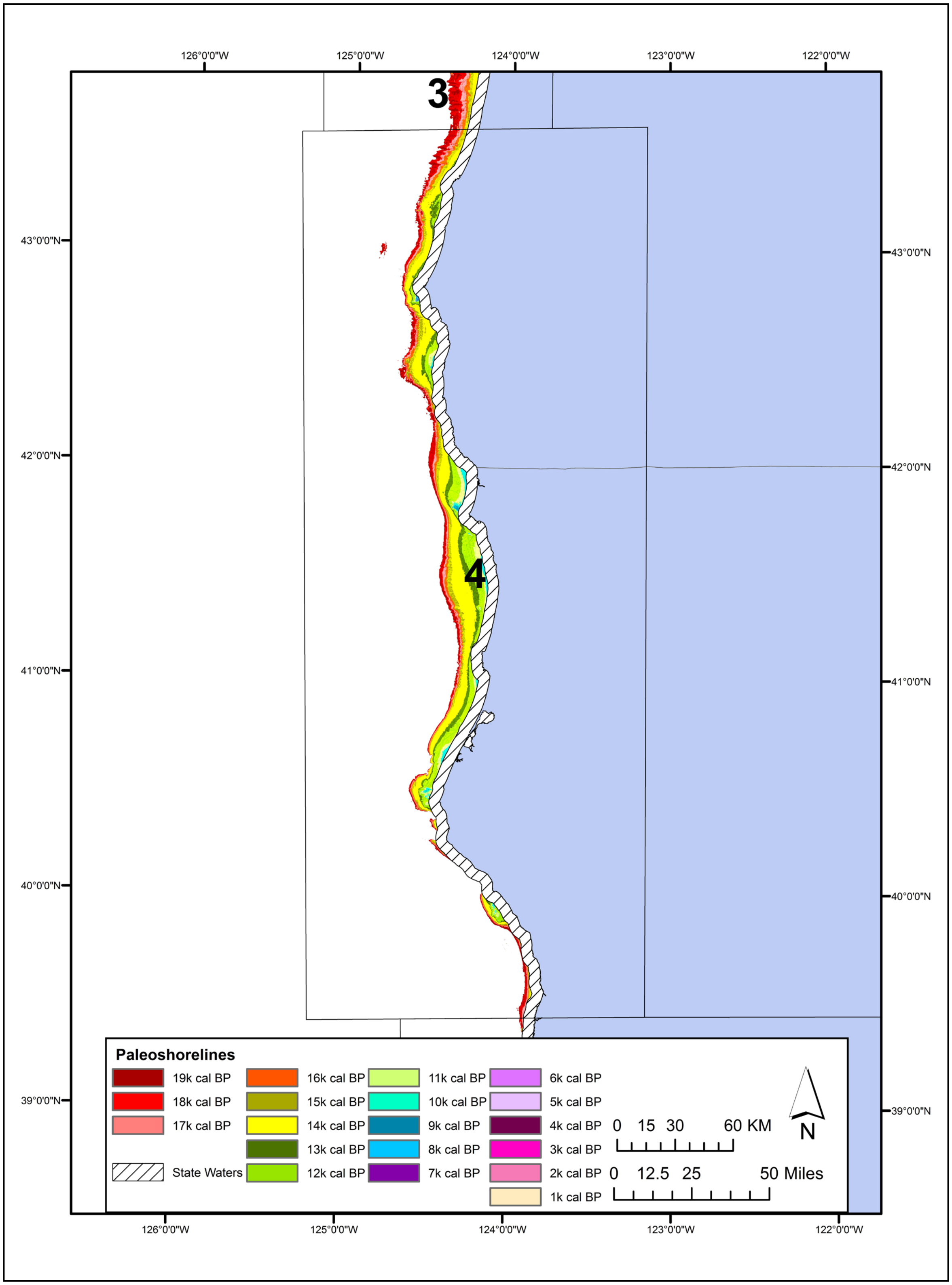


Figure 14. Inset map of Subdivision 4 showing shoreline contours present on exposed POCS coastal landscape during LGM time.

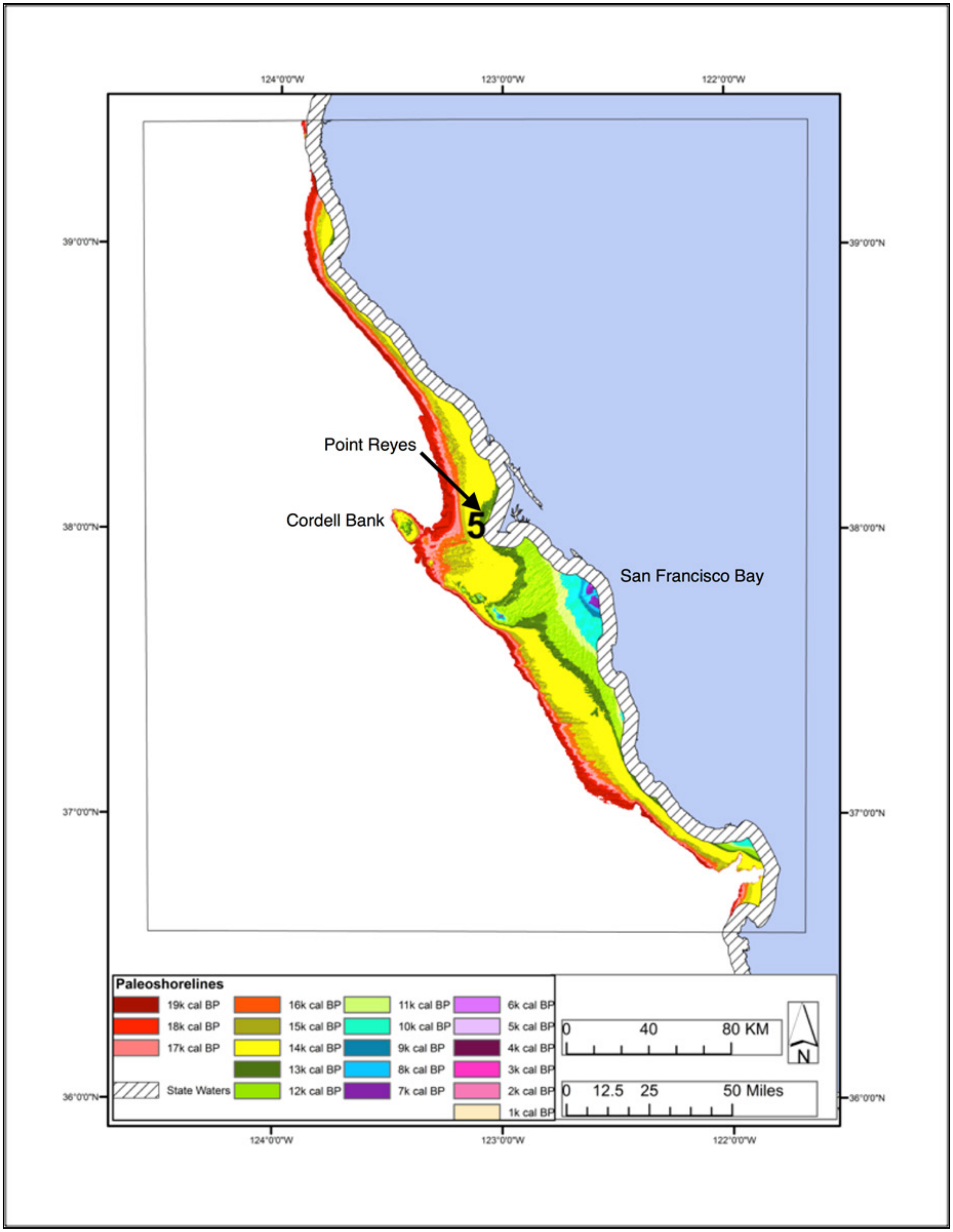


Figure 15. Inset map of Subdivision 5 showing shoreline contours present on exposed POCS coastal landscape during LGM time.

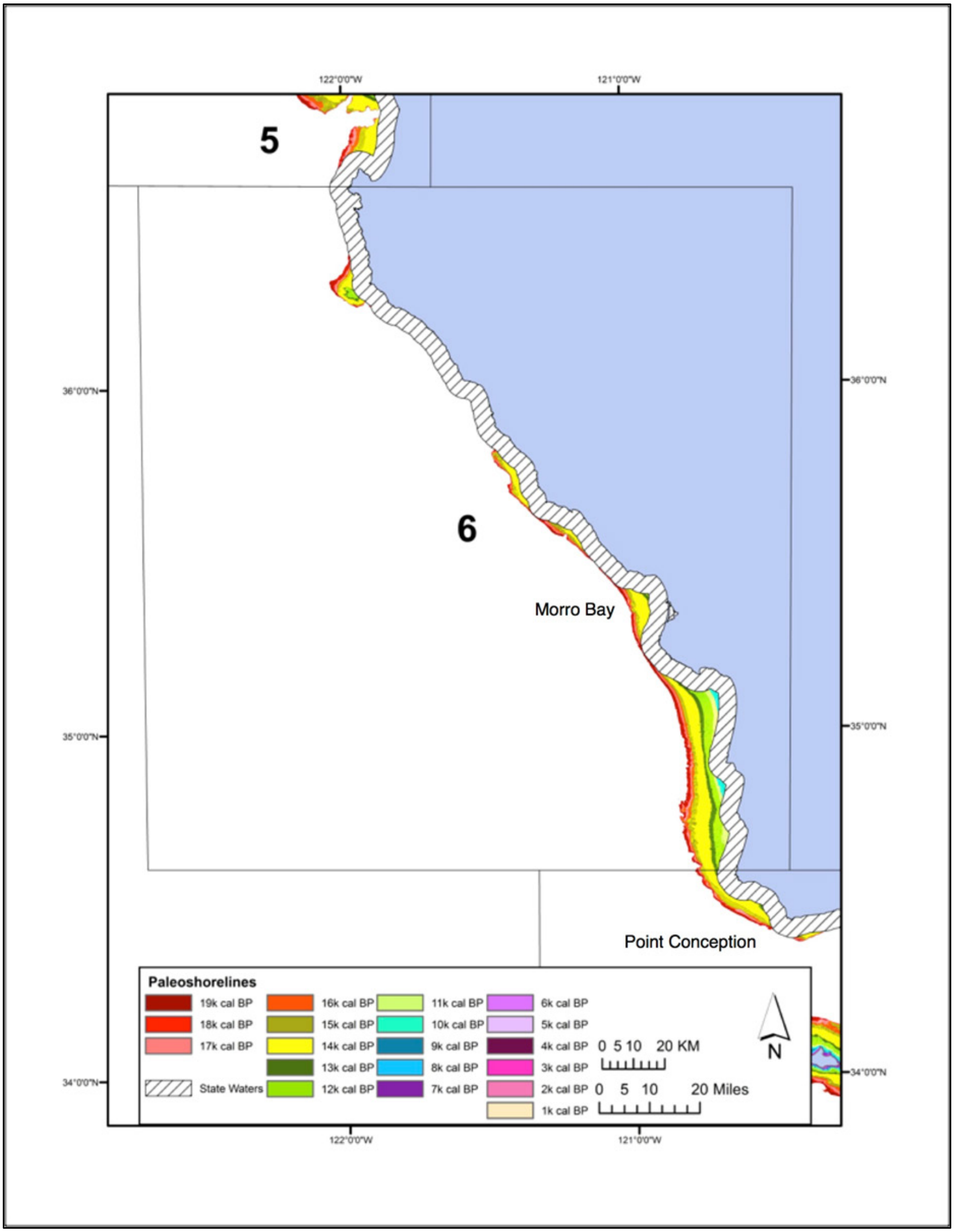


Figure 16. Inset map of Subdivision 6 showing shoreline contours present on exposed POCS coastal landscape during LGM time.

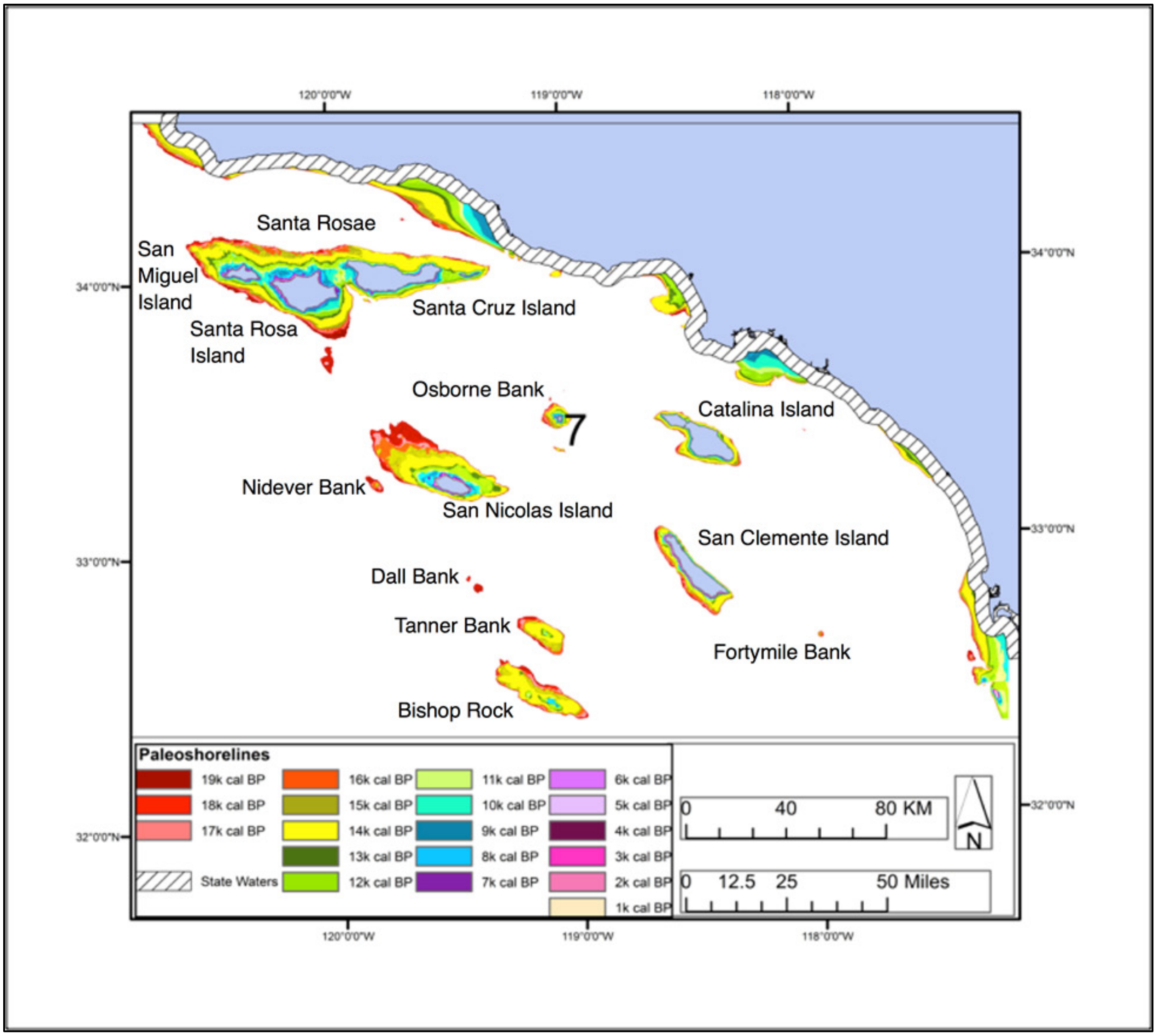


Figure 17. Inset map of Subdivision 7 showing shoreline contours present on exposed POCS coastal landscape during LGM time.

### 3.4.3. Results: Site Location Predictive Model

Using ArcGIS, we produced a diachronic projection of potential site locations on the maximum extent of the POCS paleolandscape, separated into seven subdivisions (Figure 18). We superimposed shoreline positions at millennial time scales, which provide a synchronic perspective as well. Because the ultimate use of this GIS model will be to serve as an aid to the management of potential submerged prehistoric sites on the POCS, we envisioned that it would be critical to know the aggregated value of potential site locations in our study area. Marine transgression caused the Pacific shoreline to advance landward, albeit differentially, across the paleolandscape of the POCS. As it did this, the environmental aspects of the POCS paleolandscape would have been shifted landward as well.

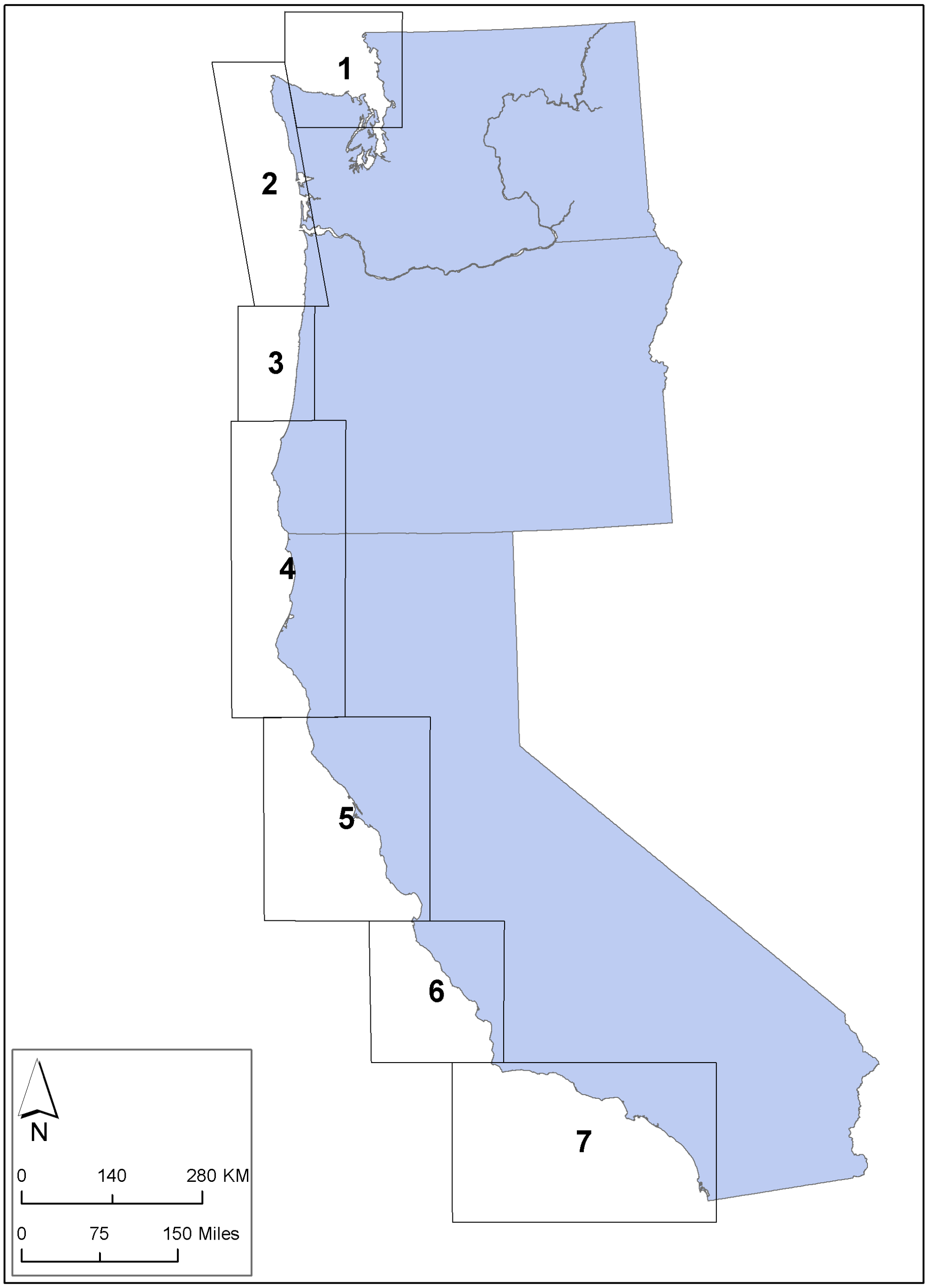


Figure 18. Overview of the site location predictive model with its seven subdivisions.

To review, we model potential site location across the POCS through a process by which numerical values associated with 10-square-meter grid squares are summed; higher values are interpreted to reflect the presence of better resource patches that served as more favorable locations for prehistoric site placement than grid squares with lower numerical values. Coastline rasters were buffered to 200 meters, extending landward, and were assigned a value of 75. Stream rasters were buffered to 100 meters (50 meters to each side of stream) and given a value of 75. A background value of 25 was given to the entire POCS to assign a fundamental numerical value to areas away from coastlines and streams. Where the stream and coastline rasters overlap, we added the values of the two environmental buffer types to represent the high productivity of estuaries. We realized that as rising sea level brought the coastline buffer eastward, the high-value estuary zone would also move upstream along alluvial basins. Rather than show this continuous environmental evolution as a series of thousand year snapshots, which would only show disconnected series of high-value estuary grid squares at the arbitrary positions of millennial shoreline locations, we chose to model the aggregated outcome of marine transgression at annual scales. All areas that were high value at any time were weighted equally. We did not add a temporal modifier for those areas with greater duration above sea level. Modeling potential site locations from the diachronic perspective allows the resource manager to better appreciate the hypothetical likelihood of where submerged prehistoric sites might be found across the entire POCS.

The site predictive model shows the distribution of shape files that contain calculated values for potential site locations that range from a low of 81 to a high of 300. Rather than display the output of our site location potential model as a continuous range of 219 different raster values, we separated the range of modeled values across six classes that were determined in ArcGIS via the Jenks Natural Breaks method. This method is commonly used to bin large data populations in a manner described in the ArcGIS 9.2 Desktop help page: "Classes are based on natural groupings inherent in the data. ArcMap identifies break points by picking the class breaks that best group similar values and maximize the difference between classes. The features are divided into classes whose boundaries are set where there are relatively big jumps in the data values" (ESRI 2007). The raster value output for the POCS site location potential model is shown in Figure 19.

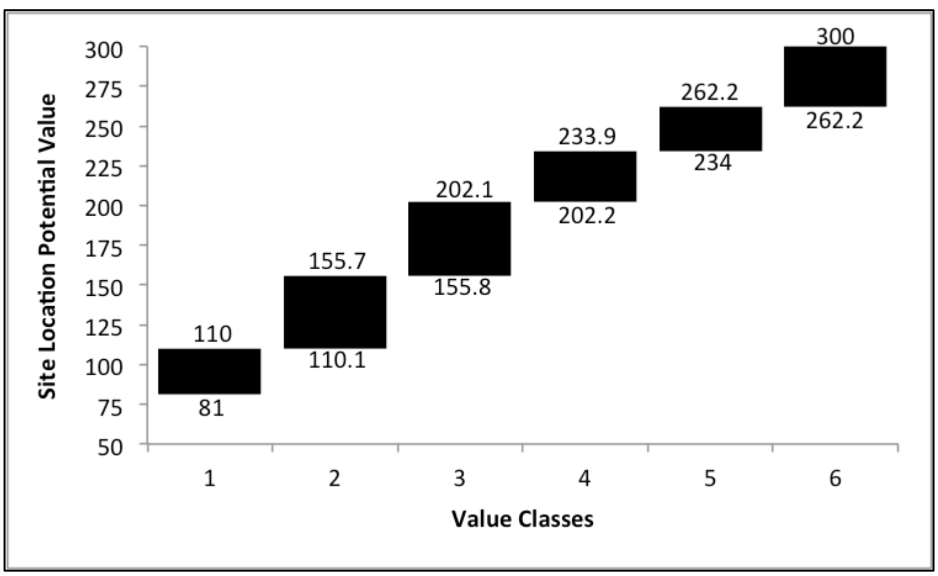


Figure 19. Raster output values generated by the POCS site location potential model, divided into six value classes via the Jenks Natural Breaks method. Numbers above and below the black boxes indicate the upper and lower numerical limits of each class.

Areas expected to have the highest potential for containing submerged prehistoric sites have modeled scores that fall within the sixth value class. Conversely, the first value class signals those areas with the lowest expected potential for holding submerged prehistoric sites. At this time, the numerical output of our GIS model must be understood to be a heuristic tool that assigns relative scores to parts of the POCS that are expected to have better or worse potential for preserving prehistoric sites. Ultimately, the full value of these site location potential values can only be realized through direct groundtruthing of the GIS model. This groundtruthing would involve subsurface sampling of buried deposits to evaluate whether archaeological sites or sediments of the target age and type exist in grid squares with different output values. Armed with a sufficient amount of groundtruthing data, the heuristic site location potential values could be converted to statistical probability values. In this way, the GIS model could evolve into a quantitatively supported tool capable of generating actual probability statements about the likelihood of site locations.

For ease of discussion, we present the results of the predictive model by the spatial subdivisions presented earlier. Subdivisions 1 through 7 are organized along the POCS from north to south.

Table 4 shows the distribution of site location predictive values held in each of the subdivisions. Because we divided the summed area of each predictive value class by the total area of all predictive value shapefile polygons the percent values shown in Table 4 and Figure 20 are directly comparable, despite differences in the sizes of the subdivisions.

Table 4
Aggregate Values of Site Location Predictive Shapefile from each POCS Subdivision

| **Predictive Value Class** | **Predictive Value Class Shapefile Area (square meters)/Subdivision Total Area (square meters)** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Subdivision** | | | | | | |
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| 1 | 1.14976 | 0.00455 | 0.00201 | 0.00000 | 0.00000 | 0.00000 | 0.00929 |
| 2 | 6.19836 | 0.39704 | 0.01309 | 0.03164 | 0.00502 | 0.00000 | 0.07052 |
| 3 | 89.06093 | 74.63530 | 4.69114 | 1.17059 | 0.73815 | 1.45498 | 6.53895 |
| 4 | 0.91705 | 20.69553 | 90.66299 | 93.96321 | 94.62711 | 93.31367 | 90.65597 |
| 5 | 0.66958 | 0.09179 | 0.13236 | 0.12544 | 0.07288 | 0.26942 | 0.14773 |
| 6 | 2.00433 | 4.17579 | 4.49840 | 4.70912 | 4.55683 | 4.96193 | 2.57755 |
| **Totals** | **100** | **100** | **100** | **100** | **100** | **100** | **100** |

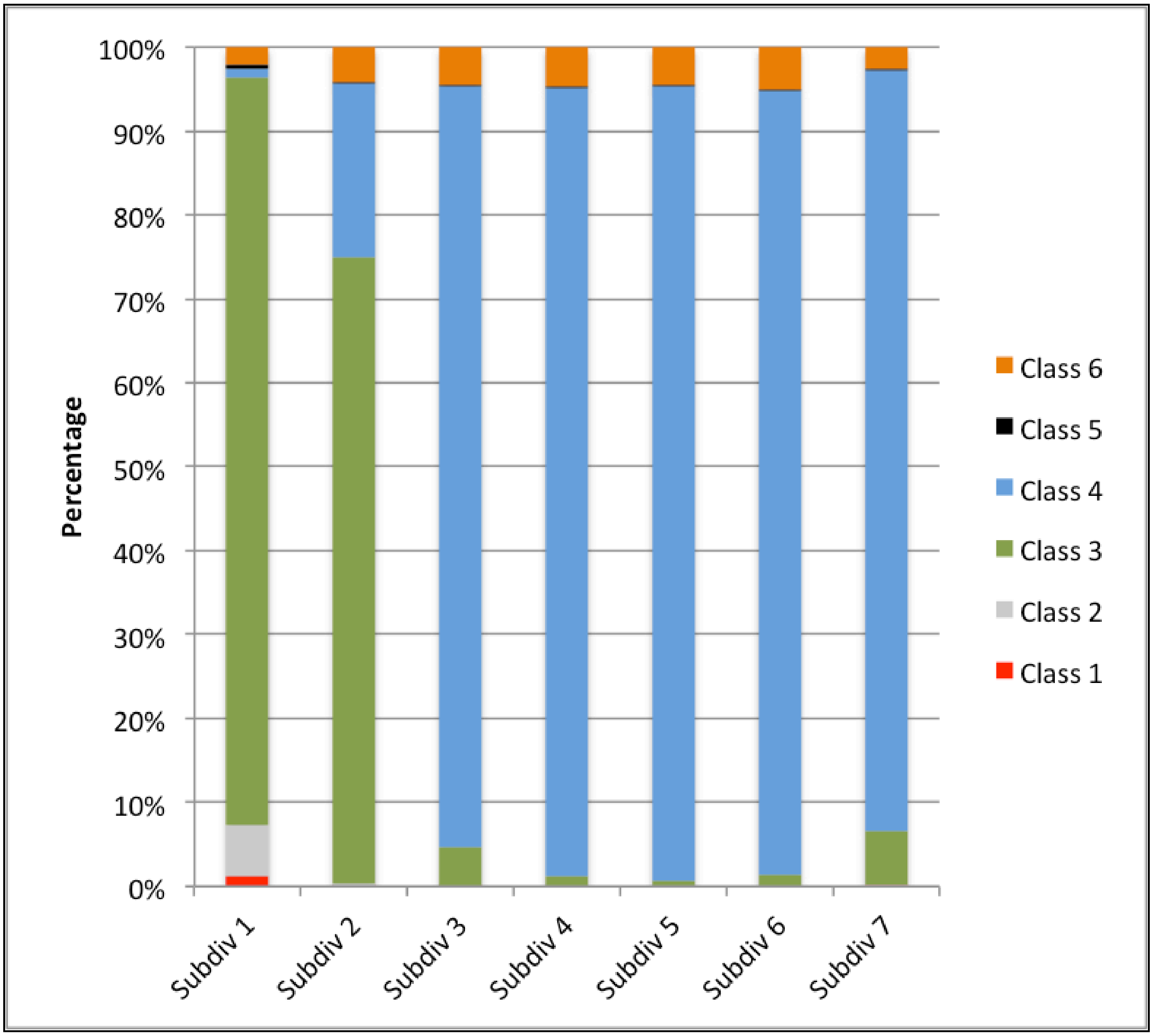


Figure 20. Proportional area (square meters) of shapefile polygons associated with different site location predictive value classes within Subdivisions 1 through 7.

Previous POCS submerged site prediction studies present large scale (e.g., 1: 250,000 scale maps) spatial predictions about submerged prehistoric sites on the POCS based on lower resolution bathymetric data and non-digital analytical approaches. The paleolandscape maps included in the Pierson et al. (1987) and Gearhart et al. (1990) reports were based on more limited bathymetric information. Paleoshoreline projections in both models were informed by sea level models built from a combination of local information and also from extraregional models. Our new study brings together the most detailed bathymetric information to date, and has applied a GIS-based model that makes predictions about potential site locations based on assumptions about resource distributions that attract prehistoric peoples to particular parts of the POCS and considers how these resource areas are differentially affected by marine transgression. The GIS study predicts that the highest potential site location areas will be found within alluvial drainages that have economically attractive resources and relatively high rates of sedimentary deposition that should serve to preserve prehistoric sites better than in the interfluve areas. Although the prediction that remaining submerged archaeological sites will be most commonly found close to alluvial environments was also voiced in the Pierson et al. (1987) and Snethkamp et al. (1990) studies, our GIS model makes georeferenced predictions about where these alluvial environments exist on the POCS. Our current study also features the most detailed reconstructions of paleoshorelines and alluvial drainage networks yet produced for the POCS, adding new dimensions of resolution to our perceptions of coastal paleoenvironmental contexts.

#### *3.4.3.1. Discussion of Results*

Figures 21 through 27 show mesoscale overviews of the site location predictive model. To appreciate the full analytical value of the model, the reader is encouraged to view the POCS GIS shapefile layers. The observations included in the discussion that follows were made from the POCS GIS model using a range of different zoom magnifications. The site location predictive model reveals several things. First, stream corridors are expected to have the absolute highest likelihood for containing submerged prehistoric sites. This situation is the direct result of the progressive up-basin movement of the estuary zone, which was expected to continuously attract prehistoric foragers who left behind archaeological sites in the course of using estuarine resources. Second, Table 4 shows a southward increase in overall site location values. Apart from Subdivision 3, most (i.e., 89 percent in Subdivision 1 and 75 percent in Subdivision 2) grid squares in the northernmost subdivisions fall within the third value class. Moving south, 90 percent or more of the grid squares in Subdivisions 3 through 7 were calculated to fall within the fourth value class. No parts of the landscape within Subdivisions 4–6 score within the lowest (first) value class. These results suggest that the southern half of the POCS paleolandscape had better overall resource potential than in the far northern half, which generally offered lower value resource patches in higher frequencies. The simplest explanation for this pattern lies in the effect that insolation has upon the numerical value of any POCS grid square, which increases latitudinally to the south. More detail on this calculation process is provided in Section 3.3.5. The numerical modification of insolation upon raster grid squares increases in a southerly direction. In contrast to this trend, Subdivision 7 shows a lower percentage of highest (sixth) ranking value squares, which is probably controlled by its narrow shelf zones that bear limited stream drainage networks. The lower insolation modifications associated with the north-facing slopes of the Channel Islands contribute to the elevated number of third value class squares. Beyond these general observations, the site location predictive model suggests that the value (and the assumed potential for holding a site) of any given grid square increases proportional to latitude, in a southerly direction. This pattern can be seen clearly in the closer overview map projections in Figures 21 through 27: the southern subdivisions show a widespread occurrence of yellow, representing the fourth predictive value class and green (predictive value class 3) is widespread in Subdivisions 1 and 2. Conversely, this fact can also be taken to suggest that sites are more likely to be concentrated in greater frequency within the highest predictive value alluvial buffers of modeled stream systems toward the northern end of the POCS study area.

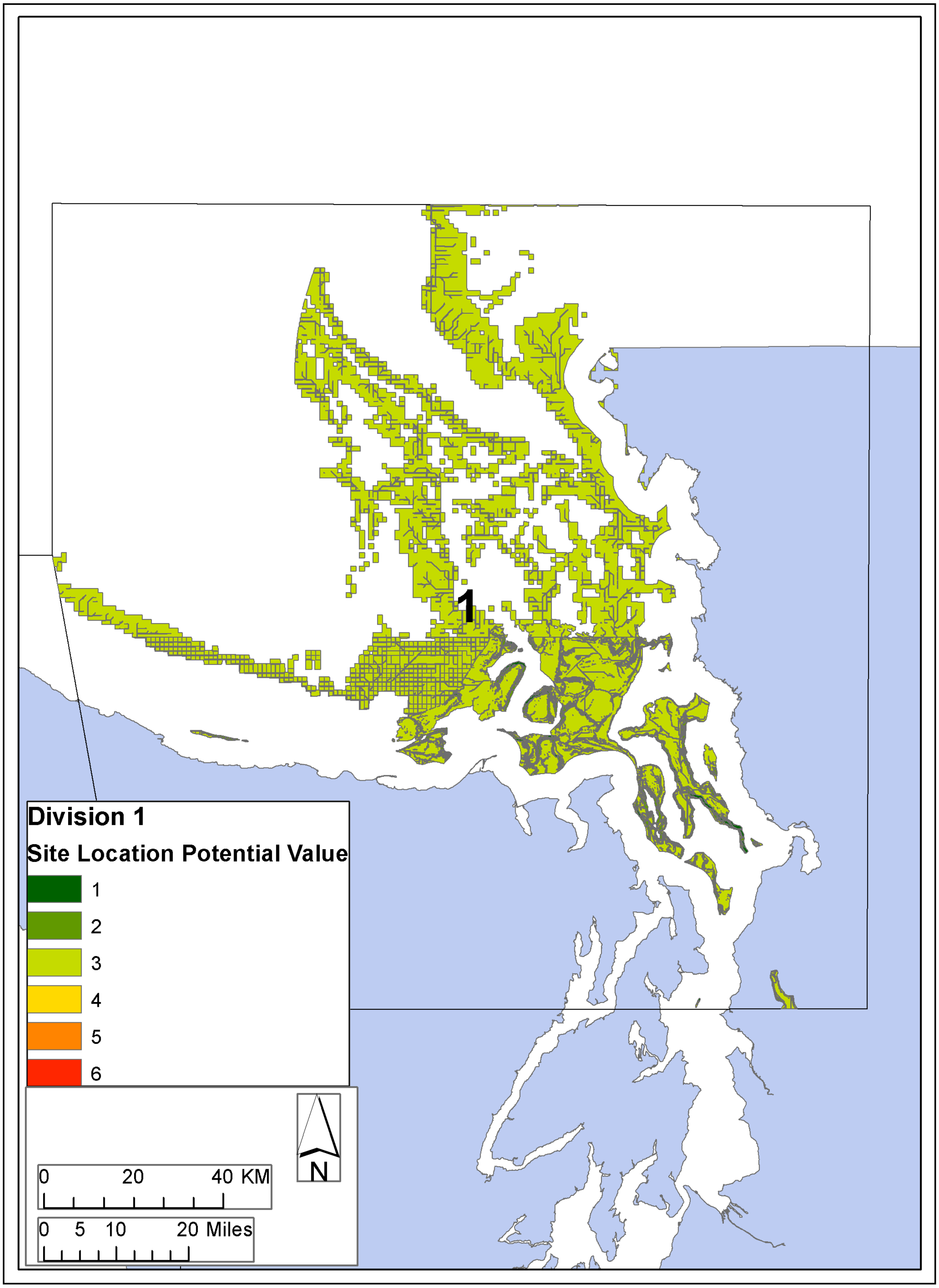


Figure 21 Overview of the total site location potential value distribution across the POCS paleolandscape within Subdivision 1.

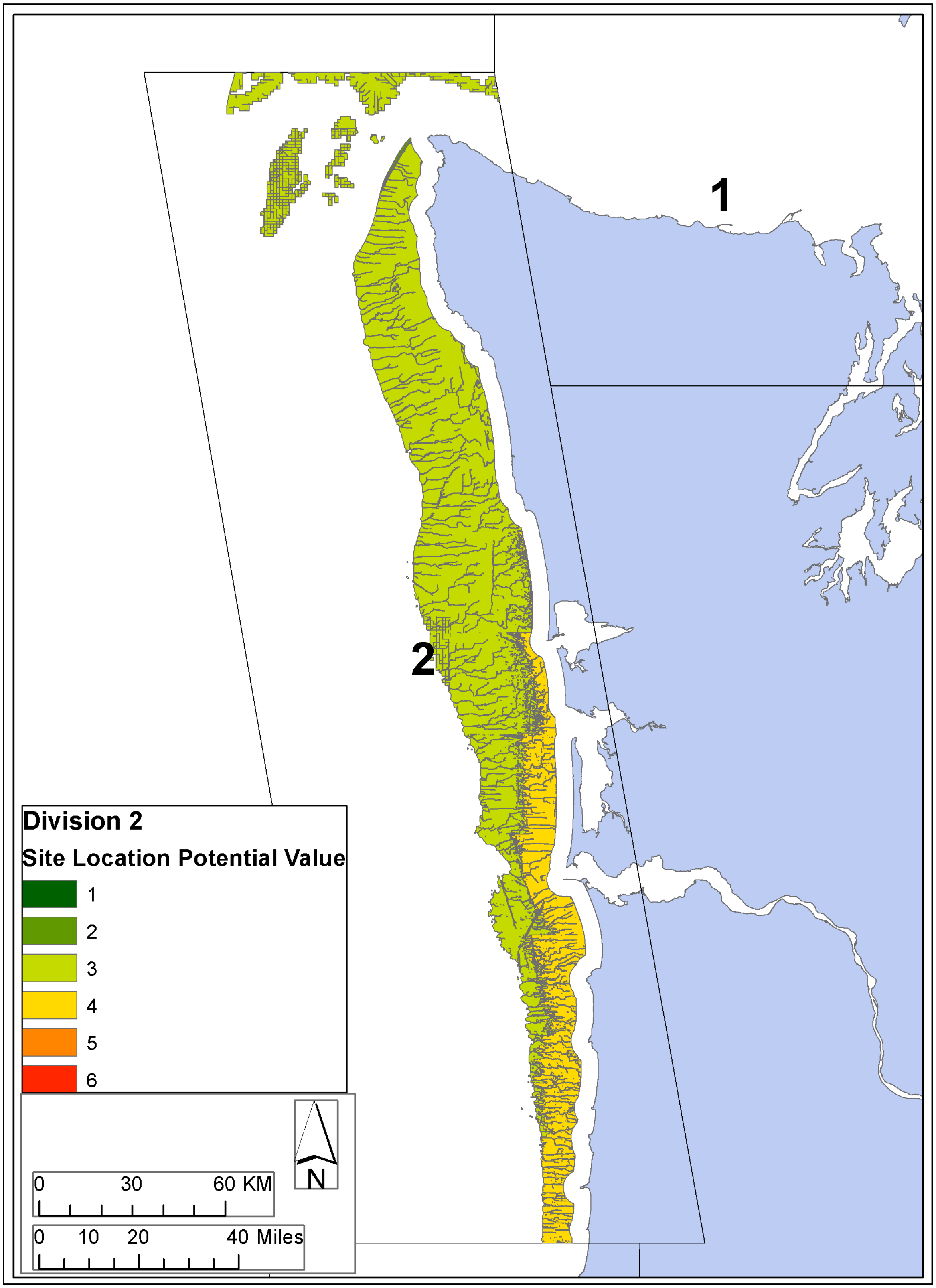


Figure 22. Overview of the total site location potential value distribution across the POCS paleolandscape within Subdivision 2.

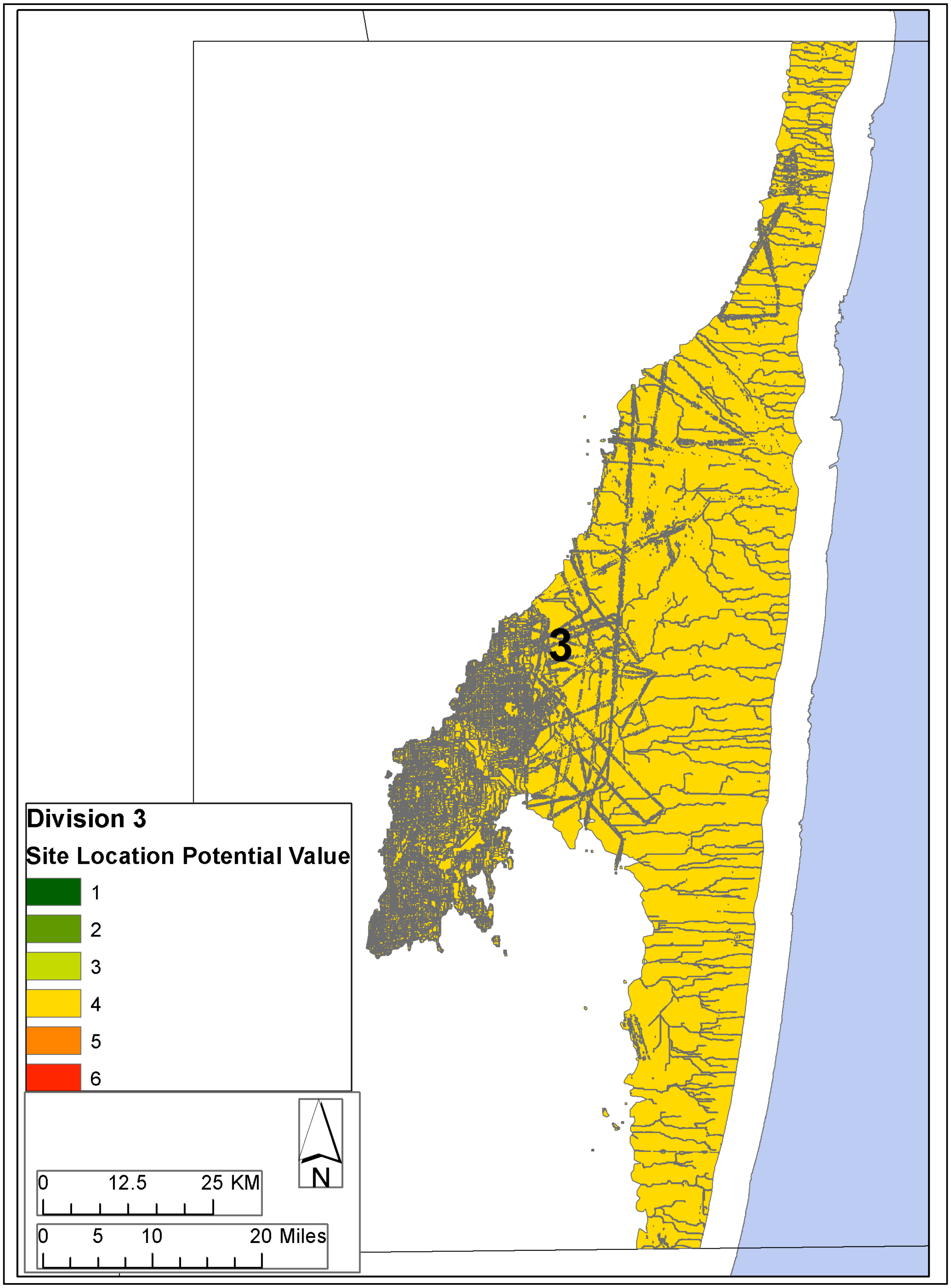


Figure 23. Overview of the total site location potential value distribution across the POCS paleolandscape within Subdivision 3.

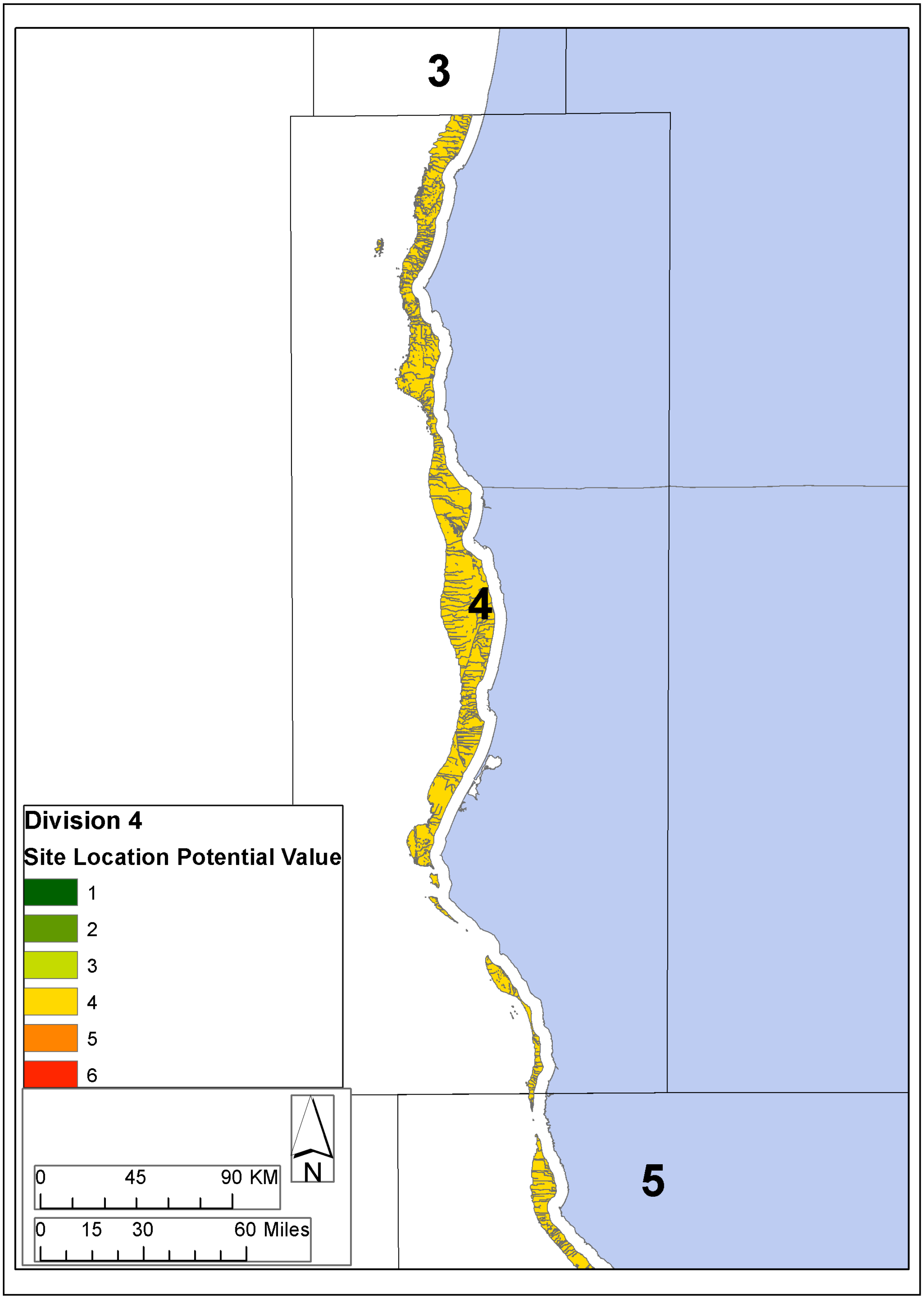


Figure 24. Overview of the total site location potential value distribution across the POCS paleolandscape within Subdivision 4.

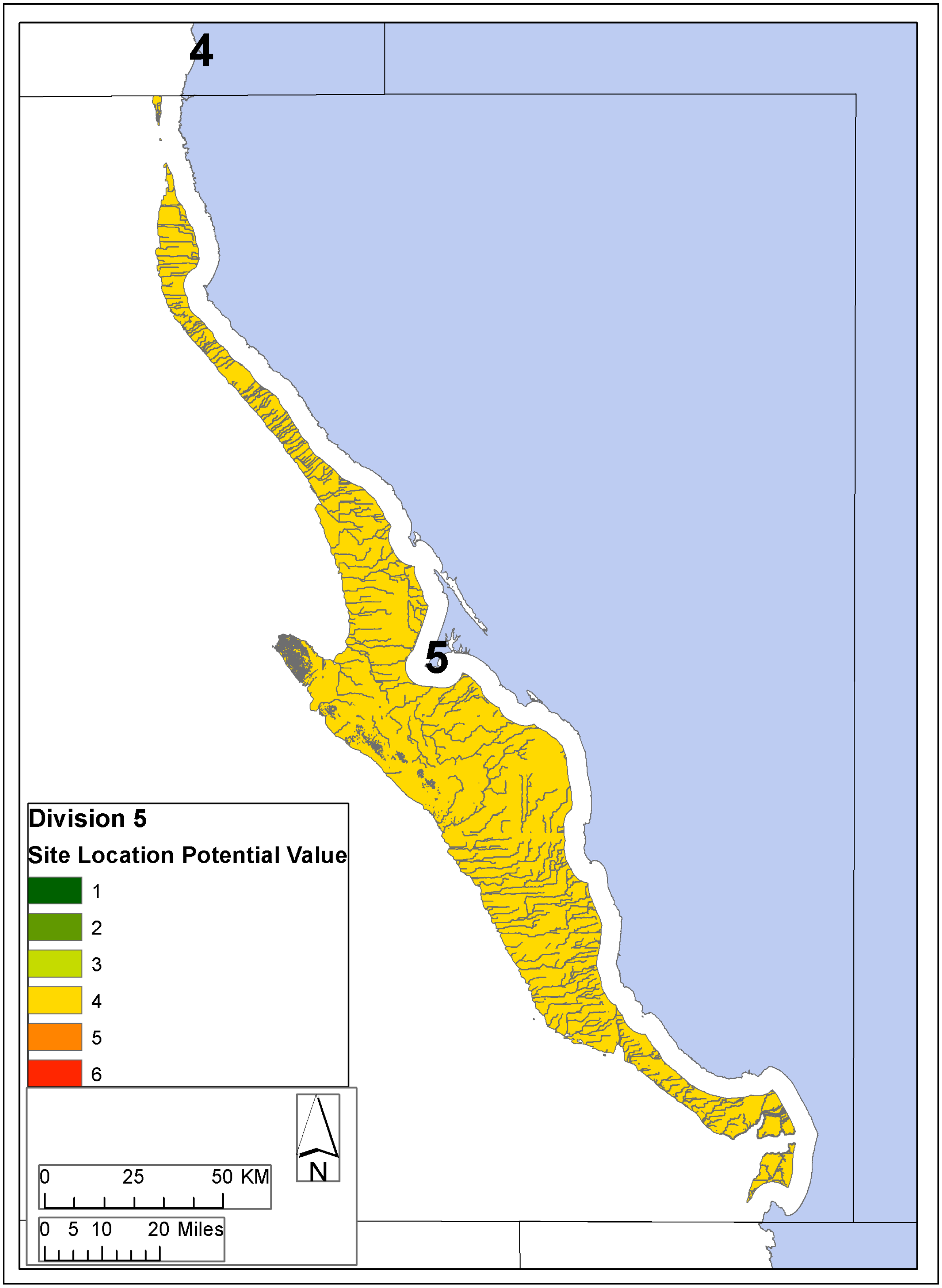


Figure 25. Overview of the total site location potential value distribution across the POCS paleolandscape within Subdivision 5.

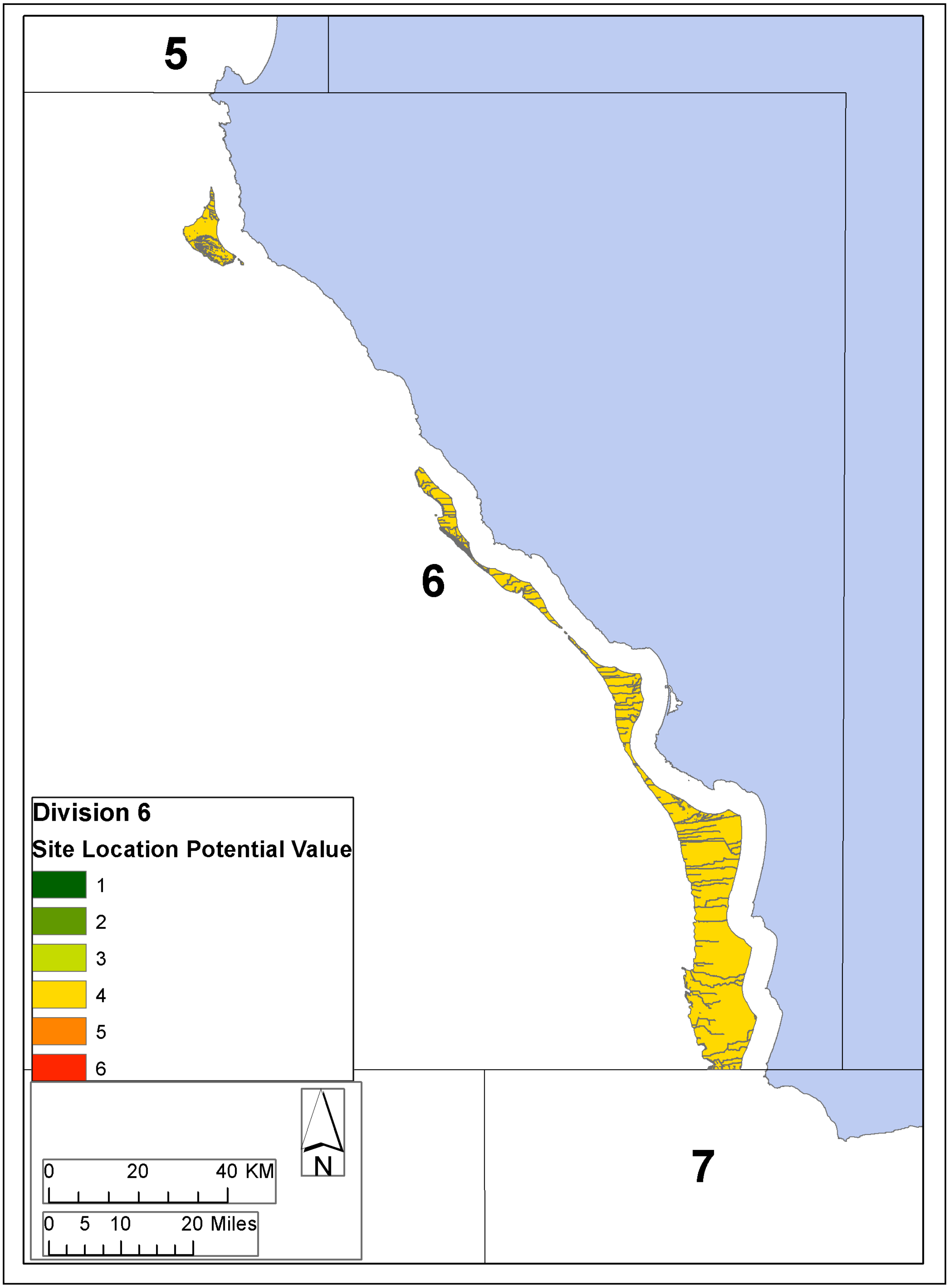


Figure 26. Overview of the total site location potential value distribution across the POCS paleolandscape within Subdivision 6.

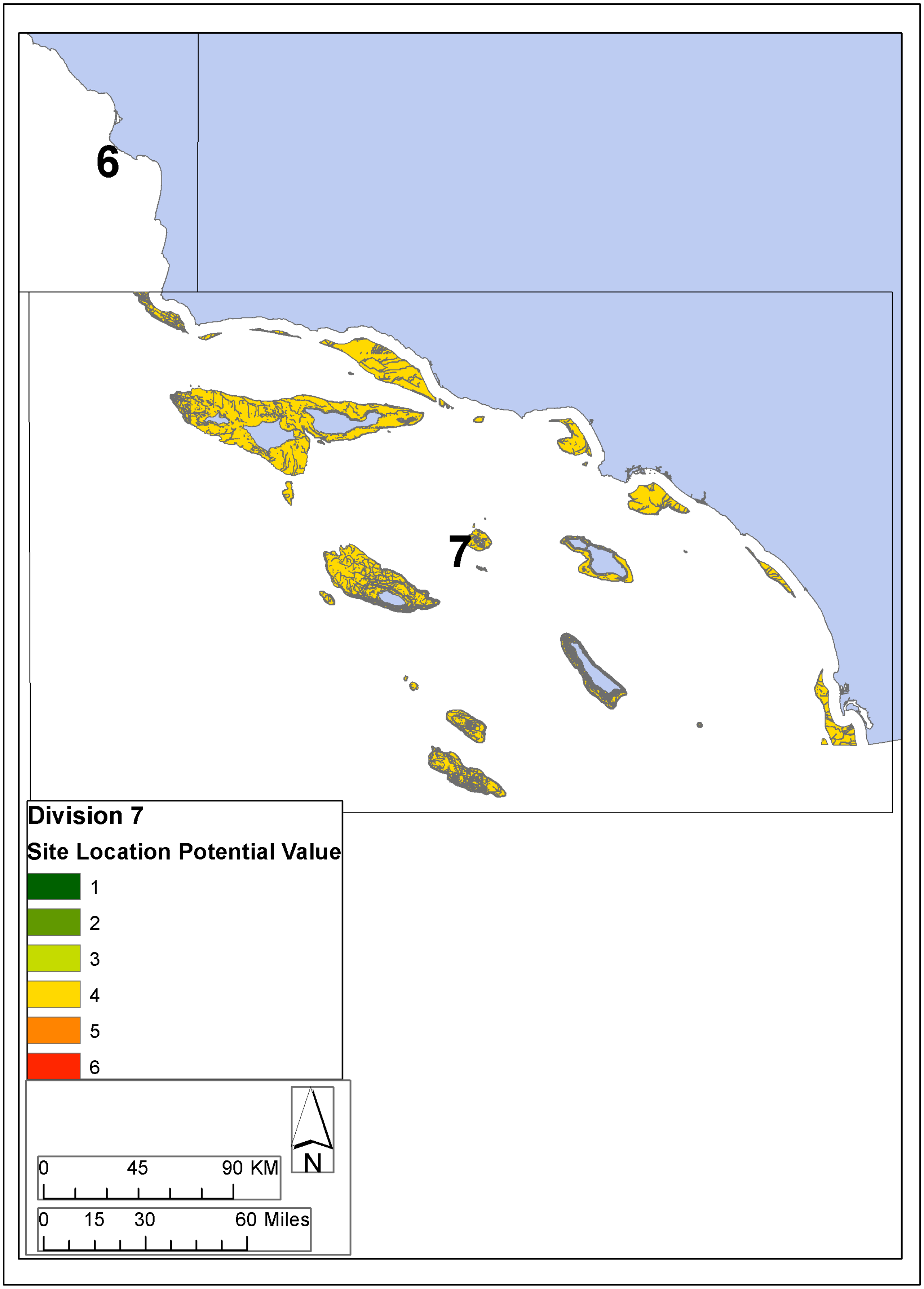


Figure 27. Overview of the total site location potential value distribution across the POCS paleolandscape within Subdivision 7.

## 3.5. Recommendations Regarding Offshore Modeling on the POCS

### 3.5.1. Improving and Testing the GIS Model

Parts of the POCS are not currently covered by 1/3 arc-second bathymetric DEM data and are needed to standardize a future version of the POCS GIS model. Higher resolution 1/3 arc-second data are currently unavailable in the northern half of Subdivision 1, in the northwestern corner of Subdivision 2, on the western half of Subdivision 3, along small western sections of Subdivisions 6 and 7, and in the area of the southern Channel Islands.

Although a great improvement over 1 arc-second and coarser resolution bathymetric DEMs, 1/3 arc-second DEM data are still too coarse to clearly reveal POCS paleolandforms such as alluvial terraces and coastal headlands—geomorphic units that are expected to hold prehistoric archaeological sites. Focus studies should be conducted at multiple localities on the POCS to collect higher-resolution remotely sensed data from areas that are modeled to hold geomorphic contexts with known signatures, such as the intersections of stream channels and past shorelines. Following current high-resolution geophysical survey methodologies and procedures for the assessment of archaeological resources prescribed by BOEM (2012) and previously by Minerals Management Service (2006) should provide high-resolution surface images and deep penetration subsurface images to reveal the stratigraphic architecture associated with buried geomorphic features. We recommend that geophysical surveys employ tighter lane spacing that would allow for evaluation of 10 meter by 10 meter grid squares, producing remote sensing data consistent with the GIS models presented in this report. Such an approach could show the geometric form and internal layering of alluvial deposits (e.g., silt and clay-rich sediments) infilling an ancient channel feature, now buried beneath a covering deposit of marine sand emplaced during sea level rise. These focus studies will provide the means to evaluate whether terrestrial geomorphic patterns predicted by our GIS model have corresponding high-resolution bathymetric expressions and internal stratigraphic architecture. Once confirmatory evidence for terrestrial geomorphic patterns is available, stratigraphic cores gathered as part of any geotechnical sub-bottom sampling activities may reveal key evidence for the evaluation and improvement of our current GIS model. Study of these cores will allow for the characterization of sediments associated with remotely sensed stratigraphic sequences, the identification of terrestrial landform deposits, the collection of samples for chronometric dating, and even the careful search for associated archaeological materials. Focus studies should also be collected in areas that our GIS model predicts to not hold alluvial channels. These studies can address questions about the nature of site formation during marine transgression. High-resolution DEMs and 3D stratigraphic models assembled from remotely sensed data will help to identify areas on submerged landforms with the highest probability of containing archaeological materials.

Focus studies will enable groundtruthing of our GIS model, allowing us to answer several questions, including: are there subtle bathymetric expressions on the POCS sea floor that correspond to modeled landform features, such as river channels, embayments, and shorelines? Do buried terrestrial deposits exist as a stratigraphic unit between post-inundation marine sediments and basal bedrock layers? If so, how extensive are these buried terrestrial deposits?

The collection and study of intact stratigraphic sequences from suspected and known terrestrial deposits from buried contexts on the modern POCS represents a critical step toward the evaluation and improvement of the GIS model's accuracy, and would provide access to stratigraphic repositories of paleoenvironmental proxy data and the most direct and careful means of evaluating whether submerged prehistoric sites are preserved on the POCS. The collection of cores with intact stratigraphic sequences from high-probability site locations is the best way to preserve the associative context between buried stratigraphic units and any archaeological evidence they might contain. Moreover, this methodological approach allows for the direct evaluation of suspected inundated terrestrial deposits in areas of deep water and beneath thick marine sedimentary cover. Alternatively, data needed to evaluate our GIS model can be obtained in a non-directed manner from the information developers submit as part of their BOEM-mandated assessment plans.

### 3.5.2. Detecting and Avoiding Impacts on Potential Submerged Prehistoric Sites

Our site location potential model offers qualified predictions about the likelihood of where submerged prehistoric sites might be found on the POCS. Our predictions of site location must be taken as they are intended: as relative assessments of whether archaeological sites might have been created at specific places and whether such sites might have survived inundation. We do not know if prehistoric sites are actually located in greater frequencies (if at all) in higher ranking predictive value grid squares; however, we interpret the model to mean that those areas with the highest ranking grid squares were more likely than other lower ranking grid squares to have attracted prehistoric foragers to conduct activities that could leave archaeological traces that would survive until today. These predictive statements are qualified assessments about the economic value and site formation potential of the POCS landscape.

The most accurate and reliable method of determining whether submerged archaeological sites remain on or in the POCS is to conduct high-resolution remote sensing and subsurface coring studies. The results of these studies will not only provide direct information about whether submerged archaeological sites are or are not located in specific parts of the POCS, direct observations can be used to evaluate and improve the predictive abilities of our GIS model.

Although we believe that the predictions of potential site location made by our GIS can be used to make initial decisions about where ground disturbance activities associated with development projects could be conducted on the POCS, the model's predictions are not final assessments of whether submerged archaeological sites exist on or in the POCS. A final archaeological assessment of whether any particular location on the POCS is suitable for conducting developer-based ground disturbance activities can only be made from remotely sensed data and stratigraphic core samples. In the case that pre-development remote sensing and coring studies reveal the presence of buried deposits containing cultural materials, the lateral and vertical extent of the archaeologically relevant stratigraphic units should be established in order to determine its geometric form. Once the geometry of submerged prehistoric site–bearing deposits is known, the associated area can be excluded from development-related impacts. The information produced from this intensive assessment of submerged site–bearing deposit stratigraphy and geometry can be used to evaluate remote sensing and coring data collected from any future POCS development projects.

# 4. INVENTORY OF COASTAL PROPERTIES

## 4.1. COASTAL PREHISTORIC AND ETHNOGRAPHIC BACKGROUND

### 4.1.1. Coastal Prehistoric Background of the Pacific Northwest

The region covered in this review of Pacific Northwest prehistory and ethnography consists of the Pacific coastal areas of the states of Washington and Oregon. Researchers (e.g., Lyman 1991) have discussed this geographic area as having a number of general similarities such as climate, topography, and natural resource availability. As a result, the archaeology and ethnography across the region demonstrate many commonalities.

The archaeological record along the outer coast of the Pacific Northwest is heavily influenced by a myriad of geologic and environmental processes (e.g., chemical and physical weathering) that have destroyed, moved, and buried sites in the region. Our understanding of human land use along the outer coast of the Pacific Northwest is limited by regional geologic and environmental processes. Since the retreat of the last glacial advance, the Pacific Northwest has seen large swings in sea level elevation, infilling of valleys and meltwater channels from fluvial accretion, and tectonic activity and regional shifts in vegetation. These processes have contributed to the potential removal, selective preservation, and burial of portions of the archaeological record from the Late Pleistocene and Holocene. The relative environmental stabilization and a decrease in the cumulative effects of environmental processes over the last 2,000 years have resulted in a more extensive and better understood archaeological record for this period. Therefore, our overall understanding of the archaeological record and landform use for the region slowly increases with temporal proximity to the present.

#### *4.1.1.1. Terminal Pleistocene/Early Holocene (14,000 to 8,000 BP)*

No archaeological evidence to support the occupation of the outer coast of the Pacific Northwest exists for the Terminal Pleistocene/Early Holocene. However, the absence of information for this period does not necessarily indicate that the area lacked human occupation. Instead, it is likely that many sites from the Terminal Pleistocene/Early Holocene have been either submerged and/or destroyed by rising sea levels. There is more tangible evidence for human occupation during this period throughout non-coastal regions of the Pacific Northwest; therefore, some important interior sites are discussed in this section in order to provide a regional context for this period.

Cultural chronologies of this period for the Pacific Northwest vary in name and description (see Ames and Maschner 1999; Ross 1990; Lyman 1991), but all seem to represent a similar adaptation to the environmental conditions of the period. The archaeological record of the Terminal Pleistocene/Early Holocene is perhaps best represented by the characteristically large, fluted projectile points commonly identified as representing the Clovis culture. Though researchers disagree on the precise dates for the Clovis culture, generally it has been placed at between 13,000 and 11,500 BP for western North America. The geographic distribution of Terminal Pleistocene/Early Holocene sites in the Pacific Northwest is wide but sparse and consists of isolated Clovis-style points found from the Puget Sound region to southern Oregon (Ames and Maschner 1999; Aikens 1983; Ross 1990; Wessen 1990). One of the few available coastal vestiges from this period is a fluted point found at Siltcoos Lake in Oregon (Aikens 1983;

Minor 1985; Carlson 1990), which appears to be associated with the Clovis tradition. Notable among the few other non-coastal sites in Washington and Oregon from this period are the Richey-Roberts Clovis cache site in central Washington and the Dietz site in south-central Oregon (Ames and Maschner 1999; Allely 1975; Lalande and Fagan 1982). The Richey-Roberts site was a cache of some of the largest, most well-made Clovis bifaces identified to date, while the Dietz site contained Clovis material situated along the beach of an ancient lake (Ames and Maschner 1999). Researchers believe that the Clovis site distribution pattern in the Northwest demonstrates that the Clovis peoples had a high degree of long-distance mobility and/or the region had insufficient resources to support substantial Clovis occupation (Ames and Maschner 1999).

There are several Northwest sites potentially dating to this period that contain artifacts not clearly associated with the Clovis culture. Three archaeological sites in the Puget Sound region have materials dating to the Terminal Pleistocene/Early Holocene. Archaeological investigations at Bear Creek in Redmond, Washington (45KI839) revealed a site containing an extensive artifact assemblage found in deposits dated to between 8,420 and 9,840 BP (Kopperl et al. 2010). The Manis Mastadon site (45CA218), located on the Olympic Peninsula near Sequim, contains the 12,800-year-old remains of a Mastodon (*Mammut americanum*) with a possible bone point lodged in one of its ribs (Gustafson et al. 1979; Carlson 1990; Ames and Maschner 1999). Similarly, remains of a now-extinct bison species (*Bison antiquus*), dated to between 13,740 and 13,460 BP, with possible evidence of human butchering (fractures, cut marks, abrasion, polish) were found at an Orcas Island site (45SJ454) (Kenady et al. 2007, 2010; Wilson et al. 2009). Also potentially dating to the period are cultural materials named the "Youngs River" complex by Minor, found near the Columbia River mouth in northern Oregon (Minor 1984). The Youngs River assemblage includes both large stemmed and large leaf-shaped projectile points, and Minor posited that the complex may be associated with two separate early cultural traditions. Based on artifact similarity with other Late Pleistocene/Early Holocene traditions, Minor suggests an age between 10,000 and 6,000 BP (Lyman 1991; Minor 1983, 1984).

Due to the lack of archaeological record of the period, settlement patterns of coastal peoples of the period are little understood. However, many researchers hypothesize that these groups were highly mobile terrestrial mammal hunters (Bonnichsen and Turnmire 1991; Waguespack and Surovell 2003), subsisting primarily on big game, such as bison and mastodon (Meltzer 2003; Kenady et al. 2010; Waters et al. 2011). Evidence for intensive use of marine resources is not apparent in any assemblages from the period.

#### 4.1.1.2. Middle Holocene (8,000 to 3,000 BP)

When compared to the California coast and the Pacific coast north of Washington State, very little Middle Holocene archaeological data are present for the Northwest coast (Lyman 1991; Ross 1990; Wessen 1990). For example, in Oregon, only three excavated archaeological sites have yielded radiocarbon dates older than 5,000 BP (only two of which date to 8,000 BP or earlier), and no excavated sites on the Washington coast have been dated to the Middle Holocene (Lyman 1991; Ames and Maschner 1999). These sites are often small, thereby precluding much inference regarding human activity and behavior (Lyman 1991). One major development of the period is an increase in the use of maritime resources (Lyman 1991; Ames and Maschner 1999). Again, rising sea levels since the Pleistocene likely submerged or destroyed much of the coastal archaeological record from this period, and the majority of the region's sites from the period are located in the interior (Ames and Maschner 1999).

Across interior western Washington, including much of the Olympic Peninsula, sites from the Middle Holocene typically contain assemblages of heavily weathered basalt flakes, cores, lanceolate (Cascade-style) projectile points, and cobble tools. Though a very broad and somewhat vague term, "Olcott Complex" has been used to describe a discrete artifact assemblage from sites that are similar to Late Pleistocene/Early Holocene sites throughout northwest North America (Kidd 1964). Nelson (1976) used the term "Olcott Complex" to describe a component of a cultural sequence he developed for Puget Sound, defining "Olcott" by both age and assemblage composition. Subsequent use of the term has been inconsistent and created some confusion amongst researchers (Dancey 1969; Morgan 1999; Stilson and Chatters 1981). Based on well-dated stylistic comparisons from the Glenrose Cannery site, Nelson (1990) suggests that Olcott Complex sites are comparable in age, and date to between 10,000 and 6,000 BP. However, several investigators have noted that the leaf-shaped projectile points associated with Olcott have been found in a variety of contexts, ranging in age from 9,950 to 2,260 BP (Blukis Onat et al. 2001; Greengo and Houston 1970). Because of their setting, Olcott Complex sites are thought to indicate an intensive orientation toward upland resource exploitation and settlement. Direct evidence of subsistence is rare, though Stilson and Chatters (1981) report that a salmonid vertebra was recovered from a site attributed to the Olcott Complex. Lyman's (1991) "pre-Littoral Period" falls within the Middle Holocene and is characterized by a general orientation toward terrestrial resource use, somewhat similar to the Olcott Complex in Washington.

An important site from the period is 35DO130. The diverse artifact assemblage from the site is one example of the relatively small size of Middle Holocene sites on the northwest coast. The assemblage contains both groundstone and flaked stone, with seven tools representing five functional classes. The site has been interpreted as a seasonal hunting camp, though likely does not provide an accurate view of human landscape use in the region. Based on these and other limited data from the period, it appears that, in general, individuals practiced a generalized subsistence pattern that included exploitation of upland and riverine environments (Lyman and Ross 1988b). As mentioned above, the use of shellfish and other intertidal resources appears during the period, though with much less frequency (Lyman 1991).

#### *4.1.1.3. Late Holocene (3,000 BP to Contact)*

In the coastal Northwest, the number of Late Holocene sites is much higher than in preceding periods, and the period was a time of dramatic developments in technology, settlement patterns, and social patterns. Archaeological data from the period evidence permanent settlement, increased focus on littoral resources, and an emphasis on resource storage.

During the terminus of Lyman's (1991) early littoral stage (3,000–2,000 BP) terrestrial mammals were the most prominently exploited large game; however, several coastal sites show substantial use of littoral resources. Several sites dating to this early littoral stage (e.g. 45CA201 and 45CA213) contain large shell middens evidencing this maritime focus (Snethkamp et al. 1990). Though houses dating between 3,000 and 2,000 BP are rare, by around 2,000 BP it appears that structures were much more common. The widespread appearance of housing structures reflects an increased degree of sedentism throughout the coast (Ames and Maschner 1999). Although sites lack community structure and ceremonial features, data indicates exploitation of storable foods (e.g., salmon). Early littoral assemblages are generally less diverse than sites from later in the period and include chipped stone, groundstone, clay tools, and antler/bone tools. Little art, personal adornment, or evidence of trade is known from the early portion of the period (Ames and Maschner 1999; Lyman 1991).

Archaeological sites and their assemblages dating to between 2,000 and 1,000 BP are more common, larger, and richer than those from earlier periods (Ames and Maschner 1999; Friedman 1976; Lyman 1991; Roll 1974). Though a diverse array of subsistence resource types continued to be used, by 2,000 BP there is a clear focus on marine mammal and fish exploitation. Subsistence technology found in coastal Northwest sites is complex and indicates a high degree of technological specialization (Ames and Maschner 1999; Lyman 1991; Wallace 1978). The presence of fish weirs along the coast, remains of juvenile marine mammals, and evidence of intertidal mass harvesting and whaling (e.g., harpoons) during this time signals a greater reliance on logistical organization and may indicate the presence of some type of corporate groups (Byram 2002; Elder et al. in prep.; Elsasser 1978c; Friedman 1976; Lyman 1991; Samuels 1994). Despite the fact that these forms of resource exploitation undoubtedly required storage facilities, only limited material (e.g., basketry) from Late Holocene sites confirms this. In Oregon, semi-permanent or permanent villages appear but lack the community patterning seen elsewhere on the Northwest coast during this time (Ames and Maschner 1999). Evidence of status differentiation, commonly thought of as a hallmark of Northwest coast cultures, is still rare at sites dating to 3,000 to 2,000 BP.

The vast majority of excavated archeological sites on the outer coast of the Pacific Northwest date to approximately 1,000 BP and later (Friedman 1976; Lyman 1991; Roll 1974; Ross 1990; Wessen 1990). Subsistence practices from the end of the Late Holocene continue to reflect a reliance on the littoral and marine environments. Faunal assemblages include a diverse array of fish and shellfish, marine mammals, terrestrial mammals, and birds (e.g., Lyman 1991; Roll 1974; Samuels 1994). The subsistence pattern includes a mix of littoral, marine, and riverine resources. Artifacts demonstrating this focus include harpoons, weirs, and nets (Byram 2002; Whelchel 2005). Diverse and rich tool assemblages recovered from sites such as Ozette (45CA24), Minard (45GH15), and Umpqua/Eden (35DO83) contain objects made from chipped and ground stone as well as perishable materials such as bone, antler, and wood. The diversity in material used for tools indicates a well-developed and flexible tool kit (Lyman 1991). Art and ceremonial items are much more common in assemblages dating to the end of the Late Holocene. Status and community organization are further reflected in faunal assemblages, as well as interior and exterior spatial patterning in villages and within houses at well-studied sites (e.g., Ozette). Along the Washington coast, the Minard and Ozette sites yielded numerous examples of art, including pendants, combs, and other objects in anthropomorphic and zoomorphic forms made from bone, wood, and stone (Roll 1974; Whelchel 2005). Commonly, personal items such as pendants indicate status and access to economic surplus as well as the presence of some kind of craft specialization, although perhaps not fulltime specialization. It is during the late portion of the Late Holocene that archaeological evidence most closely approximates ethnographically observed lifeways.

### 4.1.2. Ethnography of the Coastal Pacific Northwest

The first contact between Pacific Northwest Native American groups and European explorers occurred in 1577 when Sir Francis Drake landed on the Pacific coast (Suttles 1990). Elsewhere on the Pacific Northwest coast contact did not occur until the late eighteenth century. Captain James Cook sighted the Oregon coast during a trip to the region in 1777, and contact in the region increased steadily after the great wealth of the region's resources was discovered. The fur trade fueled exploration of the region, which in turn provided much of the earliest information about Native American lifeways in the region (Cole and Darling 1990). Early explorers such as Cook and Meares were not ethnographers, per se, but provided accounts of customs and habits of daily life of Native Americans along the outer coast (Ames and Maschner 1999; Renker and Gunther 1990; Swan 1857; Thwaites 1904; Boyd 2011). As with most other aboriginal populations along the coast, Pacific Northwest groups sustained heavy loss of life from diseases (especially smallpox) introduced by Europeans (Boyd 1990).

Native American groups along the coasts of Washington and Oregon fall into three broad language stocks, or linguistic phyla, which consist of a number of related language families. These phyla and related families include: Penutian (Chinookan, Coos, and Yakonan Families), Na-Dene (Athapaskan Family), and Algonquian-Wakashan (Salishan, Chimakuam, and Wakashan Families) (Thompson and Kinkade 1990). The Makah, Wakashan speakers, are said to have more in common culturally with other Wakashan groups (e.g., Nootka, Nitinaht) along the Canadian coast (Voeglin and Voeglin 1964).

Commonly, the Pacific Northwest is thought of as a land of bounty, where Native American hunter-gatherers had little trouble gaining access to food, particularly salmon (Ames and Maschner 1999; Suttles 1960). While this may have been the case during short periods, major environmental variability greatly affected resource abundance. Environmental variability has been cited as a major driver of cultural complexity on the Northwest coast, seemingly requiring the creation of social and physical systems as mechanisms for mediating fluctuations in resource availability (Schalk 1977; Suttles 1960; Ames 1991, 1994; Matson and Coupland 1994). Increases in population size during the late precontact period and into the ethnographic period have also been cited as a driver of this complexity (Ames and Maschner 1999). While cultural complexity and community organization are not identical along the entire Pacific Northwest coast, ethnographically a number of commonalities exist among the myriad groups who occupied the region; these include rank and status, structures, mobility, subsistence, and material culture (Suttles 1990).

Rank and status and the resultant social complexity are cornerstones of Pacific Northwest cultures (Ames 1994; Suttles 1990), and variability in the level of stratification of groups existed throughout the region (Suttles 1987). Drucker (1939) suggests that there was a general gradient in social complexity that became more pronounced farther north along the Pacific Northwest coast. Rank and status were inextricably linked with material wealth and ownership of resources and resource collection locations. In general, status along the Pacific Northwest coast was inherited. In the northern region of the Northwest coast, the Potlatch was a ceremonial feast that served as a way to display one's wealth, a means of resource redistribution, and a manner in which social bonds were initiated and solidified (Suttles 1960).

Peoples in the region were organized into villages generally consisting of groups of large wood plank houses (Ames and Maschner 1999; Elsasser 1978a, 1978c; Gould 1978; Renker and Gunther 1990). Villages acted as central gathering places, especially during the cold winter months when ceremonies required a great deal of peoples' time (Amoss 1978) and food was less readily available across the landscape. Along the Washington and northern Oregon coasts these houses functioned as the basic unit of economic production. Members joined or left depending on a variety of factors, including resource availability, internal tension, marriage, and political influence (Ames 2008; Sobel et al. 2006). Among the Makah, Chinookans, and other northern Pacific Northwest coast groups, these houses were completely above-ground and could be expanded and collapsed based on which members of an extended family were in the village at a given time (Ames and Maschner 1999; Renker and Gunther 1990; Swan 1857). The plankhouses of these groups were commonly organized according to status. For example, among the Chinookans, the “back of the house” (farthest from the door) was considered the high-status area, while slaves, the lowest status individuals in Chinookan society, lived near the door (Ames 2008). Semi-subterranean houses were used by groups along the Oregon coast such as the Tillamook and the Alseans (Seaburg and Miller 1990).

Settlements were seasonal and commonly situated near water, while resource extraction camps were typically small and consisted of easily portable, pole frame structures (e.g., Swan 1857; Miller 2010; Drucker 1939). River drainages provided suitable refuge from the open coast for many groups’ villages. The Siuslaw, for example, spent much of their time away from the coast in the Siuslaw drainage where salmon and lamprey could easily be taken during spawning (Zenk 1990). In contrast, the Makah positioned their villages on beaches that were more exposed to the weather of the open ocean (Swan 1857). Makah families would disperse during the spring and summers to fish and gather elsewhere on the coast when the weather abated (Renker and Gunther 1990).

Subsistence regimes varied along the Pacific Northwest coast region. Inhabitants depended in various degrees on riverine, terrestrial, and marine resources. The Makah seem to have been most dependent upon marine resources and regularly took marine mammals, including whales, as well as marine fish. However, terrestrial game and plants were important supplements to their diet (Swan 1857; Renker and Gunther 1990). Groups like the Chehalis relied more heavily on estuarine and freshwater fish, often caught in weirs, and exploited plants like camas. Intertidal shellfish complemented the diet as well (Miller 2010). Weirs were likely maintained by communal groups, most likely representing extended families. Fishing in estuaries, where fish such as smelt could be taken, was an important practice for inhabitants of the southern Oregon coast (Byram 2002; Kroeber and Barrett 1960). These southern Oregon people also relied on salmon, lamprey, terrestrial game such as deer and elk, marine mammals, and terrestrial plants (Miller and Seaburg 1990; Zenk 1990).

Material culture was an important component of an individual group’s self-identification (Stewart 1979; Holm 2003). Although totem poles are commonly associated with the Pacific Northwest, they are not present along the Washington or Oregon coasts (Stewart 1990). Ethnographically documented tools used by peoples along the coast were made of materials available prior to contact, such as bone, stone, wood, and antler. Copper was a coveted material and was used in Potlatch ceremonies as a display of wealth. After the introduction of Euro-American goods, beads, buttons, and thimbles became highly prized items that were commonly traded for food and animal skins.

### 4.1.3. Coastal Prehistoric Background of California

The region covered in this review of California prehistory and ethnography extends roughly from northern California south to the US–Mexico border. The discussion of ethnographic patterns below demonstrates variation between northern and southern California.

The archaeological record of the California coast is better understood and more thoroughly studied than that of the Pacific Northwest coast (Chartkoff and Chartkoff 1984; Erlandson 1997; Glassow et al. 2007; Moratto 1984). Human occupation of the California coast spans at least the last 14,000 years, and some have claimed a much greater antiquity for this habitation (e.g., Carter 1957; Moriarty and Minshall 1972); however, these claims are met with skepticism by many. The earliest evidence for habitation of the California coast may have been obscured by environmental factors similar to those of the Pacific Northwest (Rosenthal and Meyer 2004).

#### *4.1.3.1. Terminal Pleistocene/Early Holocene (14,000 to 8,000 BP)*

The earliest identified California coastal sites are located on the Northern Channel Islands of southern California, and date to between 13,000 and 12,000 BP (Erlandson et al. 2007a, 2007b; Arnold et al. 2004; Erlandson 1997). The oldest of these, the Arlington Springs site (CA-SRI-173), is located on Santa Rosa Island and contains human remains dated to circa (ca.) 13,000 BP; these are the earliest human remains encountered on the Pacific coast, contemporary with Clovis (Erlandson et al. 2007b; Arnold et al. 2004). Evidence for a substantial increase in coastal occupation soon thereafter is seen by the large number of sites dating to the period immediately following these earliest sites. In fact, the large number of marine/littoral sites dating to 12,000 to 10,000 BP, most in southern California, offers some of the best evidence for early persistent use of marine resources in the Americas (Rick et al. 2001; Arnold et al. 2004). Overall, the majority of the early sites are located on the Channel Islands and are ascribed to the Paleocoastal Tradition (Moratto 1984; Erlandson et al. 2007b). The Tradition is characterized by assemblages similar to the Paleoindian Tradition (abundant flaked stone tool types and a distinctive lithic technology), yet also contains marine-focused components such as pitted stones, asphaltum, shell spoons and ornaments, and pointed-bone objects (Moratto 1984).

Though researchers have conflicting hypotheses on the origins of Paleocoastal peoples (e.g., independent settling of coast, descending from inland Paleoindian peoples) (Moratto 1984; Davis et al. 1969), data from the earliest Channel Island sites (Arlington Springs, Daisy Cave [CA-SMI-261]), with initial components dating to between 13,000 and 11,000 BP, suggest that Paleocoastal peoples did not descend from inland Paleoindian peoples but arrived on the coast independently (Rick et al. 2001; Erlandson et al. 1996, 2007b). In addition to the antiquity of Paleocoastal sites, the disproportionality of site destruction between these sites and inland Paleoindian sites due to Late Pleistocene eustatic sea level rise has certainly biased the scope of the archaeological record in favor of the latter (Moratto 1984; Erlandson et al. 2007b). More details on the Paleocoastal Tradition are presented in section 3.2.2.2 of this document.

In addition to the many early Channel Island sites, large numbers of sites dating to 10,000 to 8,000 BP are present along the entire California mainland coast, though the majority are located in southern California (Erlandson et al. 2007b; Arnold et al. 2004; Erlandson 1997). The majority of early mainland sites are attributed to the Millingstone Culture. This Culture lasted from 10,000 to 5,000 BP and consisted of mainland coastal sites with large numbers of handstones, milling slabs, crude core and cobble-core tools, crescents, and small numbers of flake tools, side-notched projectile points, and rare contracting-stemmed projectile points—a small number of Channel Island sites contain low quantities of groundstone artifacts as well (Jones et al. 2007; Erlandson et al. 2007b; Erlandson 1997). Some important examples of Millingstone sites include the Diablo Canyon site (CA-SLO-2), CA-ORA-64, and the Cross Creek site (CA-SLO-1797). Overall, there is a dramatic increase in the number of sites along the coast between 9,000 and 8,000 BP (Erlandson et al. 2007b); however, very few sites of this period have been identified in northern California. Again, it must be noted that a large number of earlier sites were probably submerged due to rising sea levels during this period.

As the climate ameliorated from the Terminal Pleistocene through the Early Holocene, new communities of flora and fauna became available, and the inhabitants of the coast appear to have taken advantage of these new resources (Byrd and Raab 2007; Glassow et al. 2007; Erlandson 1997). As early as 12,000 BP, clear evidence exists of intensive nearshore fishing and marine mammal hunting (Channel Islands), and shellfish gathering (mainland estuaries and bays) (Erlandson et al. 2007b; Arnold et al. 2004). Several southern Channel Island sites demonstrate a focus on marine mammal hunting (dolphins and pinnipeds) (Porcasi and Fujita 2000; Porcasi 2007), with some researchers hypothesizing that this strategy may have been more important than fishing at earlier sites, at least on the Channel Islands (Arnold et al. 2004). When compared to the diet of peoples who inhabited the mainland during the period, offshore site diets focused much more on shellfish (90 versus 73 percent). These early food procurement strategies represent the base of the marine/littoral-focused cultural activities that continued through the ethnographic period (Arnold et al. 2004). However, subsistence strategies diversify with time throughout the period, and plant gathering and small mammal and bird hunting become an increasing focus of the subsistence strategy (Erlandson et al. 2007b). The appearance of groundstone (e.g., manos, metates) at mainland coastal sites (Millingstone Culture) as early as 10,000 BP most likely reflects some form of seed, nut, or root exploitation; the earliest examples of this cultural manifestation are the Diablo Canyon and Cross Creek sites. Overall, available data suggest use of a varying mix of nearshore, intertidal, and terrestrial food resources during this period (Arnold et al. 2004). An abundance of informal chipped stone tools paired with a relative dearth of bifaces and projectile points supports ideas of semi-sedentism and an increasingly diverse subsistence regime during this period (Byrd and Raab 2007; Rondeau et al. 2007; Chartkoff and Chartkoff 1984; Erlandson 1997; Glassow et al. 2007; Jones et al. 2007; Moratto 1984). Material recovered from settlements from this period also indicates that groups likely revisited camp locations on a regular basis (Erlandson 1997; Glassow et al. 2007). Repeat occupations between 10,000 and 8,600 BP at the Daisy Cave site on San Miguel Island evidence an early sea-worthy boat technology (Rick et al. 2001). The Eel Point site (CA-SCLI-43), on San Clemente Island, lithic assemblage (dated to ca. 10,000 BP) contains tools for sophisticated woodworking activities that are possibly associated with boatbuilding (Byrd and Raab 2007; Erlandson et al. 2007b). The oldest fishhooks found to date in North America were also recovered from the Daisy Cave site, also reflecting developed maritime technology (Rick et al. 2001; Erlandson et al. 2007b).

An intensive shell bead industry was present during this period (Rick et al. 2005; Erlandson et al. 2005; Glassow et al. 2007). It appears that the Channel Islands were the center of the industry and that their residents traded shell beads, *Olivella* (*Olivella biplicata*) in particular, to mainland residents. The presence of *Olivella* beads on the Channel Islands and at mainland coastal sites may reflect the beginnings of a regional exchange system that flourished during later portions of the Holocene (Byrd and Raab 2007; Glassow et al. 2007; Moratto 1984). Some of the most important finds from this period are the sea-grass basketry and cordage found at the Daisy Cave site (Rick et al. 2001; Connolly et al. 1995; Byrd and Raab 2007); this is the earliest evidence of a basketry/fiber industry in California.

### 4.1.3.2. *Middle Holocene (8,000 to 3,000 BP)*

The Middle Holocene along the California coast is a period of significant technological innovation and overall, but punctuated, population increase (Erlandson 1997; Moratto 1984). The cultural developments of southern California during the period basically are a continuation of Early Holocene patterns (Glassow 1999); the majority of coastal sites from this period are located in southern and central California (Erlandson 1997; Moratto 1984). Increasing sedentism from the Early Holocene is reflected by the appearance of formal cemeteries and small clusters of subterranean house construction on San Clemente Island; two important such sites are the Nursery (CA-SCLI-1215) and Eel Point (CA-SCLI-43) sites (Byrd and Raab 2007; Arnold et al. 2004; Glassow et al. 2007). Mainland coast sites of the Middle Holocene are associated with the Millingstone Culture and increase in number and diversity throughout the period. Notable Millingstone sites from the period include: the Sand Bluff site (CA-SCR-7), the Diablo Canyon site, CA-SBA-552, CA-SDI-9649, and CA-SDI-149. In contrast to the archaeological record of this period for the central and southern coasts, the northern California coast contains no evidence of long-term occupation or focused marine resource use (Hildebrandt 2007; Erlandson 1997). Hildebrandt (2007) speculates that the later occupation of the mainland coast of northern California, when compared to the rest of the California coast, resulted from greater inland productivity due to less arid conditions.

Overall, this period witnessed increasing diversification in subsistence technologies and strategies (Erlandson 1997). Though shellfish continue as the dietary staple in most areas of the coast, terrestrial mammals, birds, and estuarine and pelagic fish become more important to the diet (Erlandson 1997; Glassow et al. 2007). On the Channel Islands, we see a growth in the focus on maritime resources (Glassow et al. 2007); this may have been an adaptation to a speculated increase in marine productivity arising from overall cool-water conditions (Glassow et al. 1994; Arnold et al. 2004). Subsistence strategies of the period became increasingly focused on fish and large sea mammals (particularly pinnipeds) (Jones et al. 2007), seen in the first widespread appearance of the circular shell fishhook, stone sinkers/net weights, harpoon tips (Glassow et al. 2007; Erlandson 1997; Jones et al. 2007; Arnold et al. 2004), and wood-stake fishing weirs dating to as early as 4,500 BP on the mainland coast of northern California (Erlandson 1997). Along the mainland coast, plant foods take on growing importance throughout the period, particularly pulpy plants (Glassow 1999; Moratto 1984; Arnold et al. 2004; Glassow et al. 2007). This increased focus on plant resources is reflected by the widespread appearance of the mortar and pestle (on the mainland coast) (Erlandson 1997; Glassow 1999; Glassow et al. 2007; Moratto 1984). Researchers have long thought that these new groundstone implements evidence the first systematic use of acorns along the coast, especially the central mainland coast; however, Glassow (1997) believes that they may have been used primarily for processing roots.

Flaked stone technology of the period is marked by an overall increase in the number of projectile points, and the introduction of contracting stem and smaller side-notched types (Erlandson 1997; Glassow et al. 2007; Jones et al. 2007). These developments in projectile point technology and frequency coincide with the above-discussed increase in marine mammal (e.g., whales, pinnipeds, and dolphins) exploitation. According to Hayden and Cannon (1982), such hunting requires in-depth knowledge of animal behavior and probably reflects organized corporate groups. Glassow et al. (2007) suggest that this shift in projectile point type and number shows a change in warfare strategies.

Throughout the coast *Olivella* beads become more numerous, widely distributed, and elaborate in form; it is thought that this is associated with the development of, and increase in, social complexity (social stratification and ranking) similar to that known in the Pacific Northwest during this time (Byrd and Raab 2007; Erlandson 1997; Glassow et al. 2007; Jones et al. 2007; Moratto 1984; Ames 1994; Arnold 2001). Seeing that data support the theory that *Olivella* shell bead production was almost exclusive to the Channel Islands, the appearance of *Olivella* beads in great numbers at mainland sites throughout southern California as far east as the Mojave Desert may show that an extensive regional interaction sphere had developed by 5,000 BP (Arnold 2001; Erlandson 1997; Byrd and Raab 2007; Glassow et al. 2007; Jones et al. 2007; Moratto 1984). It is likely that this interaction sphere was organized along sociopolitical and/or ethnic affiliations (Erlandson 1997). Fired ceramics dating to as early as ca. 5,000 BP have been found on the Channel Islands and mainland coast and lends credence to this theory, and the generally accepted theory is that ceramics were introduced to California by Great Basin peoples (Porcasi 1998; Arnold et al. 2004). Another new technology arising during this period was asphaltum sealed baskets (earliest ca. 4,000 BP), the storage capabilities of which are suggestive of longer term planning and increased environmental awareness (Erlandson 1997; Glassow et al. 2007).

Linguistic data suggest two major migrations into the California coast by groups from elsewhere in western North America. Penutian-speaking peoples apparently entered the San Francisco Bay area during this period, and Shoshonean-speaking peoples began migrating to the southern California coast from the Great Basin between 4,000 and 3,000 BP (Shipley 1978; Erlandson 1997). The ethnographically documented range for Shoshonean peoples in southern California is highly correspondent to the distribution of period *Olivella* shell beads during the Middle Holocene (Porcasi 1998; Erlandson 1997). These intrusions may explain, at least partially, the development of new technologies, settlement patterns, and increased scope and scale of trade networks observed in the archaeological record from this period.

#### *4.1.3.3. Late Holocene (3,000 BP to Contact)*

The earliest evidence for substantial human occupation of the entire California coast occurs during the Late Holocene (Moratto 1984; Glassow 1999; Arnold et al. 2004; Erlandson 1997). As with earlier periods, cultural complexity and population size continue to increase during the Late Holocene. The overall settlement pattern is towards larger year-round villages, seen in the presence of large houses and large formal cemeteries, accompanied by ephemeral satellite camps (Raab et al. 2002; Hildebrandt 2007). Not only typically larger than those of earlier periods, sites of the Late Holocene are more abundant and display a wide range of cultural and technological developments and elaboration (Arnold et al. 2004; Erlandson 1997). Recovered archaeological material dating to this period is suggestive of shifts in the region's social organization and demonstrates increased technological sophistication, a highly diversified subsistence regime, and craft specialization (Moratto 1984; Chartkoff and Chartkoff 1984; Erlandson 1997). Combined, these phenomena may be seen as both drivers and results of a high degree of social complexity, as an overall shift occurs from egalitarianism to achieved differences in wealth and status (Jones 2002; Glassow et al. 2007). Social ranking and status appear to co-occur with increased warfare and interpersonal violence. Late Holocene coastal peoples seem to have reached a state of territorial circumscription (Carneiro 1970), with subsequent increases in both economic competition and intensification (Erlandson 1997). Territorial expansion and increased population apparently increased environmental stress throughout coastal communities (Moratto 1984; Erlandson 1997; Glassow et al. 2007; Shipley 1978). Examples of this are poorer health, reduced foraging efficiency, and overexploitation of resources (Raab 1997). By 700 BP, virtually all major aspects of coastal cultures documented at European contact had been established (Chartkoff and Chartkoff 1984; Moratto 1984; Erlandson 1997).

By the Late Holocene we have evidence for fully developed fishing and marine mammal hunting along the entire California coast (Erlandson 1997; Moratto 1984; Arnold et al. 2004). However, the period is characterized by a noticeable broadening of the diet, to include lagoonal, coastal, and terrestrial resources (Gallegos 2002; Dietz et al. 1988). These adaptive food procurement strategies are clearly demonstrated in the important and well-researched Elkhorn Slough site (CA-MNT-229) on the central California coast (Dietz et al. 1988; Patch and Jones 1984).

Some researchers (Hildebrandt and McGuire 2002) have suggested that early stages of the period witnessed an increase in the use of large terrestrial and marine species. On the northern coast, many sites (e.g., CA-DNO-11, CA-HUM-129, CA-HUM-118) contain assemblages with harpoons and remains of seals, sea lions, and marine fish; the initial development of oceangoing canoes on the northern coast is likely represented in these assemblages (Hildebrandt 2007). In contrast, there is a marked shift towards small-package food resources (smaller mammal, shellfish, sea mammal, and fish species) along the central and southern coasts after ca. 1,300 BP (Byrd and Reddy 2002; Byrd and Raab 2007). Plant resources, particularly grasses and acorns, become more important to the diet of central and southern coast populations (Byrd and Raab 2007; Glassow 1999; Moratto 1984). This shift in subsistence strategy is most likely attributable to population pressures and increased territoriality (Koerper et al. 2002; Moratto 1984; Erlandson 1997).

Bifaces and projectile point types are more diverse and occur in greater numbers during the Middle Holocene, especially after the introduction of the bow and arrow sometime around 1,400 BP (Erlandson 1997; Arnold et al. 2004; Jones et al. 2007). Desert side-notched and cottonwood arrow points are the predominant projectile point types of the period, with the disappearance of most stemmed points (Jones et al. 2007). The large numbers of mortars and pestles and bedrock milling features seen in the period attest to the increased reliance on plant foods (Arnold et al. 2004). Shell bead production (mostly *Olivella*) greatly intensifies and diversifies (new species and manufacturing techniques), though widespread low-level shell bead production is evidenced throughout the southern coast (Arnold et al. 2004; Rick et al. 2005; Glassow et al. 2007, Jones et al. 2007).

Items such as beads and pendants made from *Olivella* and other previously unused species of shellfish become highly decorative and are similar to those observed ethnographically (Glassow et al. 2007); overall, functional tool decoration becomes more prevalent. Additionally, steatite disk beads appear in large numbers (Jones et al. 2007) along the southern coast. Throughout the coast, basketry items are common to sites of the period (Byrd and Raab 2007; Jones et al. 2007; Moratto 1984). By 1,000 BP, ceramics were in common use on the southern coast, and their expanded use demonstrates cultural ties with the peoples of the Mojave and Colorado Deserts (Arnold et al. 2004; Moratto 1984). In northern California, the use of fish weirs and fish processing stations are more frequent, two activities that required cooperative labor groups deriving from large, ranked societies (Arnold et al. 2004). Sometime around 1,500 BP the plank canoe appeared on the southern and central California coasts. Construction of these canoes required substantial knowledge and skill and an associated highly developed toolkit. Also, the large amount of labor and organization required for canoe manufacture and use suggests increasing degrees of social organization and ranking (Arnold and Bernard 2005). This increased social organization is also seen in the large number of ceremonial items at sites along the coast. Site CA-HUM-174, located on a small offshore island near Patrick's Point, contains more than a thousand sea lion skulls (dated to 650 to 550 BP) but no additional faunal remains. This faunal assemblage strongly indicates that the site is associated with ceremonial activities (Heizer 1951). Finally, new mortuary practices such as cremation came into practice in some areas during the period (Byrd and Raab 2007). The Channel Island shell bead industry's rapid growth and development during this period was probably interlinked with the expansion of regional trade networks, particularly with Great Basin peoples (Arnold et al. 2004; Rick et al. 2005). However, near the end of the period long-distance movement declined among coastal peoples, replaced by more intensive local trade systems (Arnold et al. 2004; Glassow et al. 2007). Populations of the northern California coast shifted as two new groups migrated in from the east, Algic-speakers (ancestral to Wiyot and Yurok) and Athapaskan-speakers (ancestral to Tolowa, Mattole, and Sinkyone) (Erlandson 1997; Moratto 1984; Shipley 1978).

### 4.1.4. Ethnography of Coastal California

Juan Rodríguez Cabrillo's arrival in present-day San Diego in 1542 is the first well-documented arrival of a foreigner on the California coast (King 1978). Cabrillo's contact was minimal, and European influence in the region did not become sustained until the establishment of a Spanish mission in San Diego in 1769. Europeans brought new goods, religion, and diseases to North America. The cumulative influence of Europeans on Native Americans completely changed demographics and social structures across the continent, and California was no different. Over time, Native Americans slowly abandoned the coast for inland areas. Though estimates range widely, researchers believe that the Native population of California at contact was approximately 310,000, one of the highest population densities in North America north of Mexico at the time. This large population was dramatically reduced by a myriad of factors associated with the European contact, so much so it is estimated that only 20,000 Native Americans still lived in California by 1900 (c.f., Cook 1978; Castillo 1978; Kroeber 1925). Ethnographic accounts document no fewer than 16 Native American tribes along the California coast at the time of contact (Heizer 1978). The great linguistic diversity of California's indigenous populations at contact is seen by the presence of five language stocks and six language families: Na-Dene Stock (Athapaskan Family), Algic Stock (Yurok Language), Yukian Family, Hokan Stock (Pomoan Family, Chumashan Family), Penutian Stock (Utian Family), and Uto-Aztecan Stock (Takic Family) (Shipley 1978). All Native American groups along the California coast were hunter-gatherers with varied levels of social complexity (though most did have systems of rank and status differentiation), trade networks, and craft industries. Despite the great linguistic diversity, California coastal peoples shared similar technologies and cultural practices (Heizer 1978; Kroeber 1925). The following discussion provides an overview of the Native American tribes ethnographically documented at the time of European contact; populations are discussed based on location along the coast, beginning at the northernmost extent of the California coast and descending south to the Mexican border.

### 4.1.4.1. *Northern California Coast*

At the time of European contact, the following tribes (listed by location from north to south) occupied the California coast north of San Francisco Bay: Tolowa, Yurok, Wiyot, Mattole, Sinkyone, Coast Yuki, Pomo, and Coast Miwok. The Tolowa, Mattole, and Sinkyone spoke languages of the Athabaskan Family (Na-Dene Stock), a language family thought to have originated somewhere in the interior of northern British Columbia around 6,000 years ago (Golla 2007; Shipley 1978). The Tolowa language is less closely related to the more similar Mattole and Sinkyone languages. Researchers speculate that peoples speaking languages of this family may have been the latest indigenous groups to arrive in California, possibly as late as 650 BP (Moratto 1984; Gould 1978; Shipley 1978). The Wiyot and Yurok languages were part of the Algic Stock, a stock that also includes Algonquian speakers of eastern North America. The two languages are only very distantly related and appear to correspond to separate migrations. Studies on these languages suggest that the Wiyot and Yurok first arrived in California around 700 BP (Golla 2007; Moratto 1984). The Coast Yuki language is of the small and isolated Yukian Stock linguistic unit. The inland-inhabiting Wappo is the only other group with a language of the stock. Estimates put initial migration into California by Yukian speakers at somewhere between 5,000 and 3,000 BP (Golla 2007; Moratto 1984; Shipley 1978). Pomo is a Pomoan Family language of the widely distributed Hokan Stock. Conservative estimates are that speakers of the Pomo Family languages have been living in California for around 2,500 years (Golla 2007). The language of the Coast Miwok is of the Penutian Stock, a stock that linguistically dominates interior central California. Specifically, Coast Miwok-speakers may have inhabited the coast as early as 4,000 BP (Golla 2007). The Costanoan and Esselen, who inhabited the coast immediately south of San Francisco Bay, also spoke Penutian languages.

The ethnographically recorded territorial limits of the northern California coast indigenous peoples (from north to south) are as follows: Tolowa—Winchuck River (Oregon) to Wilson Creek; Yurok—Crescent City to Trinidad; Wiyot—Little River to Bear River; Mattole—Bear River to Spanish Flat; Sinkyone—Spanish Flat to Usal Creek; Coast Yuki—Usal Creek to Cleone; Pomo (coastal groups)—Cleone to Duncan's Point; Coast Miwok—Duncan's Point to Point Bonita (northern mouth of San Francisco Bay) (Fredrickson 1984; Hildebrandt 2007). All of these groups inhabited the varying-width coastal strip between the Pacific Ocean and the top of the North Coast Range, which includes four distinct ecosystems: the coast, the redwood forest, the Douglas fir-oak flats, and riverine areas. Except for the Coast Yuki and Pomo, these groups had permanent coastal villages with temporary residence in small hunting/fishing camps during the summer; the Coast Yuki and Pomo settlement pattern was the opposite, residing in permanent inland, riverine villages, and utilizing small coastal camps for summer hunting and fishing.

The first sustained contact of these peoples with Europeans/Euro-Americans occurred around 1850, except for the Pomo and Coast Miwok who had continued interaction with the Russian colony at Fort Ross between 1811 and 1842. Other than the Coast Yuki, at 750 individuals, all of these northern California groups had populations at contact estimated at between 2,000 and 3,000 each (Kroeber 1925; Gould 1978; Pilling 1978; Elsasser 1978a, 1978b; Miller 1978; Bean and Theodoratus 1978; Kelly 1978; Heizer 1962; Simmons 1997).

Subsistence patterns for northern California coast tribes were based on a seasonal cycle aligned to resource availability. With the exception discussed above (Coast Yuki and Pomo), these groups resided in permanent coastal villages during the (rainy) winter. In the summer, coastal camps were used for smelt-fishing, with groups traveling inland from these locations for acorn-collecting and salmon-fishing. Resources obtained from these non-village locales were taken back to villages in the summer as well, so that villages were never completely uninhabited. Groups along this portion of the coast had a diversified diet and relied on both marine and terrestrial environments for subsistence. The main resources used by all northern California peoples were sea lions, fish (especially salmon), acorns, deer, elk, shellfish, seabirds, eels, coast redwood (*Sequoia sempervirens*), berries, and fibrous plants for weaving and net-making (wild iris, tule reeds) (Kroeber 1925; Gould 1978; Pilling 1978; Elsasser 1978a, 1978b; Miller 1978; Bean and Theodoratus 1978; Kelly 1978; Heizer 1962; Simmons 1997).

Basketry was ubiquitous among these coastal peoples, and styles and forms exhibited similarity throughout the region. Redwood dugout canoes were the principal means of water transport, used for fishing and hunting expeditions. The Coast Yuki and Coast Miwok do not appear to have used boats, only small expedient wooden rafts for crossing small waterbodies (typically calm water). Variably, structures of these tribes consisted of redwood plank square and circular houses, sweathouses, and specialized "workshop" buildings (for tool making, butchering, fish cleaning, etc.). For the southernmost of these people, the Pomo and Coast Miwok, structures were conical and constructed of poles and covered with grass. The most common tools for all of these groups were bow and arrows, small flaked stone projectile points, harpoons, fishing nets, netsinkers, mortars and pestles, tule mats, antler woodworking wedges, adzes, and bone needles (Kroeber 1925; Gould 1978; Pilling 1978; Elsasser 1978a, 1978b; Miller 1978; Bean and Theodoratus 1978; Kelly 1978; Heizer 1962; Simmons 1997).

Compared to the Pomo, these northern California coastal groups had little social stratification (formal chiefs, etc.) and were organized in tribelets. Prestige was based on possession of specific material goods such as large obsidian bifaces, woodpecker scalps, and shell beads. Marriage typically involved men "purchasing" a wife, and polygyny and divorce were also permitted. Descent was traced patrilineally and post-marriage residence was patrilocal. Debt slavery was used by many of these groups to compensate individuals for acts considered criminal or for material debts. The main activities for women consisted of plant gathering (especially acorn), procurement and processing, and basket-weaving.

Important rituals and shamanic practices were centered on fishing/hunting activities; the main ritual for most of these groups was associated with fishing/hunting of the year's first salmon, eels, smelt, and sea lions. Disease was most commonly perceived to be associated with the intrusion of an object into the body caused by sorcery or breaking taboos. Much shamanic healing was centered on the "sucking out" of these objects; men, women, and transvestite men could all be shamans. A number of dances were used for ceremony and divination, including the nineteenth century Ghost Dance and those associated with the twentieth century Indian Shaker movement. Though origin myths varied among these groups, all had a general belief that spirits were present in both animate and inanimate objects. Warfare did occur, though was usually limited and was attributed most often to witchcraft. Leisure activities included gambling, dancing, and music (Kroeber 1925; Gould 1978; Pilling 1978; Elsasser 1978a, 1978b; Miller 1978; Bean and Theodoratus 1978; Kelly 1978; Heizer 1962; Simmons 1997).

#### 4.1.4.2. Southern California Coast

Native American groups occupying the coast of California south of San Francisco Bay at the time of European contact included the Costanoan, Esselen, Salinan, Chumash, Gabrielino, Luiseño, Ipai, and Tipai. As mentioned in Section 4.1.4.1, the Costanoan language is from the Penutian Stock. Linguistic data suggests the Costanoans inhabited the coast as early as 4,000 BP (Golla 2007). Languages of most of the groups ethnographically documented along the southern California coast (Esselen, Salinan, Ipai, and Tipai) are from the Hokan Stock, which is considered the oldest of all western North American language groups, estimated to 8,000 BP (Golla 2007; Shipley 1978). Very little is known about the Esselen and Salinan languages, limiting hypotheses on migration time-depth. The Ipai and Tipai languages are very closely related, belonging to the Yuman Family of the Hokan Stock. Most Yuman languages were documented in Arizona and Baja California. The Ipai and Tipai may have been living on the southern California coast as early as 2,000 BP (Golla 2007; Shipley 1978). Formerly classified as a Hokan Stock language, Chumash is now considered an independent language family (Golla 2007).

Archaeological material demonstrates demographic and cultural stability in the Chumash territory from as early as the Terminal Pleistocene/Early Holocene. Despite this, linguistic estimates for when Chumash-speakers originally occupied the region vary widely (Golla 2007; Shipley 1978; Moratto 1984). Gabrielino and Luiseño are languages of the Takic subfamily of the Uto-Aztecan language family. This family is the most geographically widespread of all American (North, Central, and South) language families, and most languages of the family north of Mexico are or were spoken in the Great Basin and Southwest (Golla 2007; Shipley 1978; Moratto 1984). The Gabrielino and Luiseño migrated to the California coast from the Great Basin sometime between 4,000 and 3,000 BP (Shipley 1978; Golla 2007; Erlandson 1997; Moratto 1984; Dixon and Kroeber 1903; Heizer 1962; Simmons 1997). The territorial limits of the southern California coast indigenous groups at the time of European contact were (from north to south): Costanoan—southern entrance of San Francisco Bay to Sur River; Esselen—Sur River to Point Lopez; Salinan—Point Lopez to Morro Bay; Chumash—Morro Bay to Malibu, including the Northern Channel Islands; Gabrielino—Malibu to Aliso Creek, including the Southern Channel Islands; Luiseño—Aliso Creek to Agua Hedionda Creek; Ipai—Agua Hedionda Creek to San Diego; Tipai—San Diego to Todos Santos Bay (Baja California) (Kroeber 1925; Moratto 1984). The territories of these peoples were generally situated on the coast between the Pacific Ocean and the top of the various coastal mountain ranges. However, the Chumash and Tipai, in particular, used portions of the areas east of these mountain ranges.

Additionally, the Chumash and Gabrielino inhabited the Northern and Southern Channel Islands respectively, areas extremely rich in marine resources. These groups resided in permanent coastal villages and also used small seasonal camps for summer hunting and gathering activities. Social organization of these cultures was based on the tribelet, typically geographically defined by watersheds. Patrilineally inherited chiefs of varying power acted as political leaders, and political organization was more stratified and defined among the Chumash and Gabrielino, where chiefs exercised a substantial level of control and gained prestige.

Prolonged contact between southern California coast indigenous peoples and Europeans came with Spanish expeditions and settlement in the area during the late eighteenth century. Population densities were much higher in the central and southern areas of the coast than in northern California (Applegate 1975; Bean and Shipek 1978; Bean and Smith 1978; Grant 1978a, 1978b; Luomala 1978). The Esselen and Salinan probably numbered 1,000 and 3,000 individuals, respectively, at European contact. Ethnographic accounts suggest that as many as 5,000 Gabrielino, and 10,000 each of Costanoan, Luiseño, and Ipai/Tipai (combined) were living along the southern California coast at contact. The largest and densest population at European contact along the entire California coast belonged to the Chumash, with estimated counts of 20,000 or more individuals (Kroeber 1925; Levy 1978; Hester 1978a, 1978b; Grant 1978a, 1978b, 1978c; Greenwood 1978; Bean and Smith 1978; Bean and Shipek 1978; Luomala 1978; Simmons 1997).

Acorns from various oak species were the most important food source for all of these coastal peoples except the Island Chumash. Terrestrial animals, birds, shellfish, fishes, sea mammals, and a number of seeds and roots completed their diets. Overall, the diet was highly diverse and based on seasonal availability. The Chumash and Gabrielino subsistence regimes focused on shellfish, fish, sea mammals, and acorns; however, other plant foods and terrestrial animals were commonly eaten. The highly productive waters of the Santa Barbara Channel and relatively low density of animals resulted in the Island Chumash's heavy reliance on marine resources (i.e., fishes, sea mammals, shellfish) (Kroeber 1925; Levy 1978; Hester 1978a, 1978b; Grant 1978a, 1978b, 1978c; Greenwood 1978; Bean and Smith 1978; Bean and Shipek 1978; Luomala 1978; Heizer 1962; Simmons 1997).

Fiber technology was abundant in all of these cultures, seen in their ubiquitous basketry, cordage, and woven blankets. Baskets and fiber-cord nets were important items in fishing toolkits. Structures for all the southern California coast peoples consisted of wood-framed grass- or brush-covered houses and sweat lodges. Tule rafts and dugout canoes provided water transportation, except for the Chumash (and later Gabrielino), who constructed elaborate sewn plank canoes. These seaworthy vessels required an extensive woodworking technology and allowed for contact between the Channel Islands and mainland coast (Arnold and Bernard 2005; Fagan 2004; Grant 1978a, 1978b, 1978c).

Bows and arrows were the primary means for hunting terrestrial species and birds. Projectile points, knives, and scrapers were made from obsidian, chert, metavolcanics, and other types of stone. The Chumash had a very extensive steatite (soapstone) industry, which played an important role in regional trade networks; common items were pipes, baking slabs, beads, effigies, and olas. Asphaltum was used extensively by the Chumash and Gabrielino for canoe caulking, hafting, and sealing baskets. Groundstone items were important to all of these coastal peoples and included mortars, pestles, manos, and metates. Bone and shell were used for fishhooks, harpoons, needles, awls, and other hunting items, while wood tools (e.g., adze handles) were important, especially for building the Chumash plank canoes.

The Northern (Chumash-inhabited) and Southern (Gabrielino-inhabited) Channel Islands were areas of an intensive shell bead production industry. As a coveted trade item along the coast and east into the Great Basin and Colorado Desert, these beads allowed the Chumash and Gabrielino to acquire substantial wealth (Grant 1978a, 1978b, 1978c; Bean and Smith 1978; Kroeber 1925; Arnold and Munns 1994).

Common to all of these coastal peoples was the "purchase" of a bride from her parents. Chiefs often had multiple wives, and divorce was permitted. Throughout the southern California coast both cremation and burial were customary mortuary practices. Most likely introduced by

Uto-Aztecan speakers (Gabrielino, Luiseño), the Chingichnich cult and accompanying use of the hallucinogenic toloache plant (*Datura meteloides*) was an important part of divination and puberty rituals throughout the area (Bean and Vane 1978; Applegate 1975; Bean and Shipek 1978; Bean and Smith 1978; Grant 1978a, 1978b; Luomala 1978). As with other areas on the California coast, gambling, dancing, and music were important leisure activities (Kroeber 1925; Levy 1978; Hester 1978a, 1978b; Grant 1978a, 1978b, 1978c; Greenwood 1978; Bean and Smith 1978; Bean and Shipek 1978; Luomala 1978; Heizer 1962; Simmons 1997).

### 4.1.5. Precontact and Ethnographic Coastal Resources Types

This section provides a general description of the precontact and ethnographic coastal property types known to be located in the study area. In addition to the recorded historic resources identified within the study area, there may be additional resources that have yet to be recorded. Such property types are also discussed.

#### *4.1.5.1. Archaeological Districts*

An archaeological district is more than one archaeological site historically connected by a set of similar characteristics (e.g., theme, function, time). Sites do not have to be spatially connected and a district may be discontiguous if, for example, the sites are discrete or the space between them is of no importance to their connection. The Crystal Cove archaeological district in Orange County is one example of a well-documented archaeological district.

#### *4.1.5.2. Villages*

Along the Pacific coast of the United States villages were commonly places where extended families gathered to socialize and trade, often during cold winter months. Some villages, however, were inhabited throughout the year. These sites usually consist of multiple structures—commonly either semi-subterranean pithouses or aboveground plankhouses. Villages may consist of other satellite structures, including sweat lodges, menstrual huts, and specialized processing facilities. Shell middens/shell mounds are often directly associated with villages and represent refuse deposited by inhabitants of these villages. Important villages along the coast include Ozette (45CA24) on the Olympic Peninsula in Washington and Tsotskwi (CA-HUM-120) in northern California.

#### *4.1.5.3. Rock Shelters*

Rock shelters are located in large outcroppings of exposed rock and served a number of purposes. Commonly, rock shelters were used as places of short-term occupation while performing resource harvesting activities, but they may also have been used as cache locations where gear or resources were stored. Rock shelters along the coast include 35CU153 in southern Oregon and CA-SBA-609 in southern California.

#### *4.1.5.4. Petroglyphs/Pictographs*

Petroglyphs and pictographs are commonly known as rock art. For petroglyphs, the rock has been pounded, hammered, or scratched to make a pattern or picture. For pictographs, paint or some pigment has been applied to the rock itself. Commonly, rock art is found on outcroppings of rock where it can easily be seen. Rock art may be important for a number of different reasons including navigation, storytelling, and spiritual purposes. The Wedding Rock near Ozette on the Olympic Peninsula in Washington State is an example of rock art along the Pacific coast.

#### *4.1.5.5. Shell Middens/Mounds*

Shell middens and shell mounds are locations where refuse, commonly food refuse, was disposed. Invertebrates comprised a large portion of Native American diets and are the most easily observed constituents at these sites. Sediment associated with shell middens and mounds is black or dark gray, signaling high organic content. Fully formed artifacts are generally rare in these sites. Human remains in the form of burials and occasional isolated remains are found in these sites making them particularly socially sensitive. Most commonly, shell middens and mounds are directly associated with long-term occupations, although they may also be formed at harvest locations and short-term camps that experience continual reuse. Well-known examples of shell middens and mounds along the west coast include the Minard (45GH15) and Ozette (45CA24) sites in Washington, and the Umpqua/Eden site (35DO83) in Oregon.

#### *4.1.5.6. Trails/Linear Features*

Trails were important for Native American mobility and were well-known routes of travel often used for trade, hunting, and social excursions. Trails are often difficult to observe in archaeological context; however, ethnographic data for trails are often available. Trails may be simple, essentially well-worn paths, or may be marked by particular landmarks and stacked rock features.

#### *4.1.5.7. Cemeteries/Burials*

Commonly, Native American burials and burial grounds are not as formalized as Euro-American (historic or modern) cemeteries. Human remains associated with Native American burials are often found in shell middens where the alkaline environment created by shell helps to preserve bone. Outside of shell middens/mounds Native American burials may occur at many places across the landscape and are often unmarked; however, stacked rock features known as cairns may mark burials. On the other hand, historic, formal cemeteries will often be recorded on maps or have some physical marker such as a head stone or even stacked rocks. Isolated burials, whether associated with Native Americans or non-Native Americans, can be unpredictably placed across the landscape and may be impossible to locate from a surface inspection of an area. One well-documented example of a Native American cemetery is the Tatoosh Island cemetery just off the Olympic Peninsula in Washington.

#### *4.1.5.8. Lithic Scatters*

Lithic scatters are concentrations of chipped stone tools and/or refuse from chipped stone tool production. Commonly, lithic scatters may be components of larger sites and may signal work areas away from main areas of habitation in villages, or these sites may simply consist of chipped stone refuse near a good raw material source (e.g., quarries). Indian Sands (35CU34) is one example of a well-known lithic scatter along the Oregon coast.

#### *4.1.5.9. Culturally Modified Trees*

Across the western US, Native Americans used tree bark and cambium, inner bark, for a number of purposes. These materials were removed from trees in long strips, often in small enough sections to allow the tree to remain living. Trees may heal from this but will exhibit scars that are indicative of this practice of peeling or stripping bark. Bark from many trees, including Western Red Cedar (*Thuja plicata*), was used for basketry, and cambium was a common food among Native American groups. Often, culturally modified trees are found in clusters; for example, 45CA515 on Cape Flattery in Washington consists of a number of peeled and modified trees. Other types of culturally modified trees are those that exhibit dendroglyphs—carvings that have been made in tree bark, commonly by non-Native Americans.

#### 4.1.5.10. Rock Alignments/Stacked Rock Features

Rock alignments and stacked rock features are common across western North America and served many purposes. Such facilities may have been used in hunting as blinds or drives, for navigation as trail markers, or for spiritual/ceremonial purposes. Commonly, rock alignments or stacked rock features are made of readily available stone and are often located in inaccessible areas as well as areas and locations that can easily be viewed from afar. The Spirit Jumping Off Rocks site (P-21-002628) is an example of a linear stone alignment along the California coast.

#### 4.1.5.11. Isolated Features

Isolated features are individual features such as fire pits that exist on the landscape by themselves. The location of such features is by their very nature very difficult to predict. Isolated features used for heating or cooking would consist of fire-modified rock as well as thermally altered sediment and probably charcoal. Other features would likely be represented by clusters of stones as perishable items would have deteriorated from these locations.

#### 4.1.5.12. Landscape Modifications

Landscape modification may have a number of manifestations along the coast. It has long been assumed the landscape was unmodified prior to the appearance of Europeans in North America; however, a growing body of evidence indicates that Native Americans modified and manipulated the landscape for millennia prior to the arrival of the first Europeans. In British Columbia, clam gardens consisting of constructed habitat ideal for propagation of clams have been widely documented.

#### 4.1.5.13. Quarries

Quarries are locations on the landscape where stone was collected for stone tool production. Stone may also have been flaked near quarries to make pieces of the desired material easier to carry.

#### 4.1.5.14. Isolated Artifacts

Any number of artifacts may be isolated across the landscape. Commonly, isolated artifacts represent lost items. Determining cultural and/or scientific importance of isolated artifacts is difficult unless they represent rare data classes (e.g., Clovis points) or culturally significant items (e.g., artistic pieces).

#### *4.1.5.15. Caches*

Caches are groupings of artifacts that were stored for later use at an important or logistically crucial location on the landscape. Caches can consist of any group of items—from a specialist's tool kit for making specific items to a group of projectile points stored for later use in hunting forays.

#### *4.1.5.16. Fish Weirs/Traps*

Fish weirs and traps are common along the Pacific coast but also occur in estuarine or riverine settings. Weirs and traps can be materials such as wooden stakes, brush, or stone. These facilities provide a barrier that fish are unable to escape and allow easy access for harvesting the fish. Many fish weirs and traps have been recorded on the coast, including a number in southern Oregon (e.g., 35CS128 near Coos Bay).

#### *4.1.5.17. Traditional Cultural Properties*

Traditional cultural properties can occur in many settings and are not strictly associated with Native Americans. The key elements of TCPs are that they are important to a community's cultural practices or beliefs that are part of that community's history, and that they are important for maintaining continued cultural identity within the community. King (2003) interprets necessary qualities of a TCP as reflecting one or more of the following attributes: spiritual power, practice, stories, therapeutic properties, and remembrances. For example, a community may believe a place to be a source of spiritual power (spiritual), where a ritual must be carried out (practice), associated with their origins (stories), where spiritual healing occurs (therapeutic properties), or the location of an event significant to the community (remembrance). Often, Native American TCPs are kept confidential because of their spiritual and religious significance. One notable TCP along the California coast is the MacKenzie's Dance House Site (CA-SON-175).

### 4.1.6. Submerged Prehistoric Resources

At this time, very few prehistoric sites are known to exist on the POCS. Hudson (1977) studied more than 92 artifacts recovered from 33 separate locations, almost all located off the Santa Barbara County coast. A 1987 archaeological study of the California coast from Morro Bay to the Mexican Border prepared for the United States Minerals Management Service identified ten additional underwater prehistoric resources, almost all off the coast of San Diego County (Pierson et al. 1987). Due to their durable nature, virtually all underwater prehistoric artifacts found to date are made of stone (Hudson 1977; Pierson et al. 1987), and there is no reason to believe that any future underwater prehistoric artifacts will not follow this pattern. Though there have been very few underwater prehistoric finds along the coast, this fact must not be taken as a statement of a lack of submerged prehistoric sites on the POCS. Instead, the issue remains open and requires direct evaluation of the unconsolidated deposits that lie on and beneath the sea floor to assess whether additional submerged sites exist on the POCS.

## 4.2. COASTAL HISTORIC BACKGROUND

This section provides a general overview of Euro-American settlement and development of the built environment along the coasts of California, Oregon, and Washington, and an overview of the maritime history of the west coast of the United States. Relying principally on secondary literature, the two contexts presented here describe the histories of coastal built environments and maritime activities separately, with each context followed by descriptions of their associated property types. The discussions cover the time frame beginning with initial European maritime and overland exploration, and extending to the late twentieth century.

### 4.2.1. Built Resources History

#### *4.2.1.1. European Exploration and Settlement*

Spanish explorer Juan Cabrillo commanded the first European expedition along the California coast, reaching San Diego Bay in 1542. Cabrillo continued north beyond Point Conception before turning back to San Miguel Island to spend the winter. When Cabrillo died, Bartolome Ferrer assumed command of the expedition and led it as far north as the southern Oregon border before storms and dwindling supplies forced a return to New Spain (Mexico). Apart from occasional excursions into the region by explorers and Jesuit missionaries, the Spanish made no organized effort to colonize California for nearly 170 years (Starr 2005).

By that time, Russian and British navigators had also begun exploring the Pacific coast north of California. Peter the Great sent Danish Captain Vitus Bering to search for commercial opportunities in the region, and although Bering's 1728 and 1741 expeditions were not successes, they led to the creation of successful Russian fur companies such as Alexander Baranov's Russian American Company. While exploring Washington, most of the crew members of one of Baranov's ships were killed in a clash with Native Americans. Despite such dangers, Russian fur trappers would maintain a presence along the northern Pacific coast into the nineteenth century (Black 2004; Kalani and Sweedler 2004; Rochester 2003).

During the 1770s and 1780s, British Captains James Cook and John Meares sailed the Washington coastline. The most important British expedition of the late eighteenth century, however, was led by Captain George Vancouver. An officer in the British Royal Navy and commander of the ship *Discovery*, Vancouver explored the Pacific region and in 1792 became the first European to sail Puget Sound (Bagley 1916). Following the coastline northward only two weeks behind Vancouver, American Robert Gray was the first to enter the Columbia River. Representing a consortium of Boston merchants, Gray sought fur sources and named the waterway after his ship. By exploring and mapping the Columbia River, Gray ultimately strengthened American claims over the region against British interests (National Park Service 1990).

During the second half of the eighteenth century, concern with the growing presence of competing colonial powers led the Spanish Government to create permanent settlements in the northern frontier of California, known as Alta California. In 1768, under the direction of the Spanish Crown, three prominent Spaniards—Inspector General Jose de Galvez, Father Junipero Serra, and Captain Gaspar de Portola—led missionaries, soldiers, and civilian settlers in securing Alta California through development of three institutions: presidios, missions, and pueblos (Starr 2005).

Father Serra founded the first California mission—San Diego de Alcala—on July 16, 1769, at the site of present-day Presidio Hill. Over the next half century, 21 Spanish missions would be established in California to convert the region's Native Americans to Christianity and assimilate them into European modes of economic production and social structure. Serra would found nine of these missions. Established adjacent to the first California mission, the San Diego Presidio was the first of four military forts created to serve the colonization effort by defending the missions from both Native American and foreign attackers. The Spanish established and maintained three other presidios at Monterey (1770), San Francisco (1776), and Santa Barbara (1782). Recruited to produce surplus food and provide militia personnel for the military, the non-clerical civilian population of Spanish colonists settled in pueblos (small towns) established near missions and within defensible proximity to one of the four presidios (Beck and Haase 1977; Starr 2005).

The 600-mile-long El Camino Real, Spanish for "Royal Road," connected California's missions, presidios, and pueblos from San Diego to Sonoma. The route included two or more parallel courses running north/south. However, a limited number of El Camino Real segments and Spanish-Colonial institutions were located within roughly a mile of the coastline. The latter included Mission San Buenaventura (1782), the Presidio of Santa Barbara, Mission San Carlos Borromeo de Rio Carmelo (1770) and the Presidio of Monterey, Mission La Exaltacion de la Santa Cruz (1791) and the Villa de Branciforte (1797), and the Presidio of San Francisco (Beck and Haase 1977; City of San Mateo 2001; Kimbro et al. 2009; Starr 2005).

During this period, much of California remained sparsely populated and beyond the reach of Spanish authority, particularly in the north, where the competing colonial power of Russia pursued settlement. Ivan A. Kuskov, an agent of the Russian-American Fur Company, established the permanent settlement of Fort Ross in 1812 in present-day Sonoma County. Fort Ross flourished for more than 20 years as a center of fur harvesting and agriculture until Russian officials ordered the settlers to withdraw in response to a territorial warning from the American government and the near extermination of the region's sea otter population. Both Mission Solano and Mission San Rafael were established as checks against Russian encroachment north of San Francisco (Hoover et al. 2002; Starr 2005).

Mexico assumed authority over the missions of Alta California after it won independence from Spain in 1821. By 1834, Mexican authorities had undertaken to secularize the mission system. Mexican heads of state began granting mission lands—which had originally been promised to indigenous Californians—to former Spanish colonists and other newcomers to the region. Mexico also lifted bans on foreign trade that had hindered commercial development in Alta California. Although the hide and tallow (beef fat) trades began at the start of the nineteenth century, both grew rapidly following Mexican independence. Cattle for the trade were raised on large ranchos, which often included adobe residences constructed during the late eighteenth and early nineteenth centuries using easily accessible local building materials. In addition to the kinds of adobe residences built at ranchos such as the Rancho Santa Margarita y Las Flores on the coast of today's northern San Diego County, adobe buildings also comprised pueblos such as Monterey, including the Cooper-Molera adobe (1826), one of the largest adobes still standing in northern California. Farther up the coast, the Neary-Rodiguez is the last remaining adobe building from the original Mission Santa Cruz (Beck and Haase 1977; Gearhart et al. 1990; Hoover et al. 2002).

During the early nineteenth century, the European and Euro-American presence in the Pacific Northwest remained sparse compared to California, particularly along the coastline. On October 10, 1805, Americans Meriwether Lewis, William Clark, and the Corps of Volunteers for

Northwestern Discovery entered present-day Washington at the confluence of the Snake and Clearwater Rivers, between Clarkston, Washington and Lewiston, Idaho. Sent by President Thomas Jefferson on a mission to identify a northwest passage, the group encountered difficulties such as fierce rapids, winds, relentless rain, and fleas as they made their way to the site of their winter camp on the Pacific coast at the mouth of the Columbia. The team returned east the following year (Bagley 1916).

The Hudson's Bay Company, a London-based enterprise that had operated in Canada since 1670, first entered the Pacific Northwest in the early nineteenth century. Acquiring their chief rival, the North West Company, in 1821, the Hudson's Bay Company operated in the Pacific Northwest from inland posts such as Vancouver and Fort George in present-day Washington. Although not based on the coast, the Hudson's Bay Company had a far-reaching impact on the territory from 1821 to 1860. The company acted as a governing body, with agents serving as legislators, executive officers, judges, and police forces for the region (Nisbet and Nisbet 2011).

#### *4.2.1.2. U.S. Expansion and Pacific Coast Statehood*

By the 1840s, a growing number of important Mexican leaders and landowners throughout California had come to welcome the prospect of annexation by the United States. During the Mexican-American War, skirmishes involving the U.S. military under the command of John C. Fremont and Robert F. Stockton belied a lack of concerted Californian resistance to American conquest. The Mexican government simply lacked the resources and available soldiers to back California in an extended conflict. In California the conflict ended at Campo de Cahuenga (San Fernando Valley) in 1847, when Mexico formally surrendered. With the signing of the Treaty of Guadalupe Hidalgo in 1848, Mexico ceded a vast northern territory to the United States, and California was granted statehood in 1850 (Beck and Haase 1977; Rawls and Bean 2003).

North of California, the United States secured its claim on lands south of the 49th parallel from Britain under the Oregon Treaty of 1846. Thereafter, American settlement throughout the expansive and verdant valleys of the Pacific Northwest began in earnest. In 1848 Congress created the Oregon territory, which encompassed the present-day states of Oregon and Washington. Oregon voters ratified a state constitution on November 1857, and Congress granted statehood to Oregon on February 14, 1859 (Hayes 1999; Oregon Historical Society n.d.). Soon after the creation of the Oregon territory, northern residents began demanding a territory of their own. In February 1853, Congress created the territory of Washington from the northern portion of the Oregon territory (Rochester 2004). However, it took Washington several decades to achieve statehood. Congress first passed an act enabling statehood for the territories of Washington, North Dakota, South Dakota, and Montana on February 22, 1889. President Benjamin Harrison signed the bill admitting Washington as the 42nd state on November 11, 1889 (Lange 2003).

#### *4.2.1.3. The Pacific Coast from the California Gold Rush to 1890*

In 1848, the discovery of gold on the American River in California's Sierra Nevada foothills inaugurated the California Gold Rush that forever altered the landscape of the state. Known as the "Mother Lode," California gold country was situated over 100 miles east of the coastline in north-central California. The population boom created by the Gold Rush would transform San Francisco into one of the major urban centers of the west coast and the United States (Starr 2005). San Francisco's population exploded from 450 in 1847 to 25,000 by the end of 1849. As the region's hub for the Gold Rush transfer of people and goods, San Francisco became the busiest port on the west coast. Although San Francisco's initial growth took place well beyond a mile east of the Pacific coastline, and although mining and related agricultural activity took place much farther inland, the Gold Rush dramatically increased maritime traffic along the California coast and through San Francisco Bay's Golden Gate (Conrad 1959; Hoover et al. 2002; Starr 2005).

The U.S. War Department assumed responsibility for protecting the increasingly populous new state and its growing maritime trade, dotting California's coastal population centers with military camps, forts, and barracks. Initially, the government concentrated its military presence at the Presidio of San Francisco. Some of the oldest buildings and building remnants on the military reservation include portions of the Spanish-era comandancia (Officers' Club) and the old post hospital built by American forces in 1864. In 1861, the Army Corps of Engineers replaced the Presidio's Spanish-era Castillo de San Joaquin at the mouth of the Golden Gate with Fort Point, which continues to stand today. A National Historic Landmark District today, the Presidio of San Francisco underwent new growth during the post-Civil War decades of Indian wars in the American West, and later during the Spanish-American War, World War I, and World War II (Alley et al. 1993). In southern California, Camp Drum (Drum Barracks, Camp San Pedro) protected coastal Los Angeles and served as a supply station for the Union Army during the Civil War. The military posts of Fort Bragg and Fort Humboldt protected the California coast north of San Francisco (Hoover et al. 2002).

In the absence of railroad development, overland transportation remained inefficient and undependable, and transportation difficulties put limits on economic activity along the coasts of the Pacific Northwest and much of California. Although a new rail line completed in 1885 connected Oregon's Corvallis with Yaquima City, located just east of coastal Newport, water transportation remained the region's primary means of travel and shipment. Along vast stretches of Pacific coastline north of San Francisco and in central California, residents depended on maritime shipping and travel throughout the nineteenth century (BOAS 2007; Gearhart et al. 1990; Harvey and Krafft 1987; Napoli and Lortie 1989; Wells 2006a, 2006b).

Logging activity flourished during the second half of the nineteenth century in coastal forests from areas immediately north and south of San Francisco to Washington. The shipping of redwood from natural harbors and coves determined the sites of the first towns along the northern California coast. Established in 1850, 7 miles from the entrance to Humboldt Bay, Eureka, the safest California harbor north of San Francisco, ultimately dominated northern California timber shipping. By the next decade, Point Arena's timber extraction, milling, and lumber shipment activities made it the second leading town on the northern California coast. Gualala, Mendocino, and Fort Bragg also emerged as timber centers, all of which became permanent northern California coastal towns.

Examples of historically significant northern-California coastal homes built by individuals associated with the nineteenth-century logging industry include the Weller House in Fort Bragg, the Kenny House at Cuffey's Cove, and the O. W. Getchell House southeast of Anchor Bay. Point Arena and Mendocino feature notable concentrations of NRHP-eligible homes, commercial buildings, and other community institutions created as part of the region's logging and timber shipment economy (Caltrans 2010; Hoover et al. 2002; McBroom 1980; Napoli and Lortie 1989; Scantlebury 2004; Schade 1975).

Logging began in Oregon during the California Gold Rush and expanded rapidly to meet growing demand in San Francisco and Hawaii. Lumber companies established coastal mills at Astoria, Port Orford, and Bullard's Beach in the early 1850s. Along the south Oregon coast, George Bennett founded Bandon in 1874, and New Yorker Ralph Hewitt Rosa built its first sawmill in 1883. With the aid of new jetties constructed by the Army Corps of Engineers, Bandon became a center of timber and agricultural shipping. In both Oregon and California, the logging industry attracted immigrant workers from Sweden and Finland. The Finnish population in Humboldt and Mendocino Counties, for example, rose from 10 in 1870 to 2,140 in 1910. Significant built-environment resources associated with ethnic Swedes include the Peter Roose Homestead on the coast of northern Washington and the Patrick Hugues House in Sixes, Oregon, the latter designed and constructed by the Swedish immigrant and Port Orford builder, P. J. Lindberg (Caltrans 2010; Evans et al. 2007; Fryberger and Potter 1980; Wells 2006c, 2006d).

Finnish immigrants also played an important role in northern California fishing, an industry that utilized the entire coastline of the western United States during the latter nineteenth century and fostered a large degree of ethnic diversity in many coastal areas. Whaling operations in California were dominated by ethnic Portuguese sailors, who established themselves at the central California port of Monterey in 1855. In southern California, the most prominent Portuguese whaling captain, Joseph Clark (né Machado) sailed out of San Diego and Portuguese Bend near San Pedro. As many as 14 whaling stations operated between Crescent City and San Diego during the 1870s. A museum today, the NRHP-listed Whalers' Cabin at Point Lobos south of Carmel was constructed by Azorean Portuguese whalers who established a station there in 1861. Although the market for whale oil collapsed during the late 1880s with the introduction of kerosene lamps, many ethnic Portuguese immigrants remained on the California coast and engaged in fishing into the twentieth century (Bohme 1956; Gearhart et al. 1990; Point Lobos Foundation 2010).

Home of Cannery Row, arguably California coast's most famous historic enclave associated with fishing, Monterey formed one of the most ethnically diverse towns on the west coast. Beginning in 1850, Chinese fisherman specialized in harvesting abalone and other shellfish around Monterey. Italians, who dominated the fishing wharfs at San Francisco, created a sizeable fishing community at Monterey beginning in the 1870s, eventually displacing Monterey's Chinese immigrant fishermen. The latter fished around Monterey and worked in its canning factories until the 1890s, when their numbers dwindled due to exclusionist anti-Chinese sentiment and policy. A smaller community of Japanese immigrants also specialized in abalone harvesting on the Monterey peninsula (Architectural Resources Group 2001; Bohme 1956; Caltrans 2010; Point Lobos Foundation 2010).

Salmon fishing and oyster harvesting became important features of the Pacific Northwest economy during the second half of the nineteenth century. Driven by the growing San Francisco market, oysters were harvested at Washington's Willapa Bay beginning in the 1850s, at Oregon's Newport starting in 1863, and at Coos Bay estuary beginning in 1874. Salmon fishing on the Columbia River prompted development of the first salmon cannery there in 1866. Salmon canning quickly grew into one of the most important industries in the coastal regions of the Pacific Northwest coast. By 1883, 55 canneries on the Columbia River were producing 30.2 million pounds of canned salmon annually. As with Pacific Northwest logging, most of the historic built environment associated with fishing was located along rivers and harbors east of the coastline, but both promoted development of infrastructure at the coastline to improve maritime safety (discussed below) (BOAS 2007; Harvey and Krafft 1987; Northwest Council 2010; Smithsonian 2012; Thomas and Little 1976; Wells 2006a).

Although arable land remained limited along much of the coastline, with the establishment of settlements and towns, farmers began agricultural enterprises in coastal valleys and on coastal plains. The cool climate north of San Francisco proved amenable to dairy farming. During the late 1850s, Vermont native Solomon Pierce established a dairy ranch on the peninsula west of Tomales Bay. Shipping over 40,000 pounds of butter annually to the San Francisco market by 1870, Pierce Ranch remained an exceptionally productive dairying operation for decades and was listed on the NRHP in 1980. Dairying also thrived in the coastal valleys of Oregon, where river valley grasses and drained wetlands sustained increasing numbers of dairy cattle in the late nineteenth century. The NRHP-listed Patrick Hughes House east of Point Blanco served as the domestic focal point of the large Irish-Catholic Hughes family's livestock and dairy ranch. Some of Oregon's coastal nineteenth-century farmers also grew grains and vegetables in addition to producing dairy goods. Livestock and dairy farms also flourished along the central coast of California south of San Francisco. The NRHP-listed Dickerman Barn at Año Nuevo is the last remaining nineteenth-century dairy barn on lands associated with the Steel Brothers Dairy Ranches in coastal Santa Cruz and San Mateo Counties (Chappell et al. 1980; Fryberger and Potter 1980; Heumann et al. 2008; Regnery 1980; Wells 2006e).

Apart from historically notable Victoria-era coastal homes, today the most prevalent nineteenth-century structures on the Pacific coast are lighthouses. During the second half of the nineteenth century, as maritime traffic increased along the Pacific coast, the Federal government intervened to improve safety. Organized in 1871, the U.S. Life-Saving Service—the predecessor to the U.S. Coast Guard—established stations staffed by personnel trained to assist individuals and vessels in distress. Although some life-saving stations built on the west coast after 1890 continue to stand, none of those developed during the 1870s and 1880s have been preserved. Lighthouses also provided a critical means of improving safety. In 1852 Congress established the U.S. Lighthouse Board in response to mounting complaints about navigation dangers. The Board organized 12 districts for inspection and maintenance of lighthouses built by the Army Corps of Engineers on the west coast between 1854 and 1892. On the Washington coastline, the Corps built lighthouses at Cape Disappointment (1856), Cape Flattery (1857), New Dungeness (1857), Point No Point (1879), and West Point (1881). The Oregon coast also received lighthouses during this period at Cape Blanco (1870), Yaquina Bay (1871), Yaquina Head (1873), Tillamook Rock (1881), and Cape Mears (1890). Farther south in California, the Corps constructed lighthouses at Point Loma (San Diego, 1855), Farallon Island (1855), Point Pinos (Monterey, 1855), Battery Point (Crescent City, 1856), Fort Point (1864), Mendocino (1868), Point Reyes (1870), Trinidad Head (1871), Pigeon Point (1872), East Brother Island (Point San Pablo, 1874), Point Fermin (San Pedro, 1874), Point Bonita (San Francisco Bay, 1877), Piedras Blancas (San Simeon, 1879), Point Conception (1882), Point Sur (Morro Bay, 1889), San Luis Obispo (1890), and St. George's Reef (between Capes Mendocino and Blanco, 1892) (Gearhart et al. 1990; National Park Service 2001, 2006; Nelson and Nelson 2003; Oregon State Parks n.d; Shallat 2010).

Native Americans in coastal regions and other parts of the American west mounted their last campaigns of resistance to geographical conquest during the second half of the nineteenth century. Most of California's missionized Native Americans never received mission lands and ended up as laborers at Mexican ranchos and the farms of subsequent American newcomers (Rawls and Bean 2003). Before and after the Civil War, northern California's Native Americans undertook the most effective resistance to Euro-American conquest in the new state. This process led to creation of some of the largest Native American reservations in the far northern coastal counties of Mendocino, Humboldt, and Del Norte. In 1851, a meeting of 13 northern California tribes resulted in a treaty with the United States government concerning the creation of sovereign Indian land. Continued conflict between indigenous peoples and Euro-American newcomers, however, led the U.S. Army to establish a military presence with creation of Fort Humboldt in 1853. As in Humboldt County, Euro-American encroachment on native land frequently led to skirmishes. In Mendocino County, north of the town of Covelo, the Round Valley Reservation was established in 1858 for nine native groups, some with histories of conflict with each other. Amid growing tensions, the U.S. government established a military post there in 1863, and, for a time, Round Valley served as a destination for hostile tribes forced into resettlement. Round Valley developed into a large and eventually self-governing Native American community. In Humboldt County, bloody conflict between native peoples and Euro-American newcomers abated with the formation of the Hoopa Valley Indian Reservation. Incorporating 93,000 acres, it is the largest reservation in the state. The Army abandoned Fort Humboldt in 1870 (Hoover et al. 2002).

In the coastal areas of Oregon and Washington, peaceful early interactions among trappers, settlers, and native peoples soon erupted in conflict as Euro-American newcomers disrupted native ways of life. During the early 1850s, native groups in Oregon and Washington entered into agreements with the government to turn over lands in exchange for rights to traditional gathering areas, money, and newly designated reservation lands (Buchanan 1859; Buerge 1989; Gates 1955; Klingle 2007; Pierce 1855; Slauson 2006; Thrush 2007). Instead of providing for native cultural persistence, however, the reservations were formed near areas of industry and commerce so that Euro-American entrepreneurs could make use of native labor. Organized to facilitate Native American assimilation, the reservation system disrupted traditional native subsistence patterns. Wage labor created social instability and frustration among native groups, and many Native Americans refused to relocate to reservations, where they would be forced to live among rival native groups. During the 1850s, native frustration over treaty agreements requiring abandonment of homelands resulted in multiple conflicts, including the Yakima Indian War, Cayuse War, and Rogue River War (Klingle 2007; Oregon Secretary of State 2012; Smith and Codieck 2010). In the end, the U.S. government succeeded in forcing Native Americans in Oregon and Washington onto reservations. These include the coastal Makah, Ozette, Quilleute, Hoh, Quinault, Shoalwater Bay, Coos, Lower Umpqua, and Siuslaw Reservations (University of Washington n.d.).

Compared to northern California, coastal southern California has far fewer built-environment historical resources dating to the nineteenth century. San Francisco dwarfed both San Diego and Los Angeles in terms of creating an urban market for building materials and food harvested or cultivated along the coast. Toward the end of the nineteenth century, railroad development gradually provided speedier means than oceanbound vessels and overland stages for travel and shipment of goods between coastal towns and inland urban centers in central and southern California. However, between 1869, when the transcontinental railroad was completed, and 1885, construction of major railroad lines linked coastal centers such as San Diego, San Francisco, and Monterey. Having constructed Banning Wharf in 1857 at Wilmington—what would later become the Port of Los Angeles—Phineas Banning sought to capitalize on the growing demand for trade in Los Angeles by organizing the Los Angeles & San Pedro Railroad (LA&SP). The completed line provided a reliable means of moving cargo from San Pedro Harbor 20 miles north to Los Angeles and spurred expansions of the harbor in the 1870s. By 1890, additional branch lines connected other coastal towns in central and southern California to larger urban centers. A single NRHP-sited railroad depot built prior to 1890 continues to stand within a mile of the Pacific coast of the continental United States: the Carlsbad Santa Fe Depot in San Diego County, a Folk Victorian building with Gothic elements constructed by the Atchison, Topeka and Santa Fe Railway in 1887 (Cratty 1993; Rawls and Bean 2003).

The Pacific coast attracted visitors seeking recreational activities and rugged or placid scenery, depending on the season and region, but the paucity of rail lines limited the development of coastal tourism during much of the nineteenth century. Entrepreneurs established hotels in Oregon's Newport and Seaside during the 1860s and 1870s, but railroad lines did not extend to Newport-bound ferries until 1885, and the first railroad did not arrive in Seaside until 1898 (Wells 2006b). Beginning in 1880, Henry Harrison Tinker established another important coastal vacation venue at the site of Lewis and Clark's famed winter camp. This area of Washington would subsequently develop into the community of Long Beach (Northwest Fisheries Science Center n.d.; Wells 2006b). Southern California's coastal community of Santa Barbara received an important endorsement by *New York Tribune* writer Charles Nordhoff, who visited the town in 1872 and extolled its virtues as a tourist destination and health retreat in *California—A Book for Travelers and Settlers.* The Southern Pacific extended a railroad line from Los Angeles to Santa Barbara by 1886 that significantly increased tourist visits. An even greater number of tourists would begin to visit Santa Barbara after 1901, when the Southern Pacific completed a line providing for service between the coastal town and San Francisco to the north (Caltrans 2010; Cole 2006).

Located on a long peninsula across the bay from San Diego, Coronado became a winter vacation spot for many well-to-do tourists from outside of California. Constructed in 1886 in the Queen Anne style, and establishing Coronado's main draw, the Hotel del Coronado was one of the largest wooden structures in the world and drew celebrities, presidents, and foreign dignitaries. In addition to constructing the hotel, the Coronado Beach Company laid out a grid of streets, wells, and parks. The area was accessed beginning in 1888 by the Coronado Railroad, which reached the resort from the land-enclosed south end of the bay. Although the southern California real estate boom of the mid-1880s turned to bust by the end of the decade, during the first quarter of the twentieth century Coronado would rebound and become one of the most exclusive residential districts in the San Diego area (Jones & Stokes 2007). Coronado's example of speculative tourist development leading to middle- and upper-class residential and vacation-home development would be repeated across the southern California coast and in some areas of the central California coast during the twentieth century. Vacation-oriented coastal enclaves farther afield from urban centers than southern California's would also be developed in northern California, Oregon, and Washington.

#### *4.2.1.4. The Pacific Coast and the Coming of the American Century, 1890s through the 1930s*

From the 1890s to the onset of World War II at the end of the 1930s, the United States became a global industrial and military power. Major ports and cities on the California coast grew rapidly during this period, and completion of the Panama Canal helped increase maritime shipping to and from west coast ports. Although San Francisco growth spread westward toward Ocean Beach as its population doubled from 342,000 to 634,000 between 1900 and 1940, the Bay Area's relatively mountainous coastline encouraged metropolitan growth in the inland valleys surrounding the interior bay shoreline. The still more rugged coastal regions of Oregon and Washington remained at a distance from those states' centers of urban growth. In southern California, however, and in Los Angeles in particular, population growth far surpassed any other coastal region of the three westernmost mainland states. Between 1900 and 1940, the population of Los Angeles County grew from 170,000 to 2,700,000, encouraging more and more development near and at the southern California coast (Lotchin 1992).

The Federal government invested heavily in the defense of California's port cities. The U.S. Navy expanded significantly during the 1890s to become a truly international force, and the Army assumed responsibility for defending the country's coasts and ports. In 1885, President Grover Cleveland established the Endicott Board to modernize coastal defenses. The board ultimately recommended new defenses at 22 U.S. seaports, and gave San Francisco second priority behind New York. Construction of new batteries around San Francisco began in 1891 and increased as the United States projected its growing power in the Western Hemisphere and the Western Pacific during the Spanish-American and Philippine-American Wars (1898–1902). The Army also developed batteries south of the San Francisco Presidio at Fort Miley and areas farther south, as well as north of the Golden Gate at Forts Baker and Berry. In southern California, the Army developed coastal defense batteries at Palos Verdes, the Fort MacArthur and White Point Military Reservations at San Pedro, and at Point Loma in San Diego (Berhow n.d.1, n.d.2; National Park Service 2012).

Just south of Point Loma, on the northern portion of the Coronado peninsula, the Navy established the Naval Air Station North Island (NASNI) in 1917. The site is known as the birthplace of naval aviation because the first Navy pilot, Lieutenant Gene Ellyson, trained there at a flight camp that predated the Naval Air Station. Several aviation feats, including the first midair refueling, also distinguish the site, which was home to the Navy's first aircraft carrier. NASNI has played a critical role the Navy's arsenal on the west coast since World War I, and the station's Rockwell Field Historic District is listed on the NRHP (Jones & Stokes 2007; Yatsko 1990).

Maritime transportation and trade remained critically important to the west coast economy during these decades and increased with completion of the Panama Canal in 1914, requiring construction of new lighthouses and maintenance of existing ones. Beginning in 1910 the Lighthouse Service replaced the Lighthouse Board. From 1891 through World War II, the government built or replaced 16 lighthouses in California, five in Oregon, and 14 in Washington (National Park Service 2001, 2006; Nelson and Nelson 2003). By 1914, 19 U.S. Life-Saving stations also dotted the coastlines of California, Oregon, and Washington. The following year, the newly created U.S. Coast Guard subsumed both the Life-Saving Service and the U.S. Revenue-Cutter Service. During prohibition, the Coast Guard assumed responsibility for policing the coast for illegal maritime shipments of liquor. In 1939 the Coast Guard took over the responsibilities of the Lighthouse Board. There are six NRHP-listed station complexes or buildings associated with the Life-Saving Service and the Coast Guard on the west coast: one in Washington at Klipsan Beach (1891); two in Oregon, one at Port Orford (1934) and another at Umqua River (1939); and two in California, one on Drakes Bay at Point Reyes (1927) and another on the north spit of the Samoa peninsula in Humboldt Bay (1936) (Delgado et al. 1985; Donovan and Kadas 1991; Kirk 1977; Linke and Dilkes 1983; Port Orford Heritage Society 1998; Weathers 1978).

From the 1890s through the 1930s, today's Port of Los Angeles began to take shape as a modern industrial harbor. In 1897, after a long battle against Colis P. Huntington of the monopolistic Southern Pacific Railroad—who wanted extensive harbor development to occur at Santa Monica—San Pedro's harbor promoters won Federal backing for further development. The Army Corps of Engineers dredged the inner harbor, and in 1899 the Corps began construction on a 9,250-foot segment of a new breakwater off San Pedro Point, which would be built to a length of 2 miles. In 1909 the harbor towns of Wilmington and San Pedro became districts within the municipality of Los Angeles. As the harbor's infrastructure expanded, the Federal government made provisions to defend it with a coastal artillery battalion at a military installation formally named Fort MacArthur in 1914. In addition to the Point Fermin Lighthouse, the Los Angeles Harbor Light Station, and two batteries constructed west of the harbor, two industrial buildings associated with the port and located within a mile of the coast are listed on the NRHP: The American Trona Corporation Building at Fort MacArthur (1916–1917), and the Municipal Warehouse No. 1 (1917) (Beland/Associates, Inc. 1984; Lassell 1999; Silka 1993).

Expanding maritime trade and the introduction and growth of automobile travel increased demand for oil. From the turn of the century into the 1920s, California distinguished itself as the leading oil-producing region in the world. Offshore oil drilling began in 1896 at the coastline of Summerland, just south of Santa Barbara. Summerland originally took shape as a spiritualist community. By 1899, oil and natural gas production had transformed Summerland into a focal point of commercial and industrial activity. Numerous wharves supporting rows of oil derricks stretched seaward from the Summerland shore. Soon coastal oil production spread south to Los Angeles and Orange Counties. During the oil boom of the 1920s, large concentrations of oil derricks came to dominate the shoreline landscapes of Huntington Beach and the area south of Venice known today as Marina Del Rey. In 1921 California enacted new regulations that provided for the leasing of tidal and submerged lands—then considered state property—for oil exploration and development. Well drilling in tidal zones continued to require wharves until after World War II. Although oil wharves and derricks comprised prominent features of the coastal built environment in parts of southern California during the early twentieth century, little or no trace of these features remains today. However, continued oil exploration and extraction would introduce new kinds of infrastructure to some areas of the southern California coast after World War II (Priest 2008; Yerkes et al. 1969; Williams 1996).

North of San Francisco, industrialized logging and fishing continued along the northern California, Oregon, and Washington coasts. New railroad lines, developed in these regions from 1890 through the first two decades of the twentieth century, helped facilitate travel and overland shipping in these regions. Rebuilding efforts following the San Francisco earthquake and fire of 1906 helped revive the logging and lumber-production industry after the economic depression of the 1890s. The industry continued to thrive through World War II. However, as railroad development provided more convenient access to the coast from inland population centers, and as more and more visitors traveled to the coast for scenic leisure and recreation, some people grew increasingly concerned about desolate clear-cut forests (Bearss 1982; BOAS 2007; Cox 1974; Oregon Coastal Zone Management Association 2012; Sullenberger 1980; Wells 2006b, 2006f).

During the first quarter of the twentieth century, multiple social movements associated with Progressive-era reform shaped aspects of the coastal built and natural environments by encouraging new responses to problems posed by extraction and commodification of natural resources, and new responses to a variety of social issues. Although influential Progressive-era conservationists such as William Kent and Gifford Pinchot disagreed with Progressive-era preservationists such as John Muir about how much of the natural environment should be protected from destructive resource extraction and development, a growing consensus of opinion insisted that at least some of it should be set aside. In 1901, the California legislature created the first of its state's parks, California Redwood Park. Within a decade, executive orders issued by President Theodore Roosevelt established the Monterey Forest Reserve and the Muir Woods National Monument, the latter encompassing lands donated by William Kent. Intensified logging during World War I led to creation of the Save-The-Redwoods League in 1918, which advocated for further preservation of natural landscapes in northern California and played a significant role in the establishment of the California State Parks Commission. The acquisition of lands for preservation within the emerging California State Parks system continued over subsequent decades. By the 1960s, over half a million people would visit California Redwood Park annually (Bearss 1982; Hyde 1994; Walters 1986).

Washington and Oregon followed similar courses. Washington created a State Board of Park Commissioners in 1913 and acquired its first park properties in 1915. Oregon also created a State Parks Commission and appointed Samuel H. Boardman as its first State Parks Superintendent in 1929. Thereafter, Oregon and Washington grew their park holdings substantially in response to people's increasing desire to visit scenic landscapes across the state. Washington added more than a dozen parks, and superintendent Boardman acquired 55,000 additional acres for Oregon's system, including large portions on the coast (Estrem 2011; Oregon State Parks 2012; Washington State Parks 2012; Wells 2006b).

In the wake of commercial overfishing in the late nineteenth century, the scientific element of the conservation impulse joined with Progressivist philanthropy in the creation of new marine science institutions. Stanford University president David Starr Jordan and wealthy railroad heir Timothy Hopkins established the Hopkins Seaside Laboratory in Pacific Grove in 1892. After the turn of the century, San Diego philanthropists Ellen Browning Scripps and E. W. Scripps funded development of new facilities for Dr. Fred Baker's oceanography operation at La Jolla Shores, which was formally named the Scripps Intuition of Oceanography in 1925. Constructed in 1909–1910 and designed by the reform-minded architect, Irving Gill, the institution's George H. Scripps Memorial Building is listed on the NRHP. In 1924, Ed Ricketts established the Pacific Biological Laboratories at Monterey's Cannery Row. Fire destroyed Ricketts' first laboratory in 1936, and the building, which was reconstructed at the same site in 1937, is now listed on the NRHP. Ricketts was a longtime friend of central California author, John Steinbeck, who invested money in the lab in 1939. In the novel *Cannery Row* (1945), Steinbeck based the character "Doc" on Ricketts (Charleton 1982; McEvoy 1987; Seavey 1994; Starr 1989).

Other aspects of Progressive-era reform in the United States also shaped the built environment in some coastal locales. The reform ethos fostered a new level of sociopolitical engagement and institutional development that included efforts to assimilate new immigrant populations through urban settlement houses and "Americanization" schools. It also encouraged increasing civic engagement among middle-class and more well-to-do women, many of whom were involved in the Young Women's Christian Association (YWCA) or joined local women's clubs devoted to self- and community improvement (McGerr 2003; Woloch 1994). Reformers and women's clubs constructed a number of historically important buildings and complexes along the California coast. In the San Diego area, for example, Irving Gill designed the proto-modernist Spanish Colonial Revival-style La Jolla Women's Club (1914–1916) and the Americanization School in Oceanside (1931), which combined emerging modernism with Art Deco and Islamic design elements. Both are listed on the NRHP (Kelsey 1993, Schaffer 1998). Other NRHP-listed coastal buildings and complexes associated with Progressive-era reform and civic activism include: the Asolimar Conference Grounds (1913-1928) in Monterey County's Pacific Grove, a Craftsman-style complex designed by architect Julia Morgan—the first licensed female architect in California—for the YWCA; the Women's Improvement Club of Hueneme (1915) in Ventura County; and the Women's Club of Redondo Beach (1922) in Los Angeles County (Charleton 1984a; Loranger 1983; Triem 1988).

During the last decades of the nineteenth century, locales such as Pacific Grove in Monterey County and Redondo Beach and Venice Beach at the shores of Los Angeles County's Santa Monica Bay had become centers of Chautauqua culture. Chautauqua culture promoted educational, morally edifying entertainment—lectures, plays, music—as a form of middle-class leisure. With an interurban rail line from downtown Los Angeles reaching Venice Beach via Santa Monica in 1896, Abbott Kinney sought to establish a Pacific coast Venice replete with canals, gondolas, Venetian architecture, and a Chautauqua meeting hall on the Santa Monica Bay. Although a portion of Abbott's vision survives today in the waterways that comprise the NRHP-listed Venice Canal Historic District (1905), new mass-cultural and more purely amusement-oriented forms of leisure and entertainment overtook the more refined Chautauqua culture on the Santa Monica Bay and elsewhere after the turn of the century (Bruce and Branan 1978; ICF Jones & Stokes 2010; Kasson 1978; Krintz 2009; Page & Turnbull 2011).

Denounced by some moralistic Progressive-era reformers, these new forms of mass-culture amusement—dance halls, music halls, cheap theaters, and amusement parks modeled on the example of New York's Coney Island—began to reach some California coastal areas after the turn of the century, particularly around Los Angeles. These new forms of recreation proved immensely popular and increasingly attracted visitors from across the class and ethnic spectrums. Adding to an existing recreational infrastructure of bath houses and hotels, promoters also built pavilions, theaters, and amusement parks or so-called "pleasure piers" that included carousels, rollercoasters, and other attractions. Santa Monica and Venice had southern California's first large pleasure piers, but coastal resort and amusement centers also took shape in Redondo Beach, Long Beach, Seal Beach, Newport Beach, San Diego's Mission and Ocean Beaches, and central California's Santa Cruz. A number of amusement-oriented buildings and structures from the early twentieth century are currently listed on the NRHP: the Looff's Amusement Pier Carousel Building (1916) in Santa Monica, the Balboa Pavilion (1906) and the Balboa Inn (1929) in Newport Beach, the Santa Cruz Beach Boardwalk Carousel (1911) and Roller Coaster ("The Big Dipper," 1924), and the Belmont Amusement Park Roller Coaster at San Diego's Mission Beach (1925). Beach clubs such as Santa Monica's NRHP-listed, Italian Renaissance Revival-style Club Casa del Mar (1926) also flourished in southern California during the 1920s and 30s (Charleton 1984b, 1984c; Ciani and Ciani 1978; ICF Jones & Stokes 2010; Krintz 2009; McAvoy 1999).

Other coastal locales maintained an image of refinement and exclusivity that contrasted with the democratic commercialism of the mass-culture amusement centers. At the northern end of southern California, Santa Barbara became a preferred destination of affluent winter residents and tourists who arrived by private railroad cars, swelled the local population, and stayed at new posh hotels such as the Arlington or Wentworth. Constructed in the Mission Revival style, Santa Barbara's NRHP-listed Southern Pacific Railroad Depot building was completed in 1905. As with the Hotel del Coronado, hotels such as the Arlington and Wentworth stimulated a desire in some well-to-do visitors for permanent residence in Santa Barbara. After much of the city's building stock was destroyed by an earthquake in 1925, local planners ensured that the entire downtown was reconstructed in the Spanish Colonial Revival style. This effort offers an example of the early twentieth-century City Beautiful movement influencing development on the coast. Plans inspired by the City Beautiful movement and commissioned for parts of other California cities expressed a desire for unified, orderly, and aesthetically pleasing architectural and planning visions. Other municipalities never implemented or only partially implemented their commissioned City Beautiful plans. In Santa Barbara, however, City Beautiful planning resulted in development of post-earthquake design guidelines that the municipal government successfully implemented and enforced. Most of Santa Barbara's NRHP-listed buildings and structures located within a mile of the shore exhibit the Spanish Colonial Revival style and were constructed after the 1925 earthquake. These include the reconstructed Virginia Hotel (1925), the Andalucia Building (1926), the Janssens-Orella-Birk Building (1927), the Santa Barbara County Courthouse (1929), and the Los Banos Del Mar bathhouse and associated Moderne-designed enclosed pool (1939) (Bryton et al. 1987; Conrad et al. 1992; Mikesell and McMorris 1999; Ooley et al. 2004; Starr 2005; Wheeler 1999).

Like Santa Barbara, some other coastal communities in California grew increasingly exclusive during the three decades prior to World War II. Monterey County's Carmel maintained an image of refinement as an artists' and writers' community and a scenic getaway for urban professionals and business elites. It grew increasingly elite thanks to rising real estate values and good planning. Initially a San Diego-area coastal getaway attracting artists and intellectuals, La Jolla evolved into a community of beach cottages and Craftsman bungalows. It grew increasingly exclusive during the 1920s and 1930s as architect-designed homes, many in the era's revival styles, multiplied across the landscape (Heumann et al. 2008; Jamison 1985; McClain 2011).

In smaller private planning endeavors, developers created new coastal villages based on the types of comprehensive plans advocated by the City Beautiful movement and implemented by Santa Barbara. During the 1910s, Samuel F. B. Morse set into motion the development of Pebble Beach as a planned resort community for wealthy and upper middle-class residents. Morse's plan incorporated the famous Pebble Beach Golf Links to function as the main recreational draw and as a waterfront greenbelt that would preserve open views of the coastlines. Plans for individual homes required review by a board of architecture that enforced a Mediterranean design vision of Spanish Colonial, French Provencale, or Italian- or Moorish-styled homes. The area came to be known as the Riviera of California (JRP Historical Consulting, LLC 2010).

At the southern end of the Orange County coast in southern California, Ole Hanson led a group of investors in developing a comprehensively planned recreational beach town on the Santa Fe Railroad line: San Clemente. Here too, Spanish Colonial Revival–style architecture was enforced through community-wide design guidelines and planning review established by architects J. Wilmer Hershey and Virgil Westbrook, hired by Hanson for their experience planning Santa Barbara's reconstruction following the 1925 earthquake. Today the city's Hotel San Clemente (1927), Ole Hanson Beach Club (1928), Casa Romantica (1928), Goldschmidt

House (1928), and Easley Building (1929) are listed on the NRHP; and the San Onofre Inn (1928) has been determined eligible for listing on the NRHP (Historic Resources Group 2006). These and other coastal communities in southern California, on central California's Monterey peninsula, and in San Francisco's Sea Cliff and westernmost districts, have retained high concentrations of homes from the pre–World War II decades of the twentieth century that qualify as locally designated historical resources. As such, many are eligible for or listed on the California Register of Historical Resources (CRHR), and many are doubtlessly eligible for but not listed on the NRHP at this time.

Santa Monica and coastal locales in Orange County were home to some of California's earliest buildings associated with the Modernist movement in architecture. Completed in 1919, Irving Gill's NRHP-listed Horatio West Court apartment complex near the beach in Santa Monica featured flat roofs, rectilinear masses, and historical references limited mainly to entry and walkway arches free of ornamental elaboration. This and other Gill buildings influenced Viennese émigré architects R. M. Schindler and Richard Neutra, both of whom designed important early Modernist buildings in southern California. One of the most noteworthy of these is Schindler's NRHP-listed Lovell Beach House in Newport Beach. "In its abstraction of form and clear structure and enclosing membranes," writes architectural historian Leland B. Roth, "the Lovell beach house is equal to anything the [contemporaneous] champions of Modernism were doing in Europe" (McCoy 1973; Roth 2001: 392–393).

The Oregon and Washington coasts also retain historically significant residential properties dating to the period between 1890 and World War II. During this period, homes built on the coasts of both states frequently served as vacation residences or weekend getaways, but also as year-round residences in some cases. Around the turn of the century, southern Washington's Long Beach promoted itself as an ideal vacation and retirement enclave of rustic cottages for genteel Portland residents. In the Seaview community of southern Long Beach, both the Peter Schulderman House, a Victorian summer cottage constructed in 1894, and the Shelbourne Hotel, constructed from 1896 to 1904 and moved to its current location in 1911, are listed on the NRHP (Campiche 1978; Garfield and Gillespie 1988).

Oregon's Seaside, which first received railroad passengers from Portland in 1898, had by then already established itself as a quaint coastal tourist and vacation destination. By 1900, however, the community was accommodating 5,000 to 10,000 summer visitors annually. Seaside grew dramatically during the first two decades of the twentieth century and retains a high concentration of Craftsman-style bungalows. Three of the community's Craftsman-style homes within a mile of the shore are listed on the NRHP: the William and Nellie Fullam House (1904), the Charles Preston House (1920), and the Haller-Black House (1925) (Koler et al. 1991a, 1991b, 1991c). Railroad access also gave birth to the small coastal community of Neahkahnie. Located south of Seaside and north of Manzanita, Neahkahnie became a genteel coastal retreat beginning in the 1910s. There, architect A. E. Doyle created a number of organically styled Arts and Crafts cottages influenced by Craftsman bungalows, local vernacular buildings, Japanese architecture, and English cottages. Constructed by a local builder, these cottages had a major influence on architects who developed a regionally distinctive Northwest style during the 1930s. Three surviving Doyle cottages at Neahkahnie are listed on the NRHP: the Mary Frances Isom Cottage (1912), the A. E. Doyle Cottage (1915), and the Wentz Studio/Bungalow (1916) (Hartwig and Powers 1974; McMath 1990a, 1990b).

Another NRHP-listed early twentieth-century residential complex on the Oregon coast is located at Cannon Beach. There, beginning in 1913, Oregon Governor Oswald West developed what would come to be known as the Oswald West Coastal Retreat, which included an Adirondack log house that a fire destroyed in 1991. A Progressive-era reformer who supported women's suffrage, West also famously secured public access to Oregon beaches by pushing through legislation declaring them public highways. In this and other ways, West helped establish the basis for development of the system of highways and parks that would increase access to the Oregon coast while also preserving it as scenic public space (Drake 1995).

With the introduction and steady rise in automobile travel during the first three decades of the twentieth century, the effort in Oregon to develop a coastal highway proved critical to public enjoyment of the Oregon coastline over the long term. Ben Jones, a longtime advocate of coastal road development after working for years as a coastal mail carrier, wrote the first bill authorizing the Oregon Coast Highway in 1919 as a State Representative. Begun by 1921, the Oregon Coast Highway (today's Highway 101) would also become part of the west coast's Roosevelt Highway, named in honor of President Theodore Roosevelt. The Oregon Coast Highway required construction of numerous bridges to span coastal rivers and creeks. With five large rivers yet to be spanned, progress stalled due to funding losses during the Great Depression. In 1933, Franklin D. Roosevelt's New Deal initiated Federal funding of infrastructure projects in the region. In 1934, the Oregon State Highway Commission began receiving Federal funding and completed all the remaining Coast Highway bridges by 1936, including the steel-truss and reinforced-concrete-arch Yaquina Bay Bridge designed by Oregon State Highway engineer Conde McCullough. The Yaquina Bay Bridge and five other bridges located within a mile of the Oregon shore are listed on the NRHP: Cape Creek Bridge (1932), Rocky Creek Bridge (1927), Ten Mile Creek Bridge (1931), Big Creek Bridge (1931), and Cape Creek Bridge (1932) (Hadlow 2004; Husing 2008; Oregon Department of Transportation n.d.).

Important scenic highway and other transportation development also occurred along the California coast during this period. The southern California portion of the Roosevelt Highway opened in 1920, and in 1929 road workers completed the highway's final scenic Malibu segment linking Ventura County and Santa Monica (known today as Pacific Coast Highway). Well acquainted with the pristine Big Sur coastline south of Carmel, a destination of artists and nature lovers for decades, Dr. John L. Roberts and State Senator Elmer S. Rigdon launched a successful lobbying campaign for approval of a scenic highway from the Monterey Peninsula south to San Simeon. Delayed by World War I, construction of the Big Sur segment of the Roosevelt Highway (today's Highway 1) began in 1922 with state and Federal funds. The State Division of Highways arranged for convict laborers to perform manual unskilled work on the project, while free workers performed the skilled labor, supervised convicts, and operated mechanical equipment. John Steinbeck worked on the highway, which would include 33 major bridges between Carmel and San Simeon, including the famous spandrel concrete-arch Bixby Bridge, built in 1932. Bixby Bridge is listed on the NRHP, and six of the highway's additional concrete-arch bridges in Monterey County have been determined eligible for the NRHP: Big Creek Bridge (1938), Rockey Creek Bridge (1932), Garrapata Creek Bridge (1931), Granite Canyon Bridge (1932), Malposo Creek Bridge (1935), and Wildcat Creek Bridge (1933) (Longfellow 2011; Masters 2012; Mikkelsen et al. 2001).

Today Highway 1 terminates at San Francisco's Golden Gate Bridge, arguably the most well-known bridge in the United States. Engineered by Charles Ellis and architecturally appointed with Streamline Moderne and Art Deco elements by Irving Morrow for the Strauss Engineering Corporation and the Golden Gate Bridge and Highway District, the Golden Gate Bridge was constructed between 1933 and 1937. "Soon [after], the Golden Gate Bridge, like the Brooklyn Bridge, asserted itself as an icon of American civilization" (Starr 2005: 187). Incorporating the famous bridge, the Presidio of San Francisco National Historic Landmark District, and the Fort Point National Historic Site, the Golden Gate landscape is one of the most frequently visited tourist destinations on the west coast. Since the bridge's completion in 1937, millions of people have crossed it on foot or on bicycle to experience the breathtaking 360° views. The Golden Gate Bridge is the most important historical resource constructed on the west coast during the period between 1890 and World War II.

#### *4.2.1.5. The Pacific Coast During and after World War II*

During and after World War II, military activity made San Diego a major west coast center of defense training, production, and infrastructure. In Coronado, a small building boom took place during World War II to accommodate the large numbers of war-plant personnel living on the island. Small industrial facilities and feeder plants appeared, and an amphibious training base was established south of the Hotel del Coronado (Jones & Stokes 2007). Solidifying San Diego's growing reputation as a Navy town in 1942, the Federal government established Camp Pendleton, an advanced Marine Corps training center developed on northern San Diego County's 122,798-acre Rancho Santa Margarita y Las Flores. In 1944, Camp Pendleton was declared a permanent installation, and during the Korean War the government expanded its facilities to accommodate the tens of thousands of troops processed and trained there (U.S. Marines n.d.). San Diego also became an early center of aircraft production in addition to its distinction as the home to much of the U.S. Navy's Pacific Fleet. The naval presence combined with growth in the aircraft industry led to a massive population influx during World War II (Walters 1986).

World War-II and Cold-War military development also shaped coastal locales farther north. The Navy based its west coast construction corps (the Seabees) at Port Hueneme in Ventura County. Santa Monica became a densely populated area with a commercial core and an industrial base increasingly geared to defense. Federal defense contracts stimulated the growth of Douglas Aircraft, one of Santa Monica's largest employers and economic engines. During the war, the San Francisco Bay Area became the premier military command and embarkation center on the west coast. Apart from modernization of San Francisco Bay's coastal defense fortifications, however, most the Bay Area's military development took place east of the coastline. Cold-War defense spending played an important role in the economic growth of California urban centers following World War II. Numerous job opportunities in the aerospace, defense, and shipping industries boosted the populations of Los Angeles County and the San Francisco Bay Area. At one point, Los Angeles County alone had more than 40 percent of all aerospace jobs in the nation (ICF Jones & Stokes 2010; Rawls and Bean 2003; Starr 2005).

In 1957 the Secretary of Defense established Camp Cooke Air Force Base approximately 10 miles north of Point Conception, located at the southern end of the central California coast. In 1958 the Air Force formally renamed the installation Vandenberg Air Force Base. That same year the Army transferred a portion of Camp Cooke to the Navy for establishment of the Naval Missile Facility at Point Arguello, which the Department of Defense transferred to the Air Force in 1963. Vandenberg's Space Launch Complex 10 is listed on the NRHP. It was developed in 1958 by Douglas Aircraft Company for training launches of the SM-75 THOR

Intermediate-Range Ballistic Missile (Mondl 1986; U.S. Army Engineer Research and Development Center and National Park Service 2002).

Tourism and recreation became increasingly important to the coastal economies of Oregon and Washington as logging came under new restrictions and timber processing industries declined. The region's logging and wood products industries never regained the momentum they lost during the Great Depression of the 1930s. Beyond forested areas protected by state parks, however, a long history of unchecked harvesting left many old-growth forests decimated and many hillsides barren. This prompted the development and implementation of modern forest management practices. The Forest Practices Act of 1946 required reforestation and harvest management in an effort to stabilize forest resources and the timber industry at large. Competition from Japan's government-subsidized mills reduced Washington's wood-processing capacity by 40 percent between 1965 and 1975 (Van Syckle 1980; Wilma 2006).

New measures helped preserve forest landscapes along the coast and elsewhere in the Pacific Northwest. In 1953, Washington added a strip of coastal lands to Olympic National Park, established in 1938. Unlike forested areas protected for their value as landscapes and as commodifiable timber resources under Progressive-era conservation policies, the National Park Service preserved Olympic National Park exclusively for the value of its scenic natural features. Olympic National Park has since been designated a Biosphere Reserve and World Heritage Site by the United Nations Educational, Scientific and Cultural Organization (National Park Service 1990, 2003). Washington and Oregon's state park systems continued to grow after World War II. Succeeding Boardman as State Parks Superintendent in 1950, Chester Armstrong turned Oregon's focus from acquisition to construction. Making improvements to the parks already in place, Armstrong added facilities to improve accessibility, and succeeded in raising Oregon's state park attendance to sixth in the nation. Washington increased funding to its system, expanded park landholdings in the 1950s, and worked to improve and build new park facilities during the following decade (Estrem 2011; Washington State Parks 2012).

Highway development had fueled major coastal bridge construction in Monterey County, the San Francisco Bay Area, and Oregon prior to World War II, but the Pacific coastline's two most important post-war bridges were developed in southern California. For over a century, ferry service provided the sole means of crossing the main channel of the Los Angeles Harbor. The harbor's continued growth led to plans for development of a bridge across the channel, and the Vincent Thomas Bridge was completed in 1963. Named for Assemblyman Vincent Thomas of San Pedro, it is the third-largest suspension bridge in California, after the Golden Gate and San Francisco Bay Bridges (Port of Los Angeles 2013). Another important bridge was developed in San Diego during the late 1960s. Since the nineteenth century, Coronado's visitors and residents had to use ferries or a roundabout rail line to travel to and from the growing peninsular community. San Diegans and tourists got a direct traffic link across the bay with completion of the San Diego–Coronado Bay Bridge in 1969. The bridge was designed to reach 200 feet at its highest point in order to provide for passage of tall U.S. Navy ships (Jones & Stokes 2007).

Southern California coastal communities such as Long Beach and Santa Monica became increasingly dense, urbanized areas within a mile of the shoreline by the post-World War II period. In Santa Monica, to accommodate the demand for housing caused by a flood of returning veterans after the war and new employees for the defense industry, older buildings began to be replaced by multi-story apartment buildings. One of the most distinctive of these was the

Dingbat, with vernacular modern design elements. Newer modern buildings increasingly shared urban space with older buildings designed in the Regency and Spanish Colonial Revival styles. The Santa Monica Civic Auditorium was constructed in 1958 and hosted a variety of public events, including concerts and screenings of surfing movies by filmmakers such as Bud Brown and Jim Freeman (ICF Jones & Stokes 2010).

In post-war southern California in particular, but also in other parts of the state to the north, surfing grew increasingly popular. The sport became a leading form of coastal recreation and an iconic symbol of California in popular culture. Hawaiian waterman George Freeth had introduced stand-up board surfing to southern California in the first decade of the twentieth century while training lifeguards in modern rescue techniques. But the sport exploded in popularity amid the increasing affluence of the post-war decades thanks in part to popular films such as *Gidget* (1959) and the groundbreaking surfing documentary, *Endless Summer* (1966). By the time *Endless Summer* was released, surfers had created well-established local communities around premier surfing spots in San Diego County, San Onofre, and San Clemente; across the beaches of Orange County; in Palos Verdes; along the beaches of the Santa Monica Bay; farther north in Malibu, Ventura, and Santa Barbara; and still farther north in the colder but wave-rich waters of Santa Cruz and San Francisco. Surfing equipment and cultural production has become a multi-billion dollar industry. Many surfing spots in California have been destroyed by development of harbors or other coastal infrastructure, though in some cases such development has created new surfing spots. Forming the longest concrete municipal pier when completed in 1930, Orange County's NRHP-listed Huntington Beach Municipal Pier and adjacent beach have accommodated spectators during major amateur and professional surfing contests for decades. Although subject to ongoing controversy, the surfing spots comprising Trestles, located at the shore of San Onofre and southeast San Clemente, have recently been nominated for the NRHP as a historic district. If this effort is successful, other premier surfing spots will likely be added to the NRHP in coming decades (Donaldson and Cain 2011; Verge 2001; Whitney-Desautels 1989).

During the post-war period, wealth gravitated to the coasts of southern and central California, and later to areas north of San Francisco. Coastal living became a sign of elite status, and property values soared in areas such as Coronado, Point Loma, La Jolla, Del Mar, coastal southern Orange County, Palos Verdes, the Santa Monica Bay, Malibu, Santa Barbara, Carmel, Pebble Beach, and Pacific Grove. In many of these places, the architect-designed homes of the elite featured the latest in post-war Modern style, as did some non-residential buildings. Designed by Frank Lloyd Wright Jr., son of the preeminent American architect, Frank Lloyd Wright, the NRHP-listed Wayfarers Chapel in Palos Verdes (1951) embodies the organic branch of Modernist design in its integration with its immediate natural surroundings, bold geometry, and its use of natural redwood, stone, and an abundance of glass. In northern California, a distinctively coastal design project helped create a new architectural style known as the Third Bay Region or Modern Shed style. Designed by Charles W. Moore, William Turnbull, Jr., Donlyn Lyndon, and Richard Whitaker, Condominium 1 (1965) combined Modernism with the vernacular forms of wind-weathered northern-California coastal barns and other buildings, in an arrangement that made the building an integral feature of its shore-bluff site. The NRHP-listed Condominium 1 served as the architectural prototype for development of the Sea Ranch community on the Sonoma County coast north of the site, which proved nationally influential during subsequent decades (Carlson 2004; Tafel 2004). Today, as coastal architect-designed residences and other buildings in various Modern styles reach or surpass the age of 50 years, more and more are likely to be considered historically significant.

Amid rising demand for energy and the United States' increasing dependence on oil imports during the Cold War, public policy regarding coastal resources became the subject of increasing contention between longstanding preservationist and development-oriented constituencies in the state. Measures instituted to meet rising energy demand came into conflict with the increasing value accorded to coastal homes, communities, lifestyles, and natural coastal landscapes.

Oil development in coastal southern California became a focus of these competing concerns during the 1960s. Before then advances in drilling technology had included the first well developed in open water in 1938 and the first well developed out of sight from land in 1947, both in the Gulf of Mexico. In 1953, after decades of conflict involving federal and state authority over offshore resources, under the Submerged Lands Act the Federal government quitclaimed the belt of submerged lands within 3 miles of the coastline to states, and preserved Federal claims over submerged lands seaward beyond the 3-mile coastal belt. Also passed in 1953, the Outer Continental Shelf Lands Act empowered the Secretary of the Interior to grant mineral leases on the outer continental shelf, the area beyond the 3-mile coastal belt of submerged lands quitclaimed to states. In 1958 California's first open water drilling took place from the platform Hazel in the Santa Barbara Channel's Summerland Offshore oil field. In 1968 extraction efforts in the Santa Barbara Channel yielded 22.9 million barrels of oil. In 1969, 925 wells operated along the California coast under state and Federal leases. On January 29 of that year, a blow out on Union Oil Well A-21 off the Santa Barbara coast resulted in the release of 235,000 gallons of petroleum. The 800-mile-long slick created by the spill polluted beaches as far south as San Diego. The California State Lands Commission responded by issuing a moratorium on leases for new drilling on submerged state lands (Priest 2008; Yerkes et al. 1969; Williams 1997).

The spill helped galvanize support for passage of landmark legislation at the Federal and state level requiring formal review of actions that stand to affect the environment, including the 1969 National Environmental Policy Act, the 1970 California Environmental Quality Act, and the 1972 Coastal Zone Conservation Initiative, or Proposition 20. Charting a moderate course between the extremes of environmental and free-market radicalism, this legislation helped regulate further development as the nation confronted the energy crisis of the 1970s. Despite ongoing opposition to offshore drilling, oil platforms have become a familiar site off the coastlines of Santa Barbara and Ventura Counties, San Pedro and Long Beach in Los Angeles County, and Seal Beach and Huntington Beach in northern Orange County. Oil companies also developed coastal refineries and refined products terminals in these areas (California Energy Commission 2013; Williams 1997).

Since the landmark environmental legislation of the late 1960s and early 1970s, often competing demands for development and protection have led to new forms of coastal resource management. In 1976 the state legislature created the California Coastal Commission, empowering it with discretionary review over proposed coastal development and giving it responsibility for maintaining reasonable public access to the California coastline. Passed in 1982, the Federal Oil and Gas Management Act created the Minerals Management Service (MMS), which was charged with protection of Federal lands and management of oil and gas development at the outer continental shelf. In 2010 the MMS was renamed the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE). Over the next two years, the

Office of Natural Resource Revenues (ONRR) split from BOEMRE, which was subsequently divided into the Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE). BOEM manages development of Federal offshore resources in compliance with environmental and safety regulations enforced by BSEE (Rawls and Bean 2003; BOEM 2013a, 2013b).

In Oregon and Washington, nuclear energy sources were developed at inland locations, but in California energy companies built commercial nuclear reactors at three sites along the California coast beginning in the 1960s. Pacific Gas and Electric Company (PG&E) produced California's first commercial nuclear energy at Humboldt Bay, where a 60,000-kilowatt (kW) reactor began generating power along with two steam plants in 1963. California's first large-scale reactor (at 435,000 kW) was built beginning in 1964 and was the first of three reactors constructed by Southern California Edison at San Onofre, located just south of San Diego County's border with Orange County. The reactor began producing power in 1968. San Onofre's large spherical concrete containment buildings have become a coastal landmark for travelers on Interstate 5. PG&E completed a nuclear plant at Diablo Canyon near San Luis Obispo County's Avila Beach in 1973. However, the discovery of a nearby offshore fault, subsequent seismic upgrades to the facility, and growing concern about the safety of nuclear energy nationally delayed power generation at the plant for more than a decade. After the nuclear accident at Pennsylvania's Three Mile Island in 1977, Diablo Canyon became a focal point of anti-nuclear protest. Over 40,000 people demonstrated at Avila Beach against the Diablo Canyon plant months after the Three Mile Island accident. In 1981, over 1,900 people were arrested during a 14-day blockade of the plant. Nuclear power continues to be a subject of debate, and faulty tubes in the San Onofre Nuclear Generating Station's steam generator system recently led Southern California Edison to announce that plant's permanent shutdown. Diablo Canyon is now California's sole operating nuclear power plant (Sewell 2013; Williams 1997).

### 4.2.2. Coastal Built Resource Types

Coastal settlement patterns were influenced by topography and climate and are most concentrated in central and southern California. The majority of built resources within the study area date from the nineteenth and twentieth centuries; the few that date from the eighteenth century, such as California Missions, are rare and therefore are considered especially sensitive to adverse impacts. There are also TCPs that can date from before European contact.

Residential buildings make up the bulk of the properties in the study area, but there are also a number of commercial, agricultural, recreational, industrial, and military built resources and designed landscapes that illustrate equally important components of development. All of the historic properties presented here are within the study area and most are listed on the NRHP. All property information was found on the NRHP online database, unless otherwise specified. These properties were selected because they have been established as historically significant based on their architectural style, their association with historically significant individuals, and/or their association with important historic events or trends. They are also representative of their regions and their associated historic periods.

The majority of the following photographs of historic properties were reproduced from their NRHP nominations or from the Historic American Building Survey/Historic American Engineering Record (HABS/HAER) archived in the Library of Congress. Consequently the photographs were taken as early as 1975, with the majority taken in the 1990s. All properties were reviewed using Google Earth Pro contemporary aerial and street-view photography. All are found to be extent, and the majority appears to be unaltered, with some restored, since being photographed for the NRHP or HABS/HAER. Of note is Red Rest Cottage in La Jolla, California; it and its companion property, Red Roost, have significantly deteriorated since their listing on the NRHP in 1975.

#### *4.2.2.1. Residential*

Residential properties dating from early European settlement efforts are rare resource types, but some remnants exist from the eighteenth and early nineteenth centuries. Residential buildings on the Ranchos in California were simple single-story buildings constructed of adobe and roofed with tile, identical with those built in Mexico. The eaves were broad to protect the material from damaging rain and help the thick walls moderate hot and cold temperatures. The first architectural style to evolve in California was the Monterey Colonial Style. The Thomas Larkin house, considered to be the first home constructed in this style, (Figure 28), was built in Monterey in 1835. It is a two-story building framed in heavy timber that supports its second floor; the walls are adobe. As with earlier adobe construction, the roof was designed with deep eaves to protect the walls. A wrap-around veranda supports the extended eaves. The Rotchev House (Figure 29), a heavy timber-frame vernacular building, built ca. 1836, is the only extant home that was part of the original Russian settlement of Fort Ross in northern California, established in 1812. Other than those first built within the Fort Ross compound, wooden buildings did not appear in California until the 1830s. In the heavily forested Pacific Northwest, pioneer settlements during this period primarily consisted of rustic log cabins or simple wood-frame structures.

Figure 28. Thomas Larkin House, 1835, Monterey, California (National Historic Landmark # 66000215). Prototype for the Monterey Colonial style of architecture (From California Department of Parks and Recreation 2013a).

Figure 29. Rotchev House, ca. 1836, Fort Ross Historic District, Jenner, California (National Register # 66000239). This heavy timber-frame vernacular home is a rare example of a building associated with early European settlement in California (From Roundtree and Xie 2011).

With the California Gold Rush came the construction of lumber mills and an influx of, among others, tradesmen, skilled carpenters, and some architects. Along the entire west coast, small-scale coastal communities were established, often formed around industrial activities, such as fishing or timber. Mid-nineteenth century residences were small-scale single-family properties constructed in a vernacular or rustic manner without formal plans. The Whalers' Cabin (Figure 30), ca. 1850 in Carmel, is an example of this rustic style. Residential styles known in the eastern United States and Europe were quickly adopted, with the majority of construction remaining modest in scale. Design handbooks popular throughout the U.S. initially focused on Classical and Gothic Revival styles. The vertical form of the Italianate style followed.

Figure 30 . The Whalers Cabin, ca. 1850, Carmel, California (National Register # 07000406). Vernacular rustic style residence dating to the Gold Rush period. Image courtesy of the Point Lobos Foundation (2013).

As the nineteenth century progressed and manufacturing capabilities advanced, architectural styles evolved. The last three decades saw the enthusiastic adoption of Victorian styles with their ornate and generally machine-made decorative details. These styles include Queen Anne, Stick, Eastlake, Richardson Romanesque, Shingle, and Renaissance Revival. These styles can be found concentrated in communities on the west coast, such as Pacific Grove and Mendocino, both in California. The Queen Anne Wills/Shaw House in Gearhart, Oregon (1890) and Peter Schulderman House in Long Beach, Washington (ca. 1890) are examples of coastal summer cottages of this era, as is the three-story Peter Gano House (Figure 31) on Santa Catalina Island (1890). Carmelita Court Cottages (Figure 32), on Beach Hill in Santa Cruz, is a collection of six small Victorian wood-framed cottages built between 1866 and 1888. Builders of rural and small town residences generally applied features of these popular styles to otherwise vernacular and generally modest homes. Grand homes designed in these styles could be found in larger cities, such as San Francisco; large residential estates along the Pacific coast were also built for captains of industry, such as the 1882 Classical Revival James Kenny House (Figure 33) in Cuffey's Cove, south of Mendocino. (Scantlebury 2004)

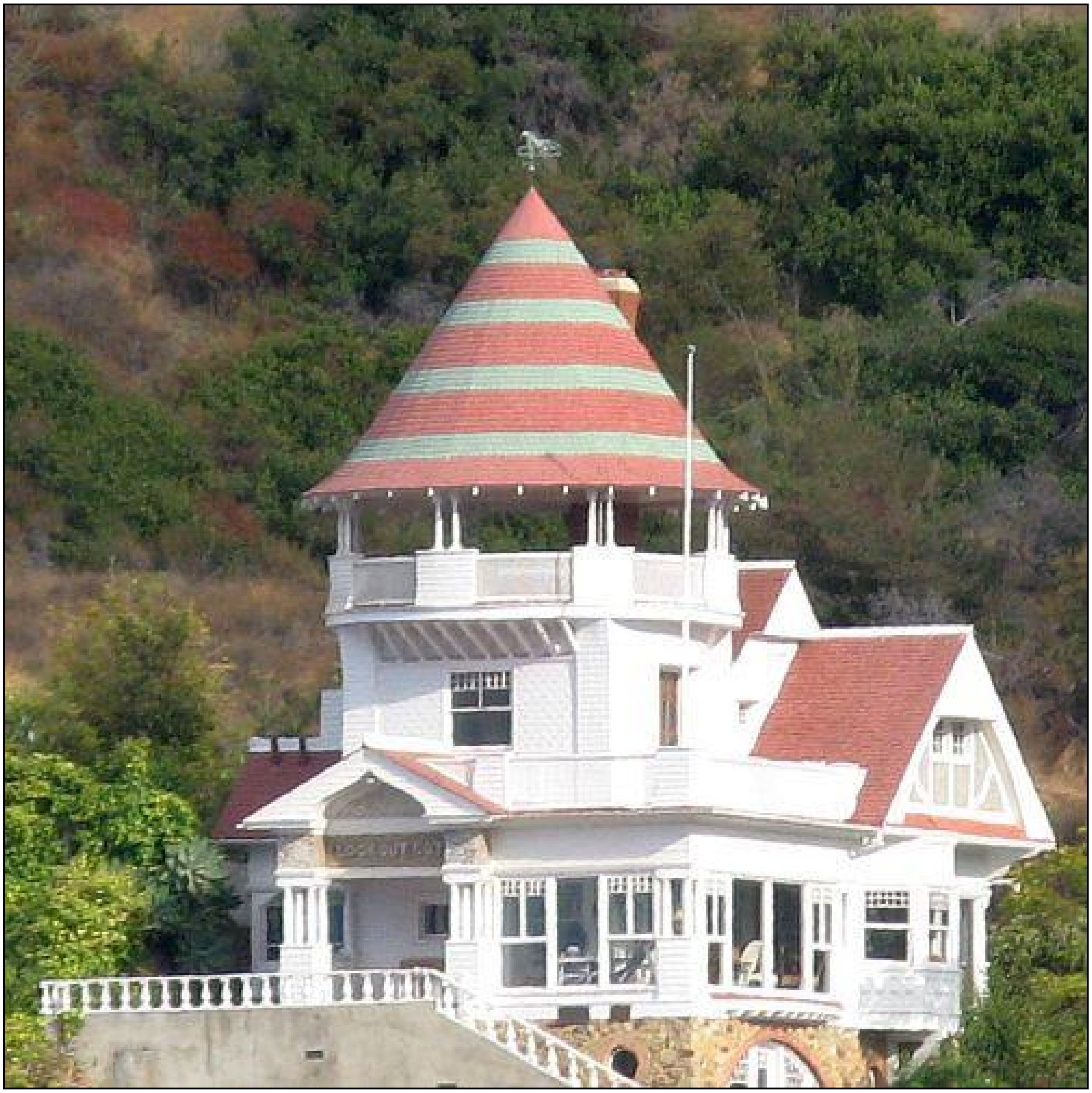

Figure 31. Peter Gano House, 1890, Santa Catalina Island, California (National Register # 83001194). This example of a late-nineteenth-century coastal summer cottage exhibits the Queen Anne/eclectic styles of architecture. Image courtesy of Catalina Realtors. (2013)

Figure 32. Carmelita Court Cottages, 1866–1888, Santa Cruz, California (National Register # 86000456). One of six Victorian cottages in the Carmelita Court Historic District. Image courtesy of NoeHill.com (2013).

Figure 33. Kenny House, 1882, Cuffey's Cove, Elk, California (not yet listed on National Register). Classical Revival style house built for early pioneer, businessman, and landowner, James Kenny. Note the small house in the back. This earlier building, now a kitchen, may have been moved here from the no-longer extant town of Cuffey's Cove (From Scantlebury 2004: 1).

The 1893 World's Columbian Exposition in Chicago introduced the Mission style, which became popular along the west coast, particularly in California. The style was interpreted in a more Mediterranean theme, with the application of Moorish towers and round arches. This style was popular from about 1915 to the late 1930s, and was applied in all scales to both residential and commercial buildings. Grand, often architect-designed residential examples in California include the Adamson House on Malibu Lagoon, a ca. 1920 Moorish/Mediterranean-style estate on 10 acres of designed Mediterranean-influenced landscape on former sand dunes; the 1930-built Villa Francesca in Palos Verdes, a Mediterranean-style estate perched on a bluff overlooking the Pacific Ocean; the Spanish Colonial Revival Canfield-Wright home (Figure 34) built in 1910 on the highest point of a sloping lot in Del Mar, maximizing the ocean view; and the Julia Morgan–designed Hearst Castle in San Simeon (1919–1947). The style was also adopted for multiple-family residences, such as the Venetian Court Apartments (Figure 35) in Capitola, a three-tier, five-building complex built in 1925 on the edge of the beach; and the Heilman Villas in Coronado, a Mission Revival bungalow court built in 1922. The five-story Charmont Apartments in Santa Monica (1928) is an example of a transitional style of this architecture, a combination of Spanish Colonial Revival with Art Deco elements. Additional and eclectic period revival styles became popular along the west coast and throughout the U.S. for residential architecture during the first half of the twentieth century. Past styles of many regions were incorporated into all scales of domestic architecture. These included Neo-Classical, English Tudor, American Colonial, and Italian Renaissance. An example of Colonial Revival is the William Wrigley, Jr. Summer Cottage, a large residential and garden complex on Santa Catalina Island. Also called the "summer White House," this estate is perched 350 feet above the ocean and was often visited by Presidents Coolidge and Hoover.

Figure 34. Canfield-Wright House, 1910, Del Mar, California (National Register # 2001747). An example of the Spanish Colonial Revival style of architecture. Photographed in 2003 (From National Park Service 2004).

Figure 35. Venetian Court Apartments, 1925, Capitola, California (National Register # 87000574). An example of the Spanish Colonial Revival style adopted for multiple-family residences. Photographed in 1986 (From National Park Service 1987a).

At the beginning of the twentieth century another architectural ideal developed, largely as an opposing response to the highly elaborate machine-made architectural elements prevalent in the preceding decades. The Craftsman bungalow was the antithesis of the Victorian architecture; honesty of materials and function was the impetus behind the new style. Exposed structural timber and stone foundations were constructed into visually horizontal planes. The style was well suited to the west coast, with the building materials readily available. An early example of the Craftsman style is the 1894-built Red Rest Cottage (Figure 36) a modest Craftsman style bungalow in La Jolla's Cove Beach. Grander craftsman examples include the Warren Wilson Beach House (Figure 37) built in Venice in 1911 and Irving Gill's Marston House in San Diego (1905).

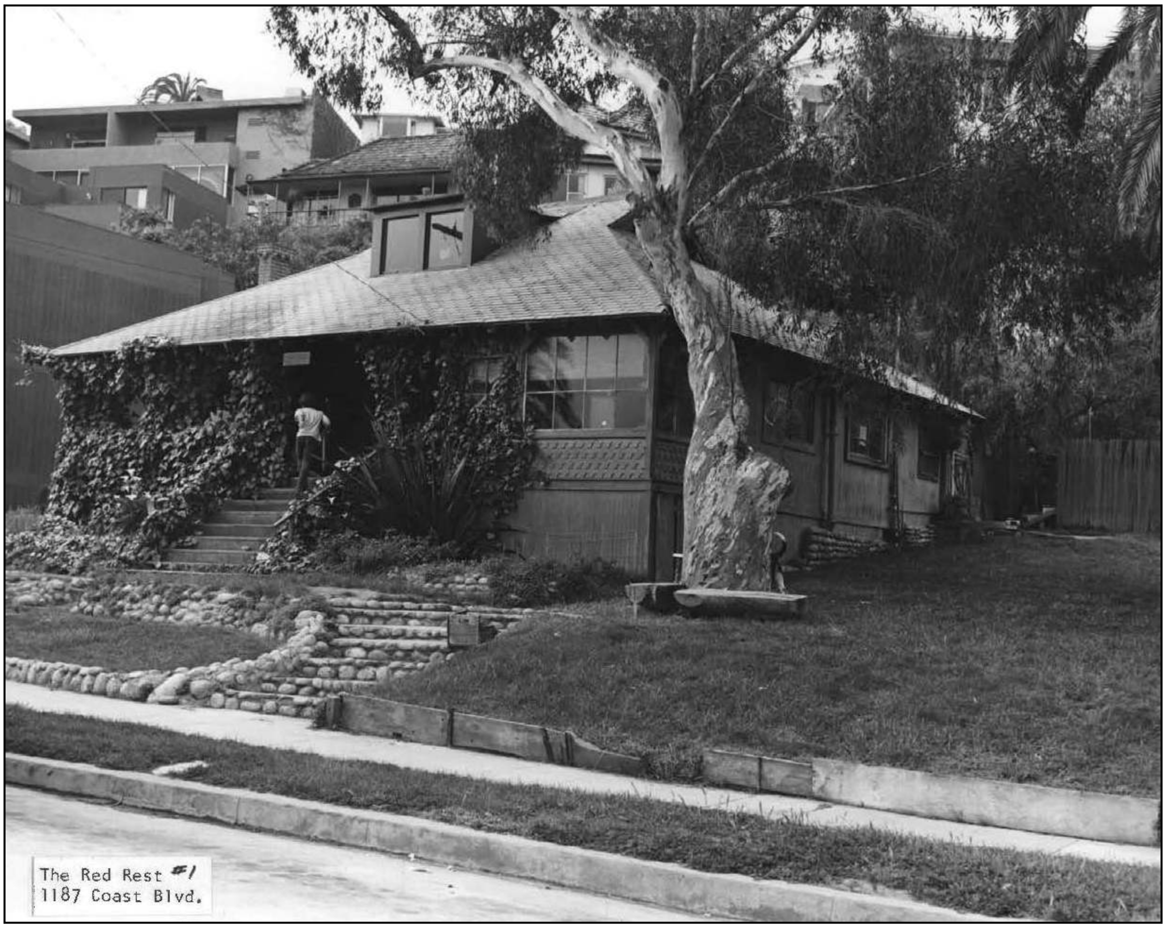


Figure 36. Red Rest Cottage, 1911, La Jolla, California (National Register # 76002247). An early example of a modest Craftsman-style bungalow. Photographed in 1975 (From National Park Service 1976).

Figure 37. Warren Wilson Beach House, 1911, Venice, California (National Register # 86001666). A grand Craftsman-style residence. Photographed in 1975 (From National Park Service 1986a).

Two important San Francisco Bay Area architects, Bernard Maybeck and his student, Julia Morgan, are credited with the Bay Region style of architecture developed in the beginning of the twentieth century, which blended the building with the landscape, used wood for both interior and exterior finishes, and incorporated windows, courtyards, and porches to create an open, natural, and informal feel. The 1917-built Acacia Lodge in Santa Barbara is a Craftsman with transitional elements of the Bay Region and Ranch style with its large windows and the merging of interior and exterior spaces. A distinctive variation of this style is the Robinson Jeffers home. An ongoing project between 1919 and 1962, Jeffers built his organic-style all-granite stone compound, including a 40-foot tower, overlooking Carmel Bay.

The Ranch style house evolved from the Mexican Haciendas combined with Craftsman and Prairie style homes. The early Ranch style homes emphasized integrating outdoors with the interior. Two California architects are primarily credited with this style: Cliff May and William Wurster. Wurster, influenced by Maybeck and Morgan's Bay Region style, used large windows, open and unadorned interior spaces, and rustic materials. In 1936 he stated that he "liked to work in direct, honest solutions, avoiding exotic materials, using indigenous things so that there is no affectation and the best obtained for the money." Cliff May, a southern California native, planned indoor and outdoor space concurrently, and added elements of modernism to homes that blended the Mexican hacienda with the Western Ranch home.

The larger scale homes were predominantly designed by well-known architects, constructed to take advantage of ocean views, and vary widely in architectural style. Some of the most famous are early examples of Modern and International Style, predominantly in central and southern California. Examples include Frank Lloyd Wright's Walker House in Carmel (1948), William Alexander's Halliburton House a.k.a. the Hangover House (Figure 38) (1938) (2012 conversation with Laguna Beach Historical Society), and R.M. Schindler's Lovell Beach House (1926), both in Laguna Beach.

Figure 38. Hangover House, 1937, Laguna Beach, California. This modern International-style house was commissioned by adventurer Richard Halliburton in and built by master architect William Alexander Levy. Image courtesy of Rich Kane/Laguna Beach Patch (2013).

Examples of moderately scaled mid-century Modern- and International-style homes include five of the architect-designed Case Study Houses—four clustered in Pacific Palisades and one in Long Beach. These include the Pacific Palisades Case Study #8 Eames House (1949) (Figure 39), #9 Entenza House designed by Charles Eames and Eero Saarinen (1949), #18 Rodney Walker–designed West House (1948), the #20 Bailey House designed by Richard Neutra (1948), and in Long Beach, the Frank House designed by Killingsworth, Brady, and Smith and Associates (1962).

Figure 39. Eames House, 1949, Pacific Palisades, California. Moderately scaled International-style house designed by master architects Charles Eames and Eero Sarrinen (National Register # 06000978). Image courtesy of Eames Office (© 2013 Eames Office, LLC, eamesoffice.com).

By the early to mid-twentieth century, suburban residential communities began to form on the outskirts of established urban areas. These suburbs consist of single-family houses, duplexes, and multi-story apartment buildings in a variety of architectural styles, ranging from Craftsman bungalows and older Revival styles, to post-World War II pre-fabricated homes, developer Ranch-style tract housing, and bungalow courts. Particularly in southern California, ocean-side communities that may have started as resort towns in the nineteenth century were now within driving distance of larger cities. These towns expanded to become bedroom communities, generally for the wealthy. Ocean-side towns include Coronado, La Jolla, Del Mar, Cardiff, Carlsbad, Oceanside, and San Clemente, to name a few. Many have historic districts, such as Venice (Figure 40) and Redondo Beach, architect-designed homes, and planned civic centers, like Pacific Palisades with its 1924 Olmsted Brothers city plan.

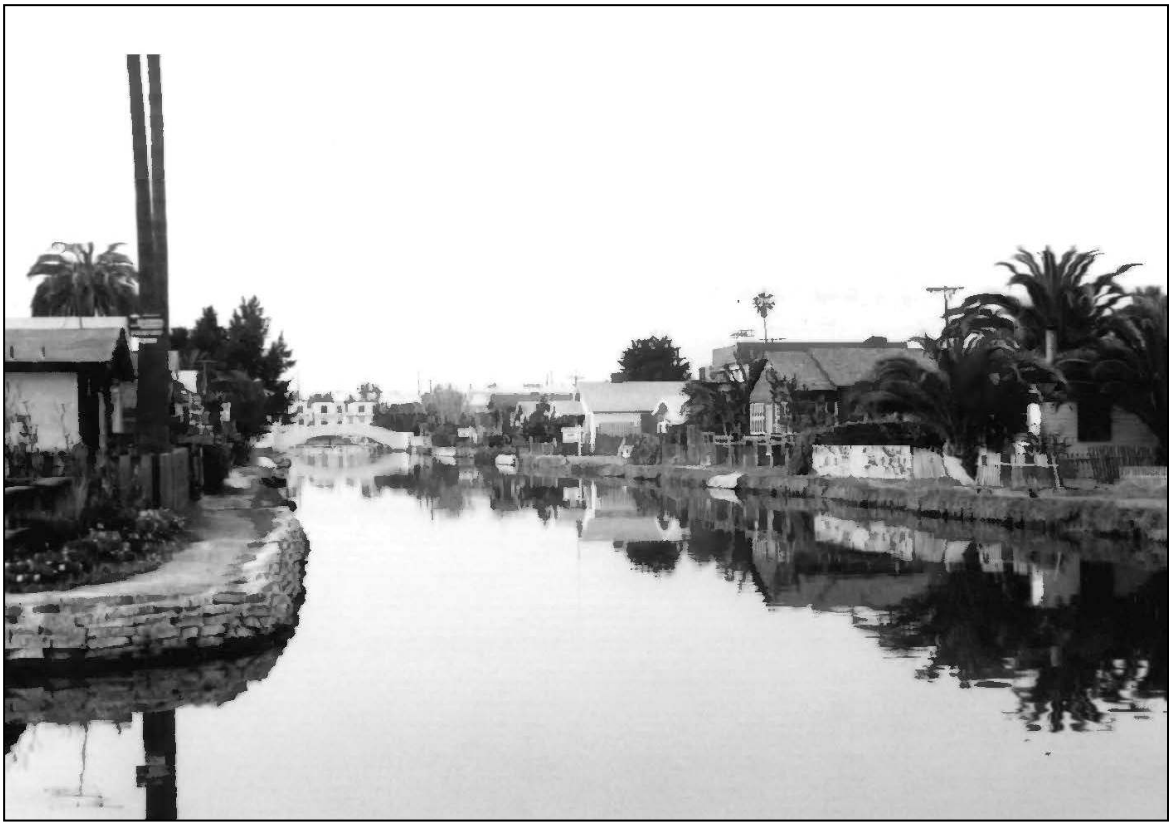

Figure 40. Venice Canal Historic District, 1905–1920, Venice, California (National Register # 82002193). Only the canals contribute to the district. Along the canals are homes representing all phases of twentieth–century domestic architecture, including Revival styles, Craftsman bungalows, post-war prefabricated homes, and more recently constructed homes. Photographed in 1981 (From National Park Service 1982).

#### *4.2.2.2. Commercial*

Commercial buildings located within the study area include a range of building types representing a variety of economic activity. These include retail stores, restaurants, banks, hotels, office buildings, and theaters. They are typically part of a large commercial block, and feature decorative façades mostly consisting of applied ornament. Some more grand examples are free-standing buildings set in prominent locations, such as a commercial street corner. Architectural styles vary depending on date of construction and region, but generally range from early adobe pueblo remnants to commercial vernacular to period revivals to Art Deco and Moderne to International style.

There are several examples of commercial buildings within the study area that are listed on the NRHP. Early commercial vernacular examples are the Breuer Building (Figure 41) in Bandon, Oregon, and the Central Building in Brookings, Oregon. Built in 1905, the balloon-frame wooden Breuer Building has Stick style and Colonial Revival elements, and represents the community's transition from a frontier town. The 1915 Central Building is a vernacular lumber company administration building with some Classical Revival features. Another early office building, the Hihn Building in Capitola, represents a very different style of architecture, designed to make a statement. This 1883 Queen Anne with Classical Revival elements was the headquarters for founding the community as a resort town.


Figure 41. Breuer Building, 1905, Bandon, Oregon (National Register # 92001308). An early Colonial Revival–style commercial building. Photographed ca. 1920 (From National Park Service 1992).

Most commercial city centers contain an eclectic mix of architectural styles from a variety of periods. An exception is Santa Barbara. A 1925 earthquake destroyed much of the historic downtown and a decision was made to create a unified look by rebuilding everything in the Spanish Colonial style. Almost the entire downtown has been determined to be eligible for the NRHP, and several buildings are individually listed. These include the Andalucia Building, four associated masonry buildings of mixed commercial use, and the Jannsens-Orella-Birk Building originally used as a restaurant.

Prominent commercial buildings include two large, imposing Long Beach, California, buildings: the Beaux Arts 1924 Middough Brothers Insurance Exchange building and the six-story 1906 Renaissance Revival First National Bank of Long Beach.

Hotels not associated with coastal resorts (see below) include the Milano Hotel in Gualala, California. Built in 1905, this minimal Italianate served the local lumbermen and travelers. The Virginia Hotel was part of the uniform rebuilding of Santa Barbara after the 1925 earthquake. Like the rest of the downtown, the Virginia Hotel was built in the Spanish Colonial Revival style. The Sovereign Hotel in Santa Monica, built in 1929, is a large luxury apartment-type hotel built in a Spanish Eclectic style.

### *4.2.2.3. Civic*

#### 4.2.2.3.1. Educational

Educational and research-based built resources vary widely throughout the study area, but mostly consist of early to mid-twentieth century public elementary and high schools and large college campuses. Some earlier nineteenth-century rustic one-room school houses remain, but examples are rare. One example is an 1878 school house on the Pierce Dairy Ranch in Point Reyes National Seashore in Marin County, California.

Built primarily in the Spanish Colonial Revival, Beaux Arts, Classical Revival, Moderne, and International styles, many of the twentieth-century schools were designed by master architects, particularly in southern California. Examples include the Point Arena High School, a 1936-built masonry Moderne and Art Deco building; the 1931 Neo-Classical Huntington Beach Elementary School Gymnasium and Plunge; the modestly sized 1931 Moderne Irving Gill Americanization School (Figure 42) in Oceanside; the George H. Scripps Memorial Biological Laboratory in La Jolla (Figure 43), built in 1910 and also designed by Irving Gill; and the 1962-built Salk Institute for Biological Studies (Figure 44), also in La Jolla—a Modern cluster of buildings designed by Louis Kahn.


Figure 42. Americanization School, 1931, Oceanside, California (National Register # 94000311). A Moderne-style building with Islamic influences designed by master architect Irving Gill. Photographed in 1993 (From National Park Service 1994).

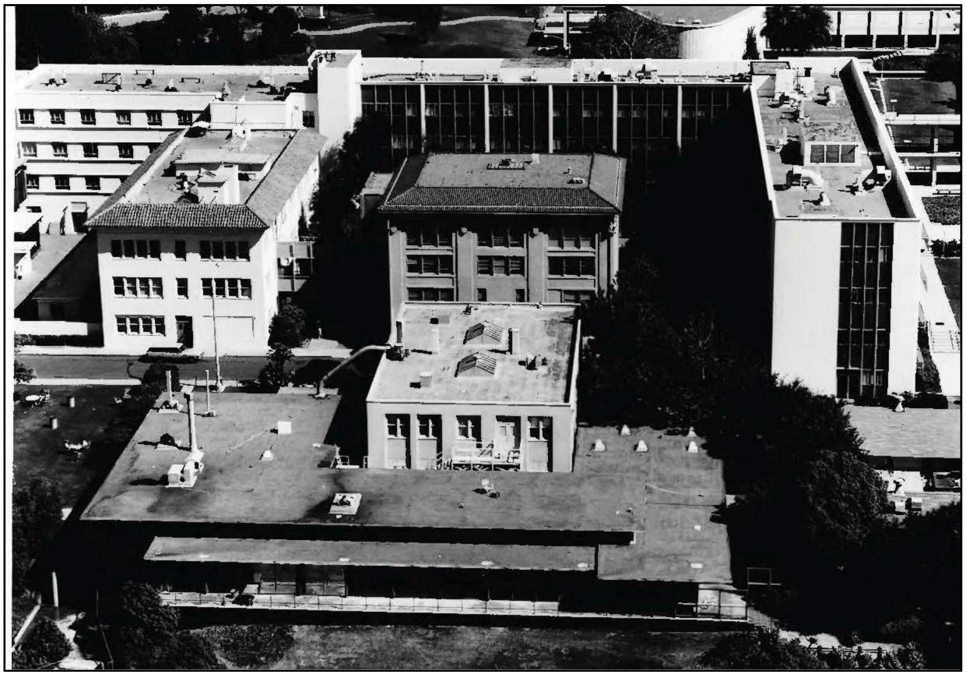

Figure 43. George H. Scripps Memorial Marine Biological Laboratory, 1910, La Jolla, California (National Historic Landmark # 77000330). A modest Modern-style reinforced concrete building designed by renowned modernist architect, Irving Gill. The Gill-designed building is the two-story front and center building, later encased by the horizontal tiered mid-century addition. Photographed ca. 1970 (From National Park Service 1977).

Figure 44. Salk Institute for Biological Studies, 1962, La Jolla, California (not yet listed on National Register). A cluster of concrete, high-Modern style buildings designed by Luis Kahn atop a bluff overlooking the Pacific. Image courtesy of the Salk Institute for Biological Studies (2013).

### 4.2.2.3.2. Medical

Hospitals in the study area date as far back as the early American period, about the mid-nineteenth century, and these typically include examples on military posts such as the 1864 Old Post Hospital on San Francisco's Presidio built in the Italianate and Greek revival styles. Later turn-of-the-century hospitals can be found throughout the Pacific coast, though most have been converted to other uses, such as residential or commercial. Many hospitals were constructed during the World War I and II periods, as well as part of Works Progress Administration (WPA) projects, and therefore include Art Deco, Moderne, and International styles in addition to period revivals.

### 4.2.2.3.3. Government

Civic buildings such as city halls, court houses, jails, or post offices are often erected as acts of civic pride. These governmental buildings vary in scale, depending on the community, and primarily incorporate period revival styles, such as Mission Revival, Spanish Colonial Revival, and Greek Revival, while some later construction utilized Modern Movement styles. There are several examples of these kinds of historic properties. One jail listed on the NRHP is the Davenport Jail (Figure 45), a small 1914-built Mission Revival style building in Santa Cruz County; the Ventura County courthouse (Figure 46) is a Classical Revival 1912-built building; the Seal Beach City Hall, built in 1929, is Spanish eclectic; and the Irving Gill–designed Oceanside City Hall and Fire Department is an example of his Moderne-designed southern California civic buildings.

Figure 45. Davenport Jail, 1914, Davenport, California (National Register # 92000422). Mission Revival-style jail house for Santa Cruz County. Image courtesy of NoeHill.com (2013).


Figure 46. Ventura County Courthouse, 1912, Ventura, California (National Register # 71000211). Classical Revival-style courthouse built for Ventura County. Photographed in 1971 (From National Park Service 1971a)

Several historic libraries are located in the study area. These include the Garfield Park Branch Library in Santa Cruz, a 1915 Carnegie-built library in the Classical Revival style; the Redondo Beach public library, a Spanish Colonial Revival building with Classical elements built in 1930; the Venice Branch Library, a blend of Mediterranean and Moderne civic architecture that was also built in 1930; and the Palos Verdes Public Library and Art Gallery of Mediterranean style built in 1929. The Palos Verdes Library is adjacent to Farnham Martin's Park, a Frederick Law Olmsted, Jr. designed park. Other examples of known historic civic architecture in California include three women's clubs, two modest examples of Craftsmen and one unadorned masonry Spanish Eclectic, built between 1910 and 1922.

#### *4.2.2.4. Industrial*

The timber industry dominated much of northern California and the Pacific Northwest commercial industry throughout the nineteenth century, peaking in the 1920s. Communities were built to support the industry. Property types consist of timber company offices, sawmills, company housing, and chutes, and are usually rustic vernacular wood-frame structures often clad in wood shingles. Several communities in northern California and Oregon contain properties related to this industry, including, in Oregon, Bandon and Brookings, and, in California, Albion, Westport, and Elk. Point Arena, California, includes two historic districts: the Main Street Historic Commercial District (1927), significant for the transition from a timber-dominated economy, and the Arena Cove Historic District (1875–1925), for its association with maritime activities—the transport of lumber and dairy products. The Mendocino and Headlands Historic District (1852–1900) (Figure 47) is a community built around the timber industry and contains properties from as early as 1852.

Figure 47. Mendocino and Headlands Historic District, 1852–1900, Mendocino, California (National Register # 71000165). An intact historic district built around the timber industry with buildings dating to the mid-nineteenth century (From Library of Congress 2013a).

Fisheries were first established in the mid-nineteenth century, with the predominant related buildings being fish canneries. These industrial buildings were located along the waterfront in rows, often close to railroad lines. They were typically constructed of wood-frame or brick, pitched above the water on piers or nearby on the shoreline.

The shipping industry was understandably built close to water, and the remaining built resource types are typically associated with ports. These include company offices, piers, bulkheads, and docks.

Oil drilling operations along the Pacific coast dates to the last decade of the nineteenth century. Oil reserves were identified beneath harbors and at river mouths, so companies set up locations directly in those areas. Built resources relating to the oil drilling industry include oil pumps, refineries, and storage tanks. An additional resource type is the oil storage house, found on larger estates or military bases that required the storage of vast amounts of oil for lighting and heating.

### 4.2.2.5. *Agricultural*

The economy along the Pacific coast began with farming and ranching, so some of the earliest built resources in the study area relate to agriculture. These include individual ranches (dairy, cattle, and sheep), farms (crops and fields), and processing facilities. Farm and ranch complexes typically consist of a primary residence with barns, silos, stables, tank houses, outbuildings, corrals, and fences. Most are vernacular and utilitarian in style, such as a gable-roofed barn, but some early twentieth-century period revival buildings do exist.

Examples within the study area are found from Washington to southern California. The Peter Roose Homestead Historic District in the Olympic National Park, Washington, a Scandinavian settlement established in the 1890s, includes a variety of extant buildings, structures, and landscape features. The Patrick Hughes House (1898) in Cape Blanco Oregon State Park is all that remains of a pioneer dairy ranch. In California, the Knipp and Stengel Ranch Barn, a mortise- and tenon-constructed redwood barn in Sea Ranch, was built ca. 1885. Additional ranch buildings, such as a hay barn, scale house, and equipment barn, were subsequently constructed between ca. 1900 and ca. 1920. The Pierce Ranch (Figure 48), now part of Point Reyes National Seashore in Marin County, California, is a large dairy ranch established in 1856. The oldest building is the 1869-constructed house. Also on the property are additional homes, barns, ancillary buildings, and a school house. The Dickerman Barn (ca. 1880), in Año Nuevo California State Reserve, is part of what was the 7,000-acre Steele Ranch. It is a very large and unusually designed mortise and tenon redwood building. Additional ranch buildings are extant. The Channel Islands National Park off California's Santa Barbara coast contains numerous built resources dating from as early as the 1870s. Although these resources are not listed on the NRHP, they have been determined to be eligible.

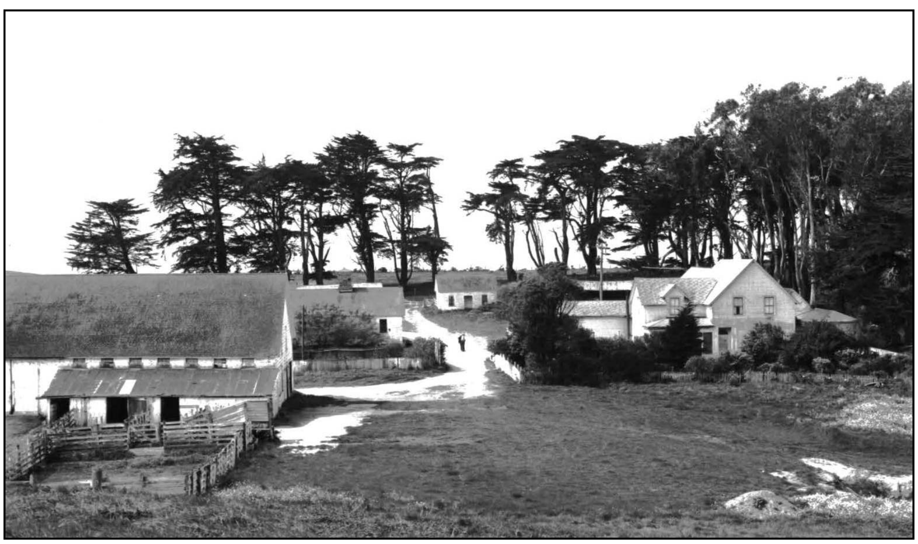

Figure 48. Pierce Dairy Ranch, 1856–1935, Point Reyes National Seashore, near Inverness, California (National Register # 85003324). Large coastal dairy ranch established in 1856 that includes vernacular residences, dairy houses, barns, and a school house. Photographed in 1980 (From National Park Service 1985).

### *4.2.2.6. Religious*

#### 4.2.2.6.1. Missions

The missions of eighteenth-century California represent some of the earliest Spanish settlement in the west. The 21 Spanish missions established between 1769 and 1823 are all located along the historic El Camino Real; are constructed from adobe; and usually feature the church, padres quarters, quadrangle, neophyte housing, and storehouses. Most of the missions still operate as active Catholic parishes, though the original adobe structures are often used as museums or historic sites. Two of them, Mission San Buenaventura in Ventura, and the San Carlos Borromeo de Carmelo Mission in Carmel (Figure 49) are within the study area.

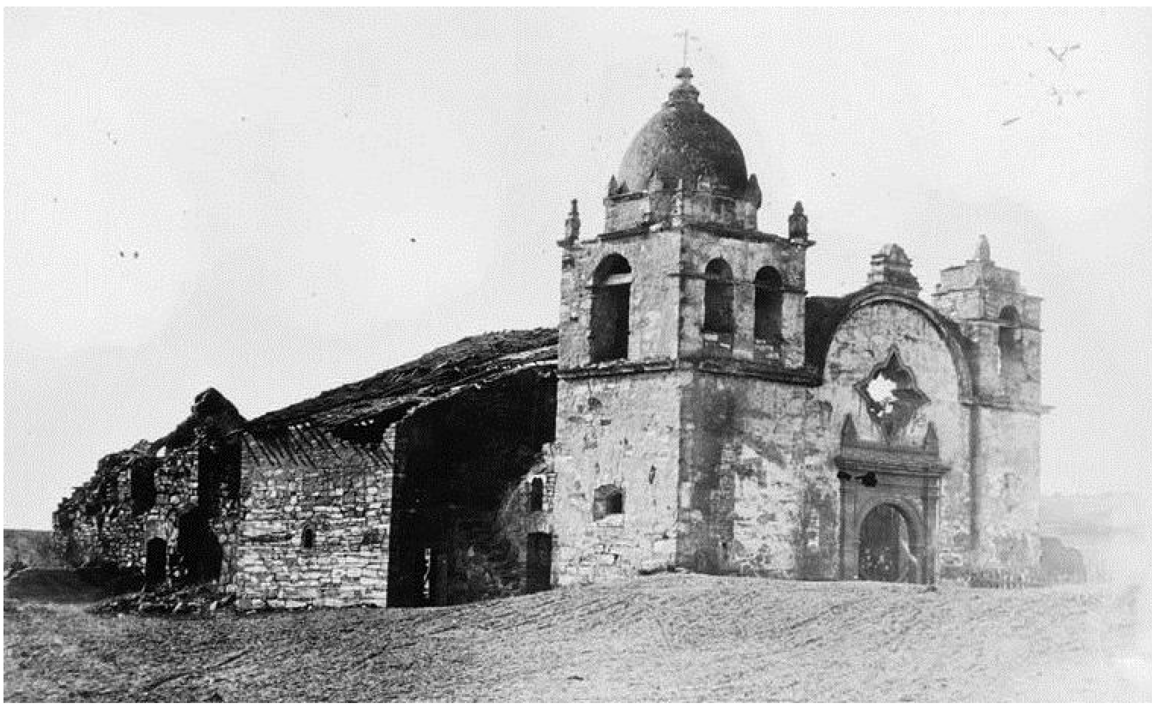

Figure 49. Mission San Carlos Borromeo de Carmelo Church, 1793–1797, Carmel, California (National Register # 66000214). One of the earliest California Spanish Missions. Photographed in 1860 and subsequently restored beginning in the 1920s (From Library of Congress 2013b).

#### 4.2.2.6.2. Churches

Christian churches are located throughout the study area, and span back to the earliest European settlements. Eighteenth- and early nineteenth-century churches are typically small-scale structures with simple floor plans and minimal ornamentation, constructed from adobe or wood, and located on military properties or rural outposts. Later nineteenth- and twentieth-century churches vary dramatically in architectural style, depending on date of construction, geographic region, and denomination. They range from ornate period revival styles to minimalistic Modern Movement.

Three disparate examples include the Gothic Revival Saint Paul's Methodist Episcopal Church in Point Arena, California (1908); the Saint Francis-by-the-Sea American Catholic Church in Laguna Beach, a 1933 eclectic building with elements of Gothic, Mediterranean, Romanesque, and Byzantine Revivals and Craftsman styles; and the 1952 non-denominational Wrightian Wayfarers Chapel (Figure 50) in Rancho Palos Verdes, designed by Frank Lloyd Wright Jr., son of pioneering architect Frank Lloyd Wright.

Figure 50. Wayfarers Chapel, 1952, Rancho Palos Verdes, California (National Register # 05000210). Constructed primarily of glass, this modern church designed by Frank Lloyd Wright Jr. provides a continuous flow of internal and external space. Image courtesy of WayfarersChapel.org (2013).

#### 4.2.2.6.3. Cemeteries

Cemeteries within the study area date back to the eighteenth century and have many associations. Some of the earliest include Mission cemeteries in California; others range from those found throughout small coastal communities dating to the mid-nineteenth century to the larger military cemeteries of the twentieth century.

### ***4.2.2.7. Military***

#### 4.2.2.7.1. Early Exploration—Spanish, Russian

The earliest military outposts date to the eighteenth- to early nineteenth-century European settlements, such as the Spanish Presidios and Russian forts. The built resources generally consist of barracks, officers' quarters, and fortification structures, with the Presidios constructed from adobe and the Russian forts from wood.

Fort Ross, a former Russian fort in northern California, was established in 1812 and abandoned in 1841. Only one building dating from the Russian period is extant—the Rotchev House, which was discussed earlier in section 4.2.2.1. The San Francisco Presidio, a National Historic Landmark District, has only one remaining built resource from the Spanish or Mexican period, an adobe wall that is part of the officers' club. In Monterey the Royal Presidio Chapel, completed in 1795, is the only extant part of the Monterey Presidio. In Santa Barbara (Figure 51) several buildings and structures from the original Presidio remain.

Figure 51. El Presidio de Santa Barbara, 1788–1797, Santa Barbara, California (National Register # 73000455). This Mission-style fortress, now a California State Park, includes multiple extant Spanish adobe structures (From California Department of Parks and Recreation 2013b).

#### 4.2.2.7.2. U.S. Rule

When the United States established the statehood and territories for the Pacific coast in the mid-nineteenth century, a military presence was established through military posts. The buildings on these posts included camps, fort structures, barracks, officers' clubs, and hospitals.

The San Francisco Presidio expanded during this era, including the construction of a hospital in 1864, one of the oldest buildings on the Presidio. Fort Point (Figure 52), at the mouth of San Francisco's Golden Gate, was built in 1861, replacing an earlier Spanish fort in the same location. Fort Stevens, on the Columbia River in Oregon was built between 1859 and 1870 as defense against a potential territorial threat by the British.

Figure 52. Fort Point 1861, San Francisco, California (National Register # 70000146). A masonry fortress, this National Historic Site features a courtyard surrounded by three stories of tiered brick arches and an octagonal metal lighthouse capping the northwest tower (From Library of Congress 2013c).

#### 4.2.2.7.3. Endicott Era

The U.S. Army assumed responsibility for defending the country's coasts and seaports in the late nineteenth century, and 22 seaports were recommended for new defenses from the Endicott Board. These Endicott-era (1891–1928) structures were reinforced-concrete gun batteries, usually built partially underground for both fortification and concealment.

Fort Miley in San Francisco, now part of the Golden Gate National Recreation Area (GGNRA), was established during the Endicott Era. There are several extant batteries up and down the west coast, from Fort Rosecrans in San Diego to Fort Stevens in Oregon, including several within the GGNRA in both San Francisco and Marin County.

#### 4.2.2.7.4. Military Bases

Aerospace and defense became dominant industries in the early to mid-twentieth century, with Navy, Army, Air Force, and Marine bases established along the coast. These large-scale military complexes included housing, hospitals, recreation clubs, warehouses, hangers, aviation facilities, training facilities, missile sites, radar sites, small industrial facilities, and parade grounds.

Rockwell Field, a U.S. Army Historic District in Coronado, California, was built between 1912 and 1932 in the Mission and Spanish Colonial styles, designed by architects Albert Kahn and Richard Requa. Space Launch Complex 10 (Figure 53), on Vandenberg Air Force Base in Lompoc, California, was built in 1958 as part of the Intermediate-Range Ballistic Missile testing program.

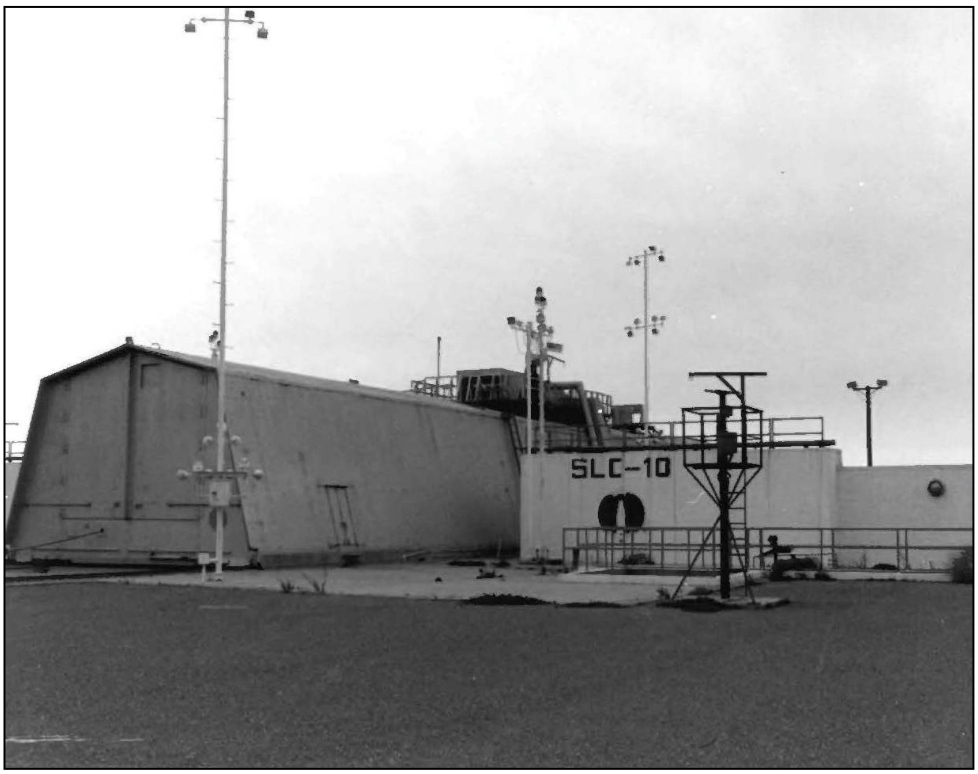


Figure 53. Space Launch Complex 10, 1958, Lompoc, California (National Historic Landmark # 86003511). One of two launch pads built by the Douglas Aircraft Company to support combat training launches. Space Launch Complex 10 consists of a Blockhouse, two concrete launch pads, a prefabricated launch shed, and some support equipment. Photographed ca. 1986 (From National Park Service 1986b).

### 4.2.2.7.5. Coast Guard Bases and Lighthouses

Coast Guard bases contain similar built resources as other military bases, but also include lighthouse and light station components, such as radar and positioning system sites. As discussed in the historic context section, multiple lighthouses are listed on the NRHP.

One example is the Cape Disappointment Historic District, which contains the oldest lighthouse (1856) in Washington. A second lighthouse was added in 1898 (Figure 54). As with several lighthouses found on the mainland or larger islands, the Cape Disappointment Historic District includes several ancillary buildings, such as residences, oil houses, and equipment shelters within the boundaries of the historic property. Oregon's southern-most lifesaving facility, the Port Orford Coast Guard Station, was built in 1934 in the Craftsman style with Cape Cod Colonial elements. Most of the buildings in the Historic District are on the bluff several hundred feet above the water, with the boathouses in the coves below, accessed by a long staircase.

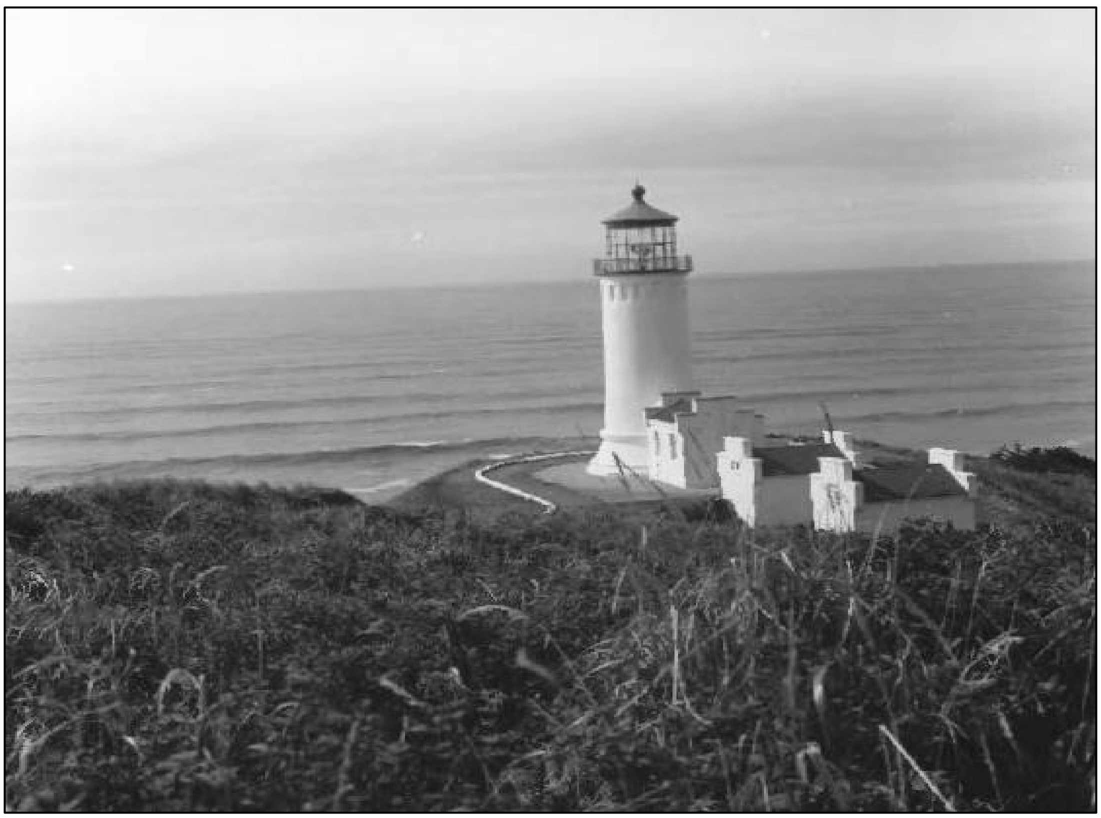

Figure 54. North Head Lighthouse, 1898, Cape Disappointment Historic District, Ilwaco, Washington (National Register # 75001864). The second of two lighthouses constructed at Cape Disappointment, the North Head Lighthouse served as an aid to navigation at the cape's northwestern spur. It features one observation deck and an attached keeper's quarters. Photographed in 1971 (From National Park Service 1975).

### *4.2.2.8. Recreation*

#### 4.2.2.8.1. Beach Resorts and Amusements

Coastal resort communities began to form in the mid- to late-nineteenth century as an escape from urban life, and served as beach recreation destinations. They include built resources such as hotels, bathhouses, and clubs. These California resorts were primarily built in the Spanish Colonial Revival and Art Deco styles. Beach clubs in particular flourished in the early twentieth century and were often designed by prominent architects catering towards the wealthy. They included amenities such as pools and private gymnasiums, often in separate buildings.

One of the most famous and extravagant historic beach resorts is the Hotel del Coronado (Figure 55). Opened in 1888, although construction continued for a few years, this grand Victorian resort includes extensive grounds, with a large courtyard, pools, tennis courts, gardens, and beachside amenities. It attracted visitors from everywhere and also had a significant impact on the development of the city of Coronado.

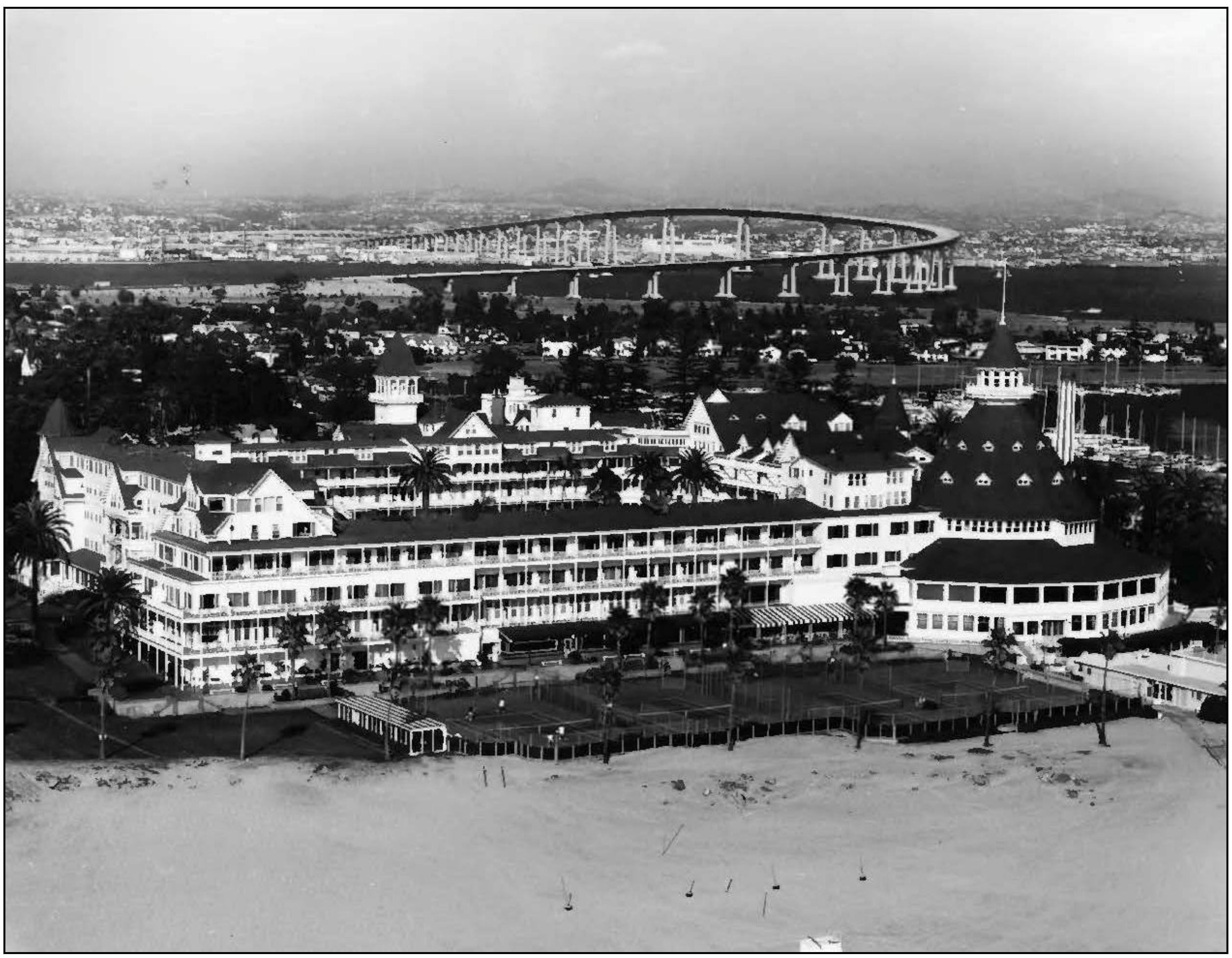

Figure 55. Hotel del Coronado, 1887, Coronado, California (National Historic Landmark # 71000181). This large-scale Queen Anne–style beachfront resort is one of the most significant coastal landmarks in southern California. Photographed in 1970 (From National Park Service 1971b).

On a much smaller, and far less successful scale, the Mission-style Princeton Hotel in El Granada, California, was built in 1908, promoted as part of a planned development called "Princeton-by-the-Sea" by the Ocean Shore Railroad. Only the hotel remains of the amusements, dance halls, and bath houses. Similarly, the New Cliff House (Figure 56) in Newport, Oregon, a 1913 Craftsman-style building was promoted by the Southern Pacific Railroad. To respond to the needs of the automobile traveler, the Dorchester House in Lincoln City, Oregon, built in 1929 and altered in 1932, once contained an auto service station and restaurant on the first floor and ocean-view hotel rooms on the second.

Figure 56. New Cliff House, 1913, Newport, Oregon (National Register # 86002962). This Craftsman-style hotel overlooks Nye Beach and the Pacific Ocean. Photographed in 1986 (From National Park Service 1986c).

Extant historic beach clubs are primarily found in southern California. Los Banos del Mar, in Santa Barbara, is a blend of Art Moderne and Spanish Revival. The 1939 building includes a bathhouse, swimming pool, and formal tropical-style landscaping. The San Clemente Beach Club was built as a municipal facility, privately funded. It is a Spanish Eclectic Revival 1927 building providing direct access to the beach. The Balboa Pavilion (Figure 57) is a two-story late Victorian boathouse and bathhouse built in 1908 in Balboa. Club Casa del Mar in Santa Monica is an Italian Renaissance Revival 1926 building. This large, once private club is oriented toward the ocean.

Figure 57. Balboa Pavilion, 1905, Newport Beach, California (National Register # 84000914). This Late Victorian–style boathouse and bathhouse played a central role in the early development of Newport Beach. Photographed in 1982 (From National Park Service 1984).

While beach culture in California is primarily expressed through beach clubs and resorts, it is also experienced through amusement parks, wharfs, and surfing locations. These range from beach boardwalks with roller coasters and merry-go-rounds, to surf retail shops to beaches that are extensively used by surfers and for surf contests.

The most well-known extant beach boardwalk is in Santa Cruz, built in 1907—the first on the west coast. The carousel dates from 1911, and the roller coaster (Figure 58) dates from 1924 and is the oldest wooden-scaffold roller coaster on the west coast. The Mission Beach roller coaster is only slightly younger. Two other beach-side carousels, both built in 1916, are the Allan Herschell Three-Abreast Carousel in Santa Barbara, and the Looff's Hippodrome, once part of Looff's Pleasure Pier that abutted the Santa Monica Municipal Pier.

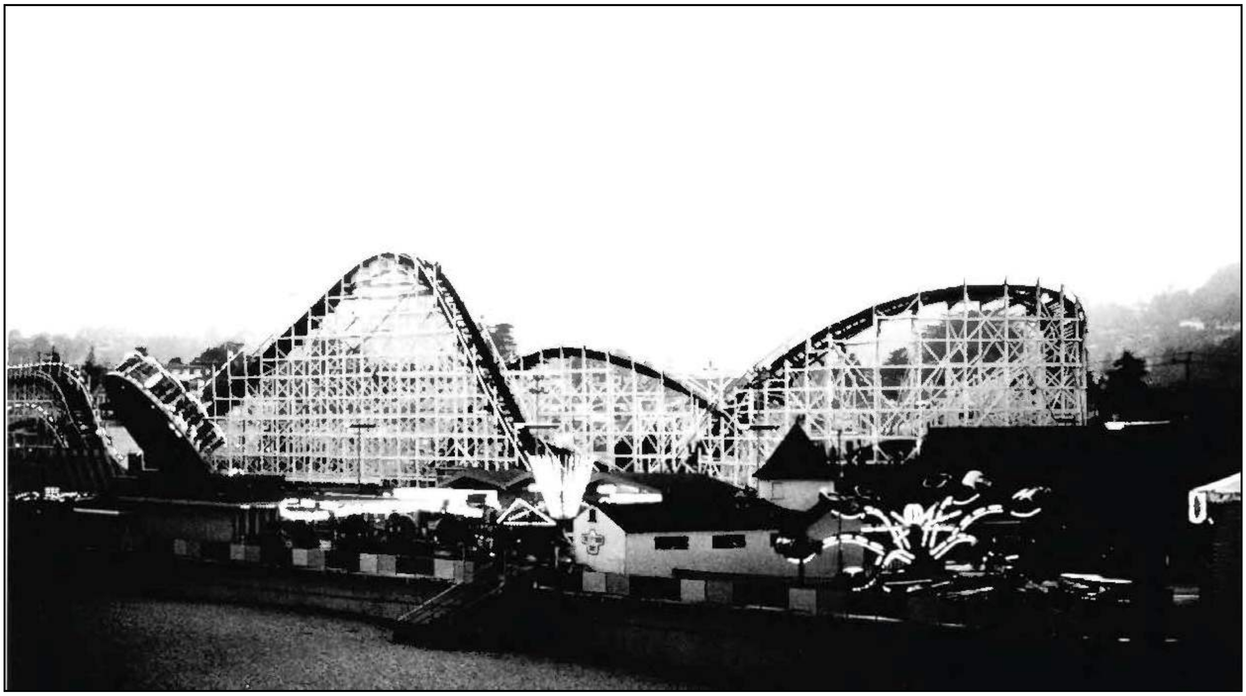

Figure 58. Santa Cruz Beach Boardwalk Roller Coaster, Santa Cruz, California (National Historic Landmark # 87000764). The oldest extant and in-use wooden-scaffold roller coaster on the west coast was built in 1924 and constructed by Charles and Arthur Looff. Photographed in 1985 (From National Park Service 1987b).

A notable property that may be listed soon on the NRHP is "Trestles," a series of surfing spots at San Onofre State Beach. Its use as a surfing beach dates to the 1930s (Donaldson 2008). The surfing spot got its name because surfers originally had to walk under a wooden trestle bridge to get to the beach. The bridge has since been replaced by a concrete viaduct.

#### 4.2.2.8.2. Fishing Piers

Recreational fishing piers were constructed in the early twentieth century to serve the influx of tourists. These were often components of a larger beach resort or recreation park.

The Huntington Beach Municipal Pier (Figure 59) is a historic district with Art Deco style buildings. Built in 1930 as part of the Huntington Beach resort town, it was the terminus of the Pacific Electric Railroad that initiated in Long Beach. The Santa Monica Pier is also a recreational pier from the same era; however, only the entry sign has retained enough integrity to be considered historic.

Figure 59. Huntington Beach Municipal Pier, 1930, Huntington Beach, California (National Register # 89001203). A historic district with Art Deco–style pier buildings. Photographed in 1989 (From Library of Congress 2013d).

### 4.2.2.8.3. Retreats

Artist and other retreats were found in northern California and the Pacific Northwest from the early to mid-twentieth century. They are comprised of individual residences and community buildings, primarily constructed in rustic styles. The retreats are often located within coastal dunes or wooded areas.

In 1913 the Young Men's Christian Association established Asilomar (Figures 60 and 61), which means "refuge by the sea," on an isolated point off Pacific Grove, surrounded on three sides by the ocean. The 107-acre Julia Morgan–designed landscape contains 11 Craftsman-style buildings, low stone walls, rock-lined paths, and a stone pillar entry way, each pillar topped with a large lantern. The grounds contain now mature trees and boardwalks leading to the shore. Local stone and timber construction materials are exposed, giving a rustic and informal character to the property.


Figure 60. Asilomar Conference Grounds, 1913, Pacific Grove, California (National Historic Landmark # 87000823). Entrance gates topped by Craftsman-style lanterns. Photographed in 1984 (From National Park Service 1987c).

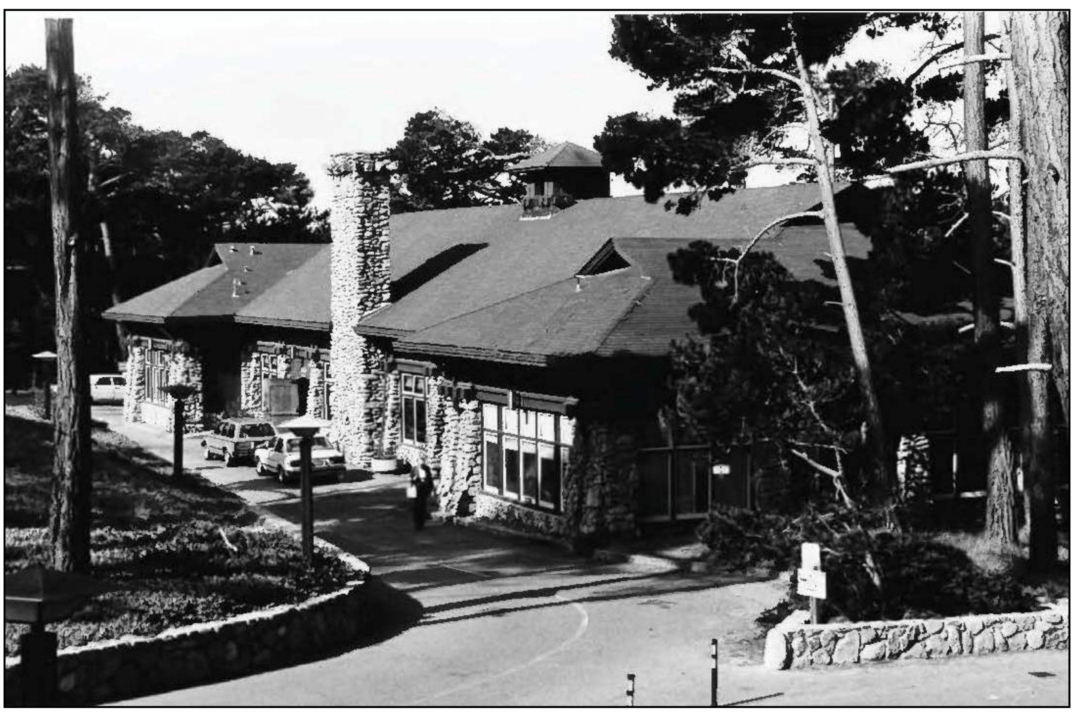

Figure 61. Asilomar Conference Grounds, 1913, Pacific Grove, California (National Historic Landmark # 87000823). The administration building at the resort was designed by master architect Julia Morgan in the rustic Craftsman-style of architecture. Photographed in 1984 (From National Park Service 1987c).

South of Asilomar is the Big Sur coastline. Deetjen's Big Sur Inn was built between 1936 and 1941 for travelers on the newly constructed Carmel to San Simeon Highway. The rustic hand-made buildings were constructed of recycled wood from Monterey's defunct fish canneries. The natural beauty and the rustic facilities attracted Bohemian newcomers—artists, writers, and craftsmen.

Architect-designed Sea Ranch is on the Sonoma County coast of California. Condominium 1 (Figure 62) is listed on the NRHP. Built in 1965, it is the prototype of the Modern movement's post-1960 shed style. This rustic, informal planned community now includes several single-family homes of the same style.

Figure 62. Condominium 1, 1965, Sea Ranch, California (National Register # 05000731). Shed-style multiple-family residence in the Sea Ranch community designed by noted Modern architects Charles Moore, William Turnbull, Donlyn Lyndon, and Richard Whitaker, and master landscape architect Lawrence Halprin. Photographed in 2004 (From National Park Service 2005).

### 4.2.2.8.4. Sports and Leisure

Various recreational sport facilities are located within the project area, ranging from golf courses to public pools. The older golf courses date to the late nineteenth century, primarily in California, though many have been altered through the decades. Other sport facilities include gymnasiums, swimming pools, and hunting clubs.

### 4.2.2.8.5. Parks and Open Space

Conservation efforts on the Pacific coast date to the early twentieth century with grassroots movements and state park programs. The formation of many parks and open spaces date to this time. Parks range in scale from small landscaped urban parks to large open space preserves and national parks. Several of these parks contain historic resources dating to before they were established as parks. For example, the Golden Gate National Recreation Area includes lands in Marin and San Francisco Counties, and its historic resources are primarily related to military history, from the Spanish period to the Cold War. Muir Woods in Marin County was declared a National Monument in 1908 by Teddy Roosevelt under the Antiquities Act of 1906. Also in Marin is the Point Reyes National Seashore, which includes several ranching properties that have been in operation since the 1850s, including Pierce Ranch. Similarly, the Olympic National Park contains historic pioneer ranches. The 1600-acre Torrey Pines California State Nature Preserve in San Diego County contains a 1923 adobe-constructed lodge designed to be in harmony with the natural native surroundings; a glider port on the ocean-side bluff, parallel to the ocean, is associated with the preserve.

The Gold Beach Ranger Station Historic District in Oregon, built in 1936 by the Civilian Conservation Corps (CCC), is a collection of rustic wooden board and batten buildings with stone veneer foundations. It includes residences, crew houses, shops, and storage sheds. Also built by the CCC in Oregon is the rustic stone lookout shelter and parapet at Cape Perpetua (Figure 63), built for the U.S. Forest Service in 1933.

Figure 63. Cape Perpetua Shelter and Parapet,1933, Siuslaw National Forest, south of Yachats in Lincoln County, Oregon (National Register # 88002016). Created by the Civilian Conservation Corps (CCC), the shelter and parapet are the only stone structures built atop Cape Perpetua. They are also the only remaining recreation sites developed by the CCC at the Cape. Photographed in 1988 (From National Park Service 1989).

Perhaps the best known west coast urban park is San Francisco's 1,000-acre Golden Gate Park, which was initially planned in 1860 in response to New York's Central Park. Planting began in 1875 on the former sand dunes, with landscape features, water features, objects, structures, and buildings continually added, replaced, or restored. Smaller urban parks include the Frederick Law Olmsted Jr.–designed park in Palos Verdes, California, and the Marston House Gardens in San Diego, California.

### 4.2.2.9. *Transportation*

#### 4.2.2.9.1. Roads

Historic roads date back to the eighteenth century's El Camino Real, a 600-mile-long route in California, connecting settlements from San Diego to Sonoma. Historic scenic routes, established for carriage rides for wealthy vacationers, date to the nineteenth century. As automobile traffic increased in the early twentieth century, asphalt roads were installed in areas previously impassible. West coast states developed the major coastal highways used today during the early twentieth century. Highway 1 serves as the main coastline route through the majority of California. Highway 101 is the main coastal route in California north of Fortuna and throughout coastal Oregon and Washington. Two abandoned stretches of Old Redwood Highway, once a part of Highway 1 in northern California, are listed on the NRHP. One was originally the Crescent City/Trinidad wagon road. It runs along a steep hillside above the Pacific Ocean and terminates at the Klamath River. The second abandoned stretch, completed in 1923, is 3 miles long and took 4 years to build. It follows the coastal cliffs until it reaches Enderts Beach.

The Carmel to San Simeon Highway Historic District is part of Highway 1 (Figure 64). This historic district, constructed from 1922–1936, is California's first Scenic Highway (dedicated 1966). This 100-mile coastal road includes 328 recorded stone-constructed features, including parapets, retaining walls, culvert headwalls, and drinking fountains. There are 36 bridges, known as the "Big Sur Arches," including the Bixby Bridge. According to architectural historian Stephen Mikesell, this highway is "one of the most beautiful public works projects in the U.S." (Mikkelsen et al. 2001: 27; Mikesell 1986).

Figure 64. Highway 1, 1922–1937, segment south of Carmel and north of Point Sur, California (not yet listed on the National Register as a historic district). The photograph shows Bixby Bridge (part of National Register # 64500890, Highway Bridges of California multi-property listing) in the distance, and illustrates the physical relationships among the road, bridge, and coastal landscape. Image courtesy of myscenicdrives.com (2013).

### 4.2.2.9.2. Bridges

Bridges in the study area include rail and automobile bridges dating back to the mid- to late-nineteenth century. Earlier bridges were constructed from timber, primarily for rail cars. Later bridges include concrete single-span bridges over creeks and rivers, and large steel bridges linking regional areas.

The most iconic historic bridge on the west coast, the 1937 Golden Gate Bridge, is within the study area. Lesser known bridges listed on the NRHP include the 36 bridges in the Carmel to San Simeon Highway Historic District, and the Oregon Coast Highway bridges, including the Depoe Bay Bridge (1927), the Rocky Creek Bridge (Figure 65) (1927), and the Yaquina Bay Bridge (1936).

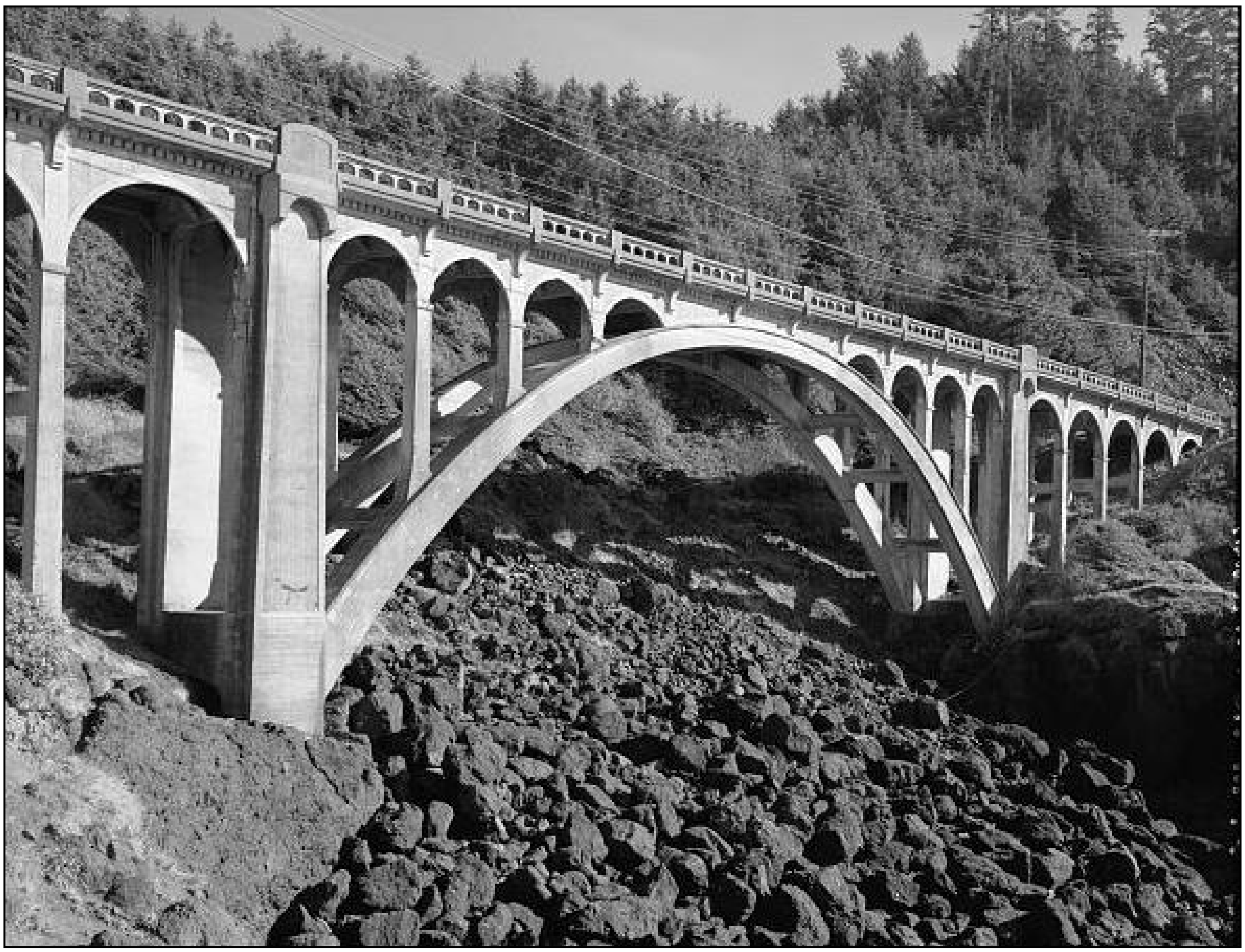

Figure 65. Rocky Creek Bridge, 1927, Depoe Bay vicinity, Lincoln County, Oregon. This is one of multiple coastal bridges designed by noted Oregon State Highway engineer Conde McCullough during the 1920s and 1930s. Photograph taken since 1968, exact year unknown (From Library of Congress 2013e).

### 4.2.2.9.3. Railroad Grades

Railroad grades, trestles, and depots are the dominant built resources associated with rail history. Railroads reached California in the 1860s, creating an extensive rail network with connection to southern California in the late nineteenth century. Logging railroads in northern California and the Pacific Northwest also date to the late nineteenth century. Recreational and passenger rail became prominent in the early twentieth century, with related infrastructure dating to that period.

Examples of railroad depots within the study area include the Southern Pacific Train Depot in Santa Barbara, California, built in the Mission/Spanish Colonial Revival style in 1905, and the Folk Victorian wood frame 1887 Carlsbad, California, Santa Fe Depot (Figure 66).


Figure 66. Carlsbad Santa Fe Depot, 1887, Carlsbad, California (National Register # 93001016). Atchison, Topeka and Santa Fe Railway (Santa Fe) architect Fred R. Perris designed this Folk Victorian–style train depot. Photographed in 1992 (From National Park Service 1993).

#### 4.2.2.9.4. Water (Harbors/Wharfs/Marinas/Ferries)

Sailing infrastructure spans the Pacific coast, dating from the earliest settlement and includes military and recreational facilities. The earliest commercial activity occurred through shipping, utilizing harbors and piers, and the need for creating breakwaters. Transportation needs met by ferries produced wharfs and ferry terminals, usually constructed in grand civic architectural styles such as period revivals.

## 4.3. METHODOLOGY FOR IDENTIFYING COASTAL PROPERTIES

ICF was tasked to assemble a database of archaeological sites, traditional cultural properties, and historic built resources along the coasts of California, Oregon, and Washington, and to prepare a report to determine which of these resources could be visually affected by the introduction of an offshore wind farm, analyze what kinds of resources are sensitive to the visual effects of offshore development, and determine where these potentially affected resources are concentrated. The intent was not only to create a database of known historic coastal properties but also to investigate what kinds or categories of historic property types are found along the coast and, of these property types, which have the potential to be indirectly affected by the alteration of the seascape resulting from offshore development. This section describes the process used to determine the survey population for the purposes of this study, and the regulatory parameters used to determine which resources are sensitive for visual impacts and how to assess visual impacts on these properties.

### 4.3.1. Resource Selection Process

The following categories of cultural resources are included in the BOEM coastal resources database: all formally listed/designated properties in the NRHP and those listed in the individual state registers, properties formally determined to be eligible for the NRHP and/or individual state registers, and those properties that appear eligible for the NRHP and/or state registers through survey evaluation. Also included are all state and national parks with historic components and sensitive resources. Other resources types of importance to the study are those identified by staff or through consultation with experts, Native American Tribes, or historical interest groups that may not be listed or inventoried, and where views of the Pacific Ocean are central to the property's historical significance or to the cultural and traditional values of Native Americans.

For properties in California, the project was initiated with a records search. Records searches were conducted in January and February, 2012, at the five coastal California Historical Resources Information System (CHRIS) centers: the Northwest Information Center at Sonoma State University in Rohnert Park, California, the Central Coast Information Center at University of California, Santa Barbara, the South Central Coastal Information Center at California State University, Fullerton, the South Coastal Information Center at San Diego State University, and the North Coastal Information Center in Klamath. Sources and inventories consulted by the Information Center staff researchers during the records search included: maps of previous cultural resources studies and cultural resource locations, the Historic Properties Data File, the NRHP, the CRHR, the California Inventory of Historic Resources (California Department of Parks and Recreation 1976), California Historical Landmarks (California Department of Parks and Recreation 1996), and California Points of Historical Interest (California Department of Parks and Recreation, May 1992 and updates).

In the Pacific Northwest, ICF staff conducted records searches at the Oregon State Historic Preservation Office (October 2011) and the Washington Department of Archaeology and Historic Preservation (September 2011). The Washington Information System for Architectural and Archaeological Records Data, an on-line database, was also accessed.

With these lists and databases consolidated, the computer-based research was then approached geographically. A boundary demarcation of 1 mile inland from MHW was created as an overlay on a satellite image of the Pacific coast. Using Google Earth Pro with the study area 1mile boundary overlaid, the NRHP-supplied KMZ file of listed resources was also overlaid so that all NRHP-listed properties within the study area could be identified, eliminating those more than 1 mile from shore. Next, the California Historic Resources Inventory (HRI) database was sorted by county, eliminating all resources outside of the 15 coastal counties. The lists were further culled by eliminating properties in inland communities and by including only those properties listed in the CRHR, those identified as having been determined eligible for the NRHP and/or the CRHR, and those that appear eligible for the NRHP and/or CRHR by survey and evaluation. Properties recognized as historically significant by local governments were not included in the database. Any identified traditional cultural properties and potentially sensitive archaeological resource types within 1 mile of the coast were added to the dataset. Archaeological resource types that do not have the potential for visual impacts were not considered in this study.

Georeferenced resource records of properties in Washington and Oregon were provided by each state's Office of Historic Preservation and by the Washington Information System for Architectural and Archaeological Records Data. Some CHRIS centers in California provided geo-referenced archaeological site data; other CHRIS centers lacked this technology and required staff to manually identify and obtain pertinent site records and then enter information into the database and geo-reference site locations using GIS. Built resources listed in the California HRI frequently have no locational information other than an address or partial address. Those that include Universal Transverse Mercator (UTM) coordinates and street addresses were geo-referenced using GIS. Those with only addresses but known to be in or near coastal communities were manually located, using Google Earth Pro to determine if they were within the 1-mile study limit. For resources that contribute to a historic district, the entire district was included in the database, even when the district boundary went beyond the study area. The location of all these resources have been identified and geo-referenced using GIS and are linked to the database.

ICF staff contacted 63 archaeologists and ethnographers well known for their work along the Pacific coast in an effort to obtain information on archaeological sites and traditional cultural properties they felt would be of concern to Native American groups. Additionally, ICF contacted 124 Native American Tribal representatives and individuals that are knowledgeable of the cultural resources in the study area to inquire if they would be interested in providing information on TCPs and other resources of concern. ICF staff contacted 57 local and state-wide historical and preservation groups in coastal California, Oregon, and Washington to ask if any members knew of properties not currently listed on the NRHP or state lists, not determined eligible for NRHP or state lists, or not already recognized as historically significant by their local government for which the ocean view is a critical character-defining feature. The results of these outreach efforts are presented in Section 4.3.3.

### 4.3.2. Visual Impact Assessment

#### *4.3.2.1. National and State Significance Criteria*

When BOEM considers future projects on the POCS, it will be necessary to assess potential visual impacts on significant coastal cultural resources, in accordance with Section 106 of the NHPA. Significant cultural resources are those found eligible for or listed in the NRHP. For a resource to be eligible for or listed in the NRHP, it must meet at least one of the following criteria (National Park Service 1997):

- Criterion A: association with events that have made a significant contribution to the broad patterns of our history;

- Criterion B: association with the lives of persons significant to our past;
- Criterion C: resources that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction;
- Criterion D: resources that have yielded, or may be likely to yield, information important to history or prehistory.

In addition to meeting one or more of the above criteria, for properties to be eligible for or listed in the NRHP, they must retain sufficient integrity to convey their significance. The National Park Service (NPS) has identified the following seven aspects of integrity:

- Location is the place where the historic property was constructed or the place where the historic event took place.
- Design is the combination of elements that create the form, plan, space, structure, and style of a property.
- Setting is the physical environment of a historic property.
- Materials are the physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property.
- Workmanship is the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory.
- Feeling is a property's expression of the aesthetic or historic sense of a particular period of time.
- Association is the direct link between an important historic event or person and a historic property.

The CRHR criteria for eligibility are virtually identical to those of the NRHP. Cultural resources may be listed in or eligible for the CRHR if they have significance and integrity. Cultural resources are significant if they meet any of the following criteria:

- Criterion 1: are associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage, or the United States (California Code of Regulations [CCR], Title 14, Section 4852[b][1]);
- Criterion 2: are associated with the lives of persons important in our past (14 CCR 4852[b][2]);
- Criterion 3: embody the distinctive characteristics of a type, period, region, or method of construction, or represent the work of an important creative individual, or possess high artistic values (14 CCR 4852[b][3]); or
- Criterion 4: yield, or may be likely to yield, information important in prehistory or history (14 CCR 4852[b][4]).

As with the NRHP, a resource must retain adequate integrity to be listed in or eligible for the CRHR. Integrity is the authenticity of a resource's physical identity evidenced by the survival of characteristics that existed during the resource's period of significance. Integrity must be judged with reference to the particular criteria under which a resource is eligible for listing in the CRHR (14 CCR 4852(c)). Integrity assessments are generally made with regard to the retention of the following:

- Location: where the historic property was constructed or the place where the historic event occurred.
- Design: the combination of elements that create the historic form, plan, space, structure, and style of a property. This includes organization of space, proportion, scale, technology, ornamentation, and materials. This is applicable to larger properties for the historic way in which the buildings, sites, and structures are related.
- Setting: the physical environment of a historic property. It refers to the historic character of the property. It includes the historical relationship of the property to surrounding features and open space. These include topographic features, vegetation, simple human-made paths or fencing, and the relationships between buildings, structures, or open space.
- Materials: the physical elements that were combined during a particular period of time and in a particular pattern or configuration to form the historic property.
- Workmanship: the physical evidence of the crafts of a particular culture or people during a given period in history. It may be expressed in vernacular methods of construction and plain finishes or in highly sophisticated configuration and ornamental detailing.
- Feeling: the property's expression of the aesthetic or historic sense of a particular period of time. It results from the presence of physical features that, taken together, convey the property's historic character.
- Association: the direct link between an important historic event or person and a historic property. A property retains association if it is the place where the event or activity occurred and is sufficiently intact to convey that relationship to an observer. Like feeling, association requires the presence of physical features that convey a property's historic character.

The ONRSP does not administer its own set of criteria for eligibility. ONRSP assists local governments, property owners, and the interested public in identifying and listing historic resources to the NRHP. Therefore, the NRHP criteria of eligibility are used to identify historic resources.

To be eligible for listing in the WHR, a building, structure, district, object, cemetery, historic site, archaeological site, traditional cultural property, or cultural landscape must meet one of the areas of significance (DAHP 2013):

- The property belongs to the early settlement, commercial development, or original native occupation of a community or region.
- The property is directly connected to a movement, organization, institution, religion, or club which served as a focal point for a community or group.
- The property is directly connected to specific activities or events that had a lasting impact on the community or region.
- The property is associated with legends, spiritual or religious practices, or life ways that are uniquely related to a piece of land or to a natural feature.
- The property displays strong patterns of land use or alterations of the environment that occurred during the historic period (cultivation, landscaping, industry, mining, irrigation, recreation).
- The property is directly associated with an individual who made an important contribution to a community or to a group of people.
- The property has strong artistic, architectural, or engineering qualities, or displays unusual materials or craftwork belonging to a historic era.
- The property was designed or built by an influential architect, or reflects the work of an important artisan.
- Archaeological investigation of the property has or will increase our understanding of past cultures or life ways.

In addition to the above eligibility criteria or areas of significance, in order to be listed to the WHR a resource (DAHP 2013):

- Must be at least 50 years old. If less than 50 years of age, the resource should have documented exceptional significance.
- Should have a high to medium level of integrity; i.e., it should retain important character-defining features from its historic period of significance.
- Should have a documented historical significance at the local, state, or Federal level.

In addition to individual historic built resources, there are historic districts. According to the NRHP, a district possesses a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development. It derives its importance from being a unified entity, even though it is often composed of a wide variety of resources. The identity of a district results from the interrelationship of its resources, which can convey a visual sense of the overall historic environment or be an arrangement of historically or functionally related properties. A district can comprise both features that lack individual distinction and individually distinctive features that serve as focal points. It may even be considered eligible if all of the components lack individual distinction, provided that the grouping achieves significance as a whole within its historic context. (National Park Service 1997)

It is not necessary for a built historic resource or district to retain all of its historic physical features or characteristics for the resource or district to be eligible for or listed in the NRHP, CRHR, or WHR. The resource or district must retain, however, the essential character-defining features that enable it to convey its historic identity. These features are those that define both why a property or district is significant and the period during which it acquired its significance. Furthermore, each type of property depends on certain aspects of integrity, more than others, to express its historic significance. Determining which of the aspects is most important to a particular property requires an understanding of the property's significance and its essential physical features. For example, the view from the historic resource or district to the Pacific Ocean must be an essential character-defining feature, one that expresses the resource's or district's significance, a view that has not changed since the historic resource's period of significance.

#### *4.3.2.2. Defining Historic Built Resources*

Historic built resources are districts, sites, buildings, structures, objects, and landscapes that are significant in our history and represent the major patterns of our shared local, state, and national experience. California and Washington each maintain a list of historic resources in addition to those found on the NRHP. California keeps the CRHR, which includes NRHP-listed properties, CRHR-listed properties, properties determined to be eligible for the NRHP or CRHR, properties that appear eligible for the NRHP or CRHR through survey evaluation, properties that appear eligible through other evaluation, and properties recognized as historically significant by local government. The State of Oregon does not maintain an official state register list. However, the Oregon National Register and Survey Program (ONRSP) is administered by the Oregon State Historic Preservation Office (SHPO) under the Heritage Programs Division of the Oregon Parks and Recreation Department. ONRSP assists property owners and local governments in identifying and listing historic resources in the NRHP and maintains NRHP-listed historic resources and districts as well as resources nominated through the ONRSP survey in the Oregon Historic Sites Database. The Washington Heritage Register (WHR), maintained by the Washington State Department of Archaeology and Historic Preservation, is Washington's official listing of historically significant sites, districts, buildings, structures, and objects.

Built historic resources included in this project's database are primarily properties that are listed in or are eligible for listing in the NRHP and/or the CRHR and/or the WHR. Coastal National Parks and California, Oregon, and Washington State Parks with historic components are also included. Not included in the database are California and Washington properties recognized as historically significant by local governments but not listed in or found eligible for the NRHP, CRHR, or WHR.

#### *4.3.2.3. Defining Archaeological Resources and Traditional Cultural Properties*

Prehistoric archaeological resources are most often determined eligible for the NRHP under criterion D for their data potential. However, archaeological sites are not typically considered to have character-defining features that are subject to visual impacts. Prehistoric archaeological resources that are subject to visual impacts are generally those that also meet criterion A for their association with important events or patterns of events in prehistory or culture, although it is possible an archaeological resource may meet criterion B or C. Prehistoric archaeological sites eligible under criterion D that are also eligible under criterion A, B, or C, and whose settings include an ocean view, are subject to potential visual impacts from offshore development. As noted earlier, a common misconception is that TCPs can only be associated with Native American groups—there are many examples of identified non-Native American TCPs.

TCPs that may be eligible for inclusion in the NRHP are places whose historical significance is based on the role they play in the ongoing cultural life of a living group. Specifically, determining whether a resource is a TCP is rooted in how a community perceives its significance. A TCP is most often eligible for the NRHP under criterion A because the ongoing role it plays in cultural life is rooted in the traditional past and reflects significant patterns of events in a community's cultural past. As discussed earlier, TCPs are resources important to a community's cultural practices or beliefs that are part of that community's history and are important for maintaining continued cultural identity within the community. Attributes common to all TCPs, as interpreted by King (2003), include one or more of the following: spiritual power, practice, stories, therapeutic properties, and remembrances.

Identifying TCPs is particularly challenging because TCPs may possess characteristics that do not easily fit the criteria for the NRHP. Groups who may consider a location significant to their cultural heritage may be reluctant to share information that will be documented and used by a public agency. Additionally, the physical boundaries of TCPs can be difficult to identify so it is important to consider the setting of the TCP during the identification process. Overall, consultation with communities is key for identifying TCPs and evaluating their significance.

The term "historic property" used in the NHPA is often misinterpreted as requiring a resource to be physical in nature. NPS guidance for treatment of TCPs (National Park Service 1998) clearly states that a TCP can be immaterial; however, many continue to base their understanding of the resource type on the misinterpretation of the NHPA term "historic property," leading to a disregard for immaterial resources as potential TCPs. For the purposes of this study, those TCPs whose settings include an ocean view are subject to potential visual impacts from offshore development. Finally, an archaeological site may be a TCP, and a TCP also may be an archaeological site. Therefore, both archaeological resources and TCPs can be eligible under multiple criteria. NPS is currently developing new guidance for identifying and treating TCPs, which may remedy some of the inconsistencies in how TCPs have been and are currently treated.

#### *4.3.2.4. Potential Effects on Cultural Resources*

For Federally funded or permitted projects, Section 106 of the National Historic Preservation Act of 1966 provides guidance regarding how to determine when the effects of a project may result in adverse effects on historic properties. For projects in California with no Federal nexus, the California Environmental Quality Act (CEQA) provides this guidance. CEQA also provides guidance for the treatment of resources listed in or eligible for the CRHR but not listed in or eligible for the NRHP, when there is a Federal nexus. For Oregon, there are no guidelines to date for projects with no Federal nexus; the ONRSP assists only in listing NRHP-eligible resources. Washington provides the Revised Code of Washington (RCW) 27.34.200 as the legislative declaration for archaeology and historic preservation. In short, it declares that historic resources should be protected.

Section 106 states the following:

> An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association (800.5(1)).

Examples of adverse effects on historic properties include, but are not limited to:

- Physical destruction of or damage to all or part of the property;
- Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation and provision of handicapped access, that is not consistent with the Secretary's Standards for the Treatment of Historic Properties (Code of Federal Regulations, title 36, part 68) and applicable guidelines;
- Removal of the property from its historic location;
- Change of the character of the property's use or of physical feature within the property's setting that contribute to its historic significance;
- Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features;
- Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and
- Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

In addition to the potential visual effects from offshore development on onshore historic built and archaeological properties and TCPs, the onshore infrastructure required to support the offshore facilities has the potential to directly and/or visually affect these resources. The Section 106 process and any state-required environmental analyses, if applicable, will be implemented during project-specific planning and permitting to avoid, minimize, and/or mitigate adverse effects on these properties from both offshore and onshore development.

Offshore development has the potential to indirectly adversely affect an onshore archaeological resource, historic built resource, or TCP. An onshore resource is visually or indirectly adversely affected by offshore development when the view from the resource to the ocean is a character-defining feature—a prominent or distinctive aspect, quality, or character of that resource that contributes to its historic, cultural or religious significance. The resource must also possess historic integrity of location, setting, feeling, and association with relationship to the view. If view-altering development has been introduced outside of the resource's period of significance, the resource's integrity of setting, feeling, and association with that view will have been compromised and the view may no longer be a character-defining feature. In the case of built resources, if a resource has been moved, even if it retains a view, it would lack integrity of location, setting, feeling, and association with the ocean view, because the view from the period of significance will have changed.

### 4.3.3 Public Outreach

In concert with record searches and research from state historic preservation offices and CHRIS centers, ICF determined that outreach to regional archaeologists and ethnographers, Native American groups and individuals, and historical interest groups was necessary to better identify coastal resources that may be affected by visual impacts from future offshore development projects. Outreach efforts to these targeted groups are described below.

#### *4.3.3.1. Expert Outreach*

ICF contacted archaeologists and ethnographers recognized for their work along the Pacific coast to develop a list of potential prehistoric archaeological sites requiring further assessment. The goal was to review the records of those sites identified by experts to assess whether they possess characteristics to which values other than "data potential" may be ascribed. These include factors such as the presence of burials or indicators that a resource may also have traditional value to Native Americans, or where Native American interest in a particular site or area has been observed.

Between January and March 2012, ICF contacted 63 individuals considered to be experts in coastal archaeology and ethnography for California, Oregon, and Washington. Letters were used to initiate the contact, and further contact was conducted via email. The initial letter sent to each expert provided a study description and an invitation to provide information that could be of use on the study.

The majority of those individuals contacted did not respond to the outreach letters. Many experts requested more information about the study. Two experts, Dave Conca of Olympic National Park, and Bill Hildebrandt of Far Western Anthropological Research, Inc., suggested specific sites thought suitable to consider during this study. Several more experts suggested contacting Native American tribes and individuals directly. A copy of the outreach letter and the results of the outreach to these coastal archaeology experts are summarized in Appendix A.

#### *4.3.3.2. Native American Outreach*

ICF began the process of contacting Native American groups by identifying tribal representatives through state agencies, including the California Native American Heritage Commission, the State of Oregon Legislative Committee on Indian Services, and the Washington State Department of Archaeology and Historic Preservation. The goal of Native American outreach was to compile location-specific information about TCPs identified through established sources and where Native American tribes are willing to provide specific resource locations. Once obtained, characteristics of any identified TCPs or general areas of tribal concern would be assessed to determine if these resources have the potential for visual impacts from offshore development, and whether they could be further addressed when future projects are being contemplated.

The initial letter sent to each tribe or Native American representative provided a study description and an invitation to participate in the study by providing information that could be used to determine areas of sensitivity so that future project licensing decisions can avoid, as much as possible, impacts on significant resources. Letter recipients were asked to provide information about archaeological resources and traditional cultural properties that may be of concern. The letter emphasized that any information provided would remain subject to the confidentiality provisions of National Historic Preservation Act (NHPA) Section 304.

The challenge of this process was obtaining site-specific locational information. Generally, Native American groups were reluctant to provide this information for the current study in the absence of a specific project under consideration, although there are clearly areas of concern to Native Americans in the study area. As a result, our efforts focused on the property type approach—focusing on types and general locations of resources or landforms, and requesting any information regarding why these areas may be of concern. Specific outreach efforts by state are summarized below.

In November 2012, BOEM attempted to follow-up with Native American contacts who responded to outreach efforts. A copy of the outreach letter and a summary of the Native American outreach are presented in Appendix A. No additional information was received through this effort.

##### 4.3.3.2.1. California

On November 30, 2011, ICF contacted the California Native American Heritage Commission (NAHC) by letter in request of a Sacred Lands File Search and Native American Contacts List for the study area. On December 5, 2011, and January 12, 2012, NAHC replied with the results of the request. ICF contacted 124 Native American representatives provided by the NAHC between December 2011 and January 2012. These initial letters presented information on the project and requested participation in the study from each contact, such as specific concerns or information about TCPs, Sacred Lands, or other places.

The majority of Native Americans receiving an outreach letter did not respond. Of those tribes and individuals who did respond, most requested more information about the study or asked to be consulted when future projects are being considered. Few responses included information about TCPs or areas of tribal concern. Tribes that did provide information included the Bear River Band of Rohnerville Rancheria and the Yurok Tribe.

##### 4.3.3.2.2. Oregon

In order to compile a list of tribal representatives to contact for the study, ICF consulted the State of Oregon Legislative Committee on Indian Services (CIS) list of tribal contacts. This list is kept current by CIS and provides contact information for Tribal Historic Preservation Officers and Tribal cultural resources staff. BOEM contacted four Native American tribes whose reservations are within or adjacent to the study area, or that claim cultural affiliation with the study area, to inform them of the study and to inquire of their interest in the study. ICF identified a total of 12 individuals from five Federally recognized tribes and one tribe that is not Federally recognized. Additionally, ICF contacted staff from CIS.

In January 2012, the BOEM POCS Regional Director, POCS Regional Historic Preservation Officer, and POCS Regional Fisheries Biologist met with representatives from four Oregon tribes: the Confederated Tribes of the Coos, Lower Umpqua & Suislaw Indians, the Coquille Indian Tribe, the Confederated Tribes of the Grand Ronde Community of Oregon, and the Confederated Tribes of Siletz Indians. Among the topics of discussion was the current study. No specific conclusions were drawn at any of the meetings; however, a follow-up meeting with technical staff and ICF was held in April 2012. Technical staff from the Confederated Tribes of Siletz Indians did not participate in this meeting, but the other three tribes were represented. Tribal technical staff did not provide any specific information on coastal properties but did offer suggestions for incorporating traditional knowledge.

##### 4.3.3.2.3. Washington

ICF identified tribal representatives in Washington to contact by consulting the Washington Department of Archaeology and Historic Preservation's (DAHP) Tribal contacts list. This list is kept current by DAHP and provides contact information for Tribal Historic Preservation Officers and Tribal cultural resources staff. BOEM contacted five Native American tribes in the state of Washington whose reservations or ancestral lands are within or adjacent to the study area, or that claim cultural affiliation with the study area, to inform them of the study and to inquire of their interest in the study. ICF identified a total of 16 individuals from ten Federally recognized tribes and one tribe that is not Federally recognized. Additionally, ICF contacted staff from the Washington State Governor's Office of Indian Affairs and the Northwest Indian Fisheries Commission.

In November 2012, the BOEM POCS Regional Director, the POCS Regional Historic Preservation Officer, and the POCS Regional Fisheries Biologist met with representatives from five Washington tribes: the Quinault Indian Nation, the Shoalwater Bay Tribe, the Hoh Indian Tribe, the Quileute Tribe, and the Makah Tribe. Among the topics of discussion was the current study. No specific conclusions were drawn at any of the meetings.

#### *4.3.3.3. Historical Interest Groups*

ICF contacted 57 local and state-wide historical and preservation groups in coastal California, Oregon, and Washington to ask if any members knew of properties not currently listed on the NRHP or state lists, not determined eligible for NRHP or state lists, or not already recognized as historically significant by their local government for which the ocean view is a critical character-defining feature.

Of the 57 associations contacted, the majority either did not respond or stated they had nothing to add beyond those properties that are listed or previously determined eligible for the NRHP or state lists. Several communities, especially from Pacific Grove, California, southward, stated that local inventories have been done and those built resources need to be considered. Those same association representatives stated that these lists were decades old and were in need of updating. While the majority of these central to southern California coastal communities' associations had nothing specific to add, almost all stated that their communities are historically significant and that the visual impact from the introduction of offshore development would cause an adverse effect. The detailed results of the consultation are presented in Appendix A.

## 4.4. RESULTS OF INVENTORY OF COASTAL PROPERTIES

### 4.4.1. Database/GIS Design and Use

One of the goals of this project was to compile a database system of identified cultural resources within the study area that could possibly be impacted by the construction of offshore wind and wave energy facilities. This section summarizes the database system developed for the project, including its design and use.

ICF developed a database system comprised of a relational database in Microsoft Access format linked to GIS data. The Microsoft Access database contains a user-friendly interface and was populated with information obtained from existing cultural resources inventories, state databases, and archival records of California, Oregon, and Washington (see Section 3.2.1., above). This information was then used to plot the geographic location of identified resources in the study area and create an interconnected GIS dataset. The combined GIS/database system allows for the geographic mapping of the data and the modeling of potential visual impacts from offshore facilities.

The following sections outline the Microsoft Access database and GIS. The structure of these systems was modeled after the existing BOEM Atlantic OCS coastal database and Gulf of Mexico Regional (GOMR) OCS submerged sites database and made to be fully compatible with BOEM's existing agency GIS.

#### *4.4.1.1. Microsoft Access Database*

ICF compiled tabular data into a relational database designed in a Microsoft Access format from the electronic and hard copy information sources found while conducting research for the project. Microsoft Access version 2007 was used to design the database, and the database file itself is in Microsoft Access version 2002–2003 format. This format was chosen because of superior functionality in a multi-user network setup. A user guide for this database is included as Appendix B in this report.

The structure of the database consists of multiple components, including a user-friendly interface (or the "frontend") and a series of tabular data tables (or the "backend"). The setup of these components is based on the built-in framework of Microsoft Access, and their functionality is built around the display or manipulation of data in each of the database's individual records.

There is one record in the database for each cultural resource identified during the present study. Each record possesses a unique identifier, or OBJECTID, which is intended to help keep together information about each resource, regardless of where it appears in the database. The OBJECTID is an arbitrary number used to create relationships between the various data tables within the database (making it relational). It also provides the means to create a linkage between the Microsoft Access database and GIS. Where possible, the unique identifiers assigned to each record were based on agency provided site/trinomial numbers for individual cultural resources. When an existing agency identifier was not available for a resource, a unique alpha-numeric number was assigned and entered into the database record.

The database features 14 data tables, including one master table and 13 sub-tables. The master table contains records for all the resources recorded in the database, primarily consisting of basic location information. Each sub-table contains additional information that falls into a specific category or contains data related to a certain type of cultural resource (i.e., archaeological, built environment, or Traditional Cultural Properties). The sub-tables relate to the master table in a "one-to-one" or "one-to-many" relationship, depending on the information they contain, and are linked together by each record's OBJECTID. A one-to-one relationship exists when both the master table and sub-table each contain one recorded entry per resource. A one-to-many relationship exists when the record in the master table is linked to multiple record entries in the sub-table. This situation occurs, for example, when there are multiple architectural styles or resource types associated with a single record. The defining of these relationships is what creates a relational database.

In addition to these 14 data tables, the database also contains 13 "look-up" tables. These tables provide standardized lists of information related to the resources recorded in the database, and which were functionally used by the database's frontend during data entry. For example, they include tabular lists of commonly entered cities and counties, resource types, and the names and contact information for commonly entered groups and organizations. The use of these look-up tables helped standardize information recorded in the database and reduced data entry errors.

A series of data entry forms structured as a user-friendly interface facilitated the entry of resource data into the database. These forms also allow for viewing of the information in an easily comprehendible format and facilitate making additions and corrections to the data. A customized search function, which is built into the database's main menu, also provides quick access to desired records, based on a resource's identification number, name, location, or other criteria.

All information entered in the database was verified for accuracy through a quality assurance/quality control (QA/QC) process. This process primarily consisted of a review of all entries in the database to ensure that information was complete and entered correctly. The logical integrity of the database was checked through Standardized Query Language (SQL) queries. Tests were run on the data tables to ensure their data and structures are normalized and logical, and SQL queries were executed to confirm that each resource has necessary spatial representation data. In combination with the enforced relationships inherent in the Microsoft Access database format, these queries helped ensure the integrity of the database and its data. Documentation of this verification was recorded for each record in the database's intake–QA/QC table for future reference.

#### *4.4.1.2. Geographic Information System*

The Microsoft Access database is designed to integrate with a corresponding GIS dataset based in ArcMap 9.2 or later. Called a personal geodatabase, the OBJECTID and spatial information contained in the database for each resource was used to create this dataset in ArcMap. This format was chosen because ArcMap feature classes have a near universal ability to be imported and exported into various open and proprietary formats, which also allows this information to be available for export quickly and easily to ArcSDE format. The ArcSDE format is compatible with the BOEM TIMS database. Metadata compliant with Federal Geographic Data Committee Standards was developed for each provided dataset.

The production of the GIS data layers began with development of the study area extent. ICF identified appropriate coastline ArcMap shapefiles for Washington, Oregon, and California. These were then merged into one shapefile, and two buffers were created: a 1-mile inland buffer to identify the land-based study limit accounting for potential visual impacts and a 3-mile offshore buffer to identify waters outside BOEM's jurisdiction that could potentially be disturbed by the installation of infrastructure to support any offshore facilities. The two buffers were then merged and dissolved into one feature class representing the study area extent.

The production of the GIS data layers continued with the preparation of feature classes displaying the location of resources located in the Microsoft Access database. Each unique resource in the database has a single spatial representation in the ArcMap geodatabase as a point, line, or polygon feature. Most resources are represented by a data point. Resources are only denoted as a line or polygon if they are significantly large in size, defined in this case as any linear resource of more than 2 miles in length or sites or districts greater than 75 acres in area.

Resource locations were plotted using a variety of methods. First, if UTM coordinates or full site addresses were known, this information was used to automatically generate resource locations in GIS through the importation of tabular x, y data (UTM coordinates) and address geocoding. All archaeological site locations developed using these methods were then checked and corrected as needed, while all built environment resources were spot checked and corrected. If UTM coordinates or address information were not available, then ICF referred to the SHPO databases to obtain their location information. If the SHPO databases contained inadequate information to locate the resources (most in California, with some isolated resources in Oregon and Washington) staff plotted the resource locations using location maps and/or narrative information provided in site forms obtained during the records search. The UTM coordinates of these locations were then generated in NAD 83 by calculating their x and y coordinates within ArcMap.

Using these methods, the ArcMap geodatabase was populated with data for both the study area extent and the spatial locations of identified resources found in the Microsoft Access database. The geodatabase's spatial locations are each provided with a unique identifier in a field called "OBJECTID_DB" in the GIS data. The unique identifier corresponds with the OBJECTID field found in the Microsoft Access database, which allows the GIS and database to be linked together using these fields.

### 4.4.2. Identified Sites and Areas of Sensitivity

A total of 2,383 cultural resources with potential to be impacted by future offshore development were identified through the course of the coastal survey. Of these, 683 archaeological resources, 1,719 built environment resources, and 78 culturally significant properties were identified. Many of the identified cultural resources consist of multicomponent sites that contain two or more resources in each of these categories.

A record for each identified cultural resource was entered into the project's Access database and mapped in GIS. The information about the resources was obtained as outlined above, drawn from a range of sources, including SHPO paper files, maps, reports, or digital files, as well as tribal and interested party consultation. Based on this information, each resource was assessed to determine its potential level of visual impact from the possible construction of offshore facilities.

Visual impacts were evaluated using a rating scale of "high," "medium," or "low" and included consideration of the sensitivity of each resource's individual property type (see Section 4.2.2 for a description of identified property types) (Figures 67 through 73—Coastal Sensitivity Map). A rating of "high" was assigned to those resources whose historical significance derives (in full or in part) from its ocean views, or would likely be considered sensitive to visual impacts by interested parties. A rating of "medium" was given to those resources that are close to the ocean and would likely be considered sensitive to visual impacts by interested parties, but ocean views are not a defining characteristic of their historical significance. A rating of "low" was provided for those resources whose historical significance is not defined by ocean views and would likely not be considered sensitive to visual impacts by interested parties.

The application of these ratings varied depending on the type of resource considered and whether it was categorized as an archaeological resource, a built environment resource, or a culturally significant property. For example, archaeological sites containing burials or village components were typically assigned a “high” or “medium” rating, due to their expected importance to Native American tribes and other interested parties. Meanwhile, historical archaeological sites were typically given a “low” rating because their historical significance usually does not include consideration of ocean views. Among built environment resources, lighthouses were provided a “high” rating because of their close associations with the ocean and their inherent historic functions to see and be seen from the water. In contrast, most other historic buildings and structures were provided a “low” rating because their historical significance derives from their style or type, or associations with people and places, and not from views of the sea. Buildings and structures purposely designed to capture a specific ocean view are the noted exceptions. All of the identified culturally significant properties were evaluated with a “high” rating, due to their expected importance to Native American Tribes and other interested parties. Table 5 presents the results of the impacts analysis, broken down by resource category.

Table 5
Visual Impact Analysis Results

| Rating | Number of Resources |
|---|---|
| **Archaeological Resources** | |
| High | 147 |
| Medium | 132 |
| Low | 404 |
| **Total** | **683** |
| **Built Environment Resources** | |
| High | 49 |
| Medium | 13 |
| Low | 1,657 |
| **Total** | **1,719** |
| **Traditional Cultural Properties** | |
| High | 78 |
| **Total** | **78** |

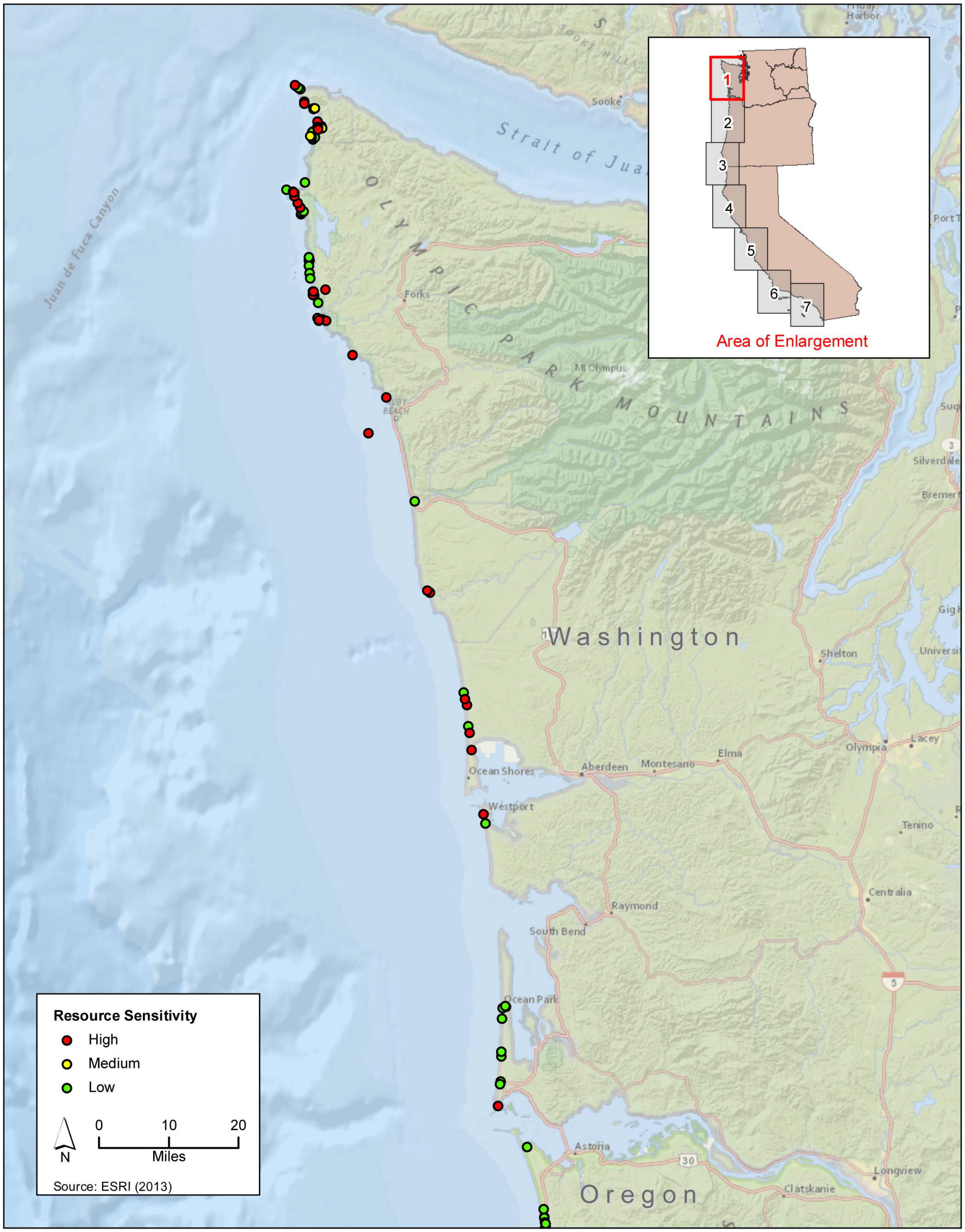


Figure 67. Coastal sensitivity map.

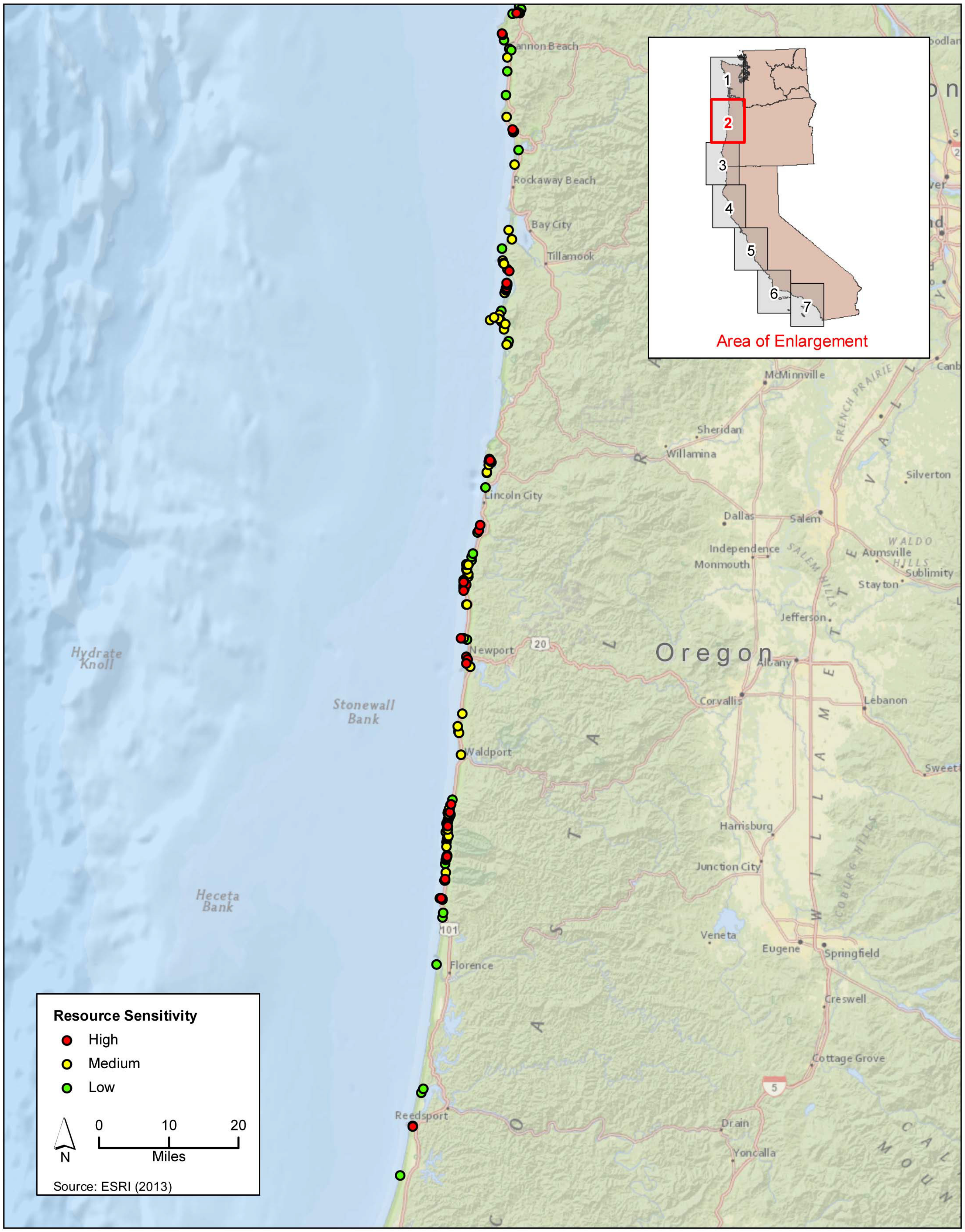


Figure 68. Coastal sensitivity map (continued).

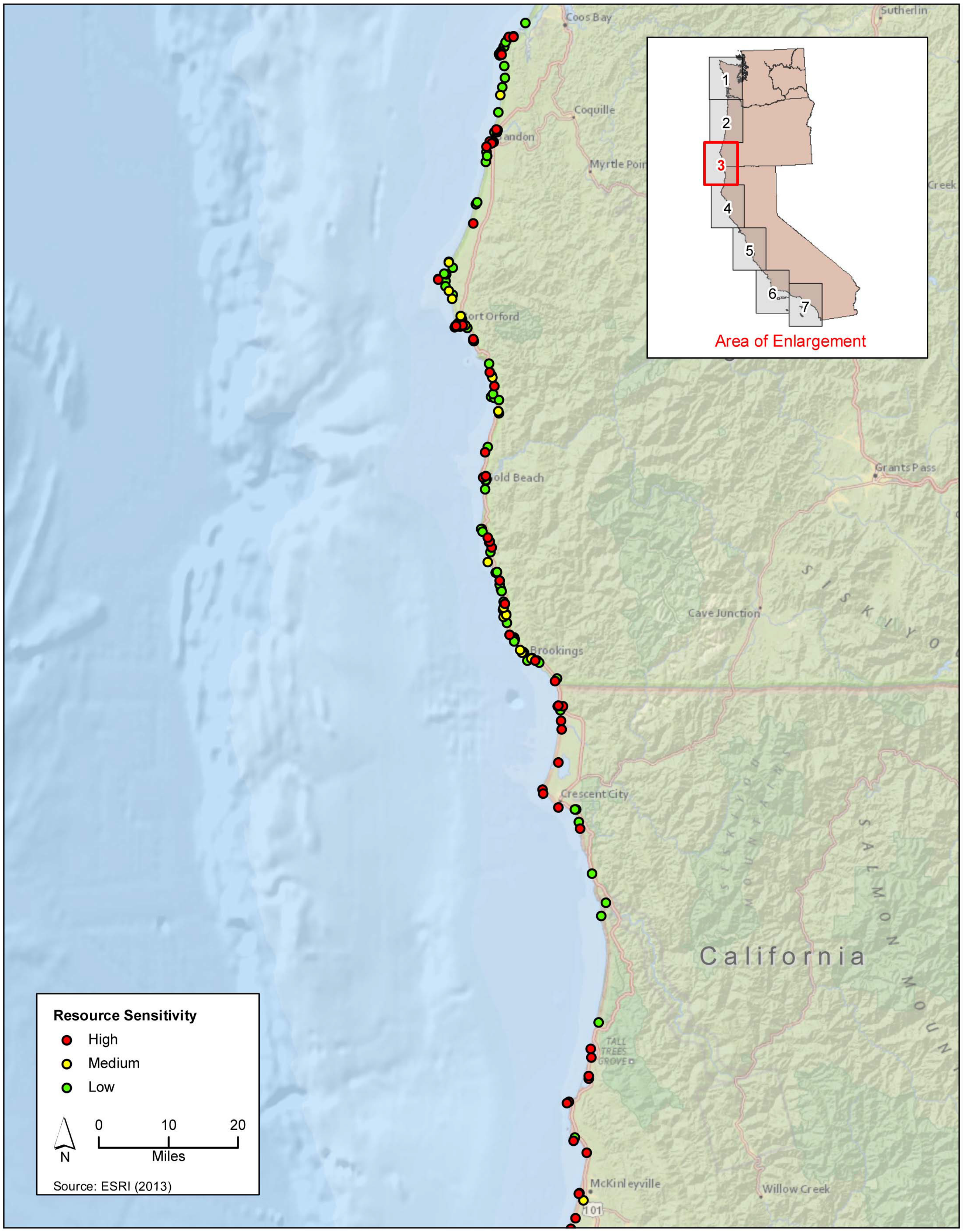


Figure 69. Coastal sensitivity map (continued).

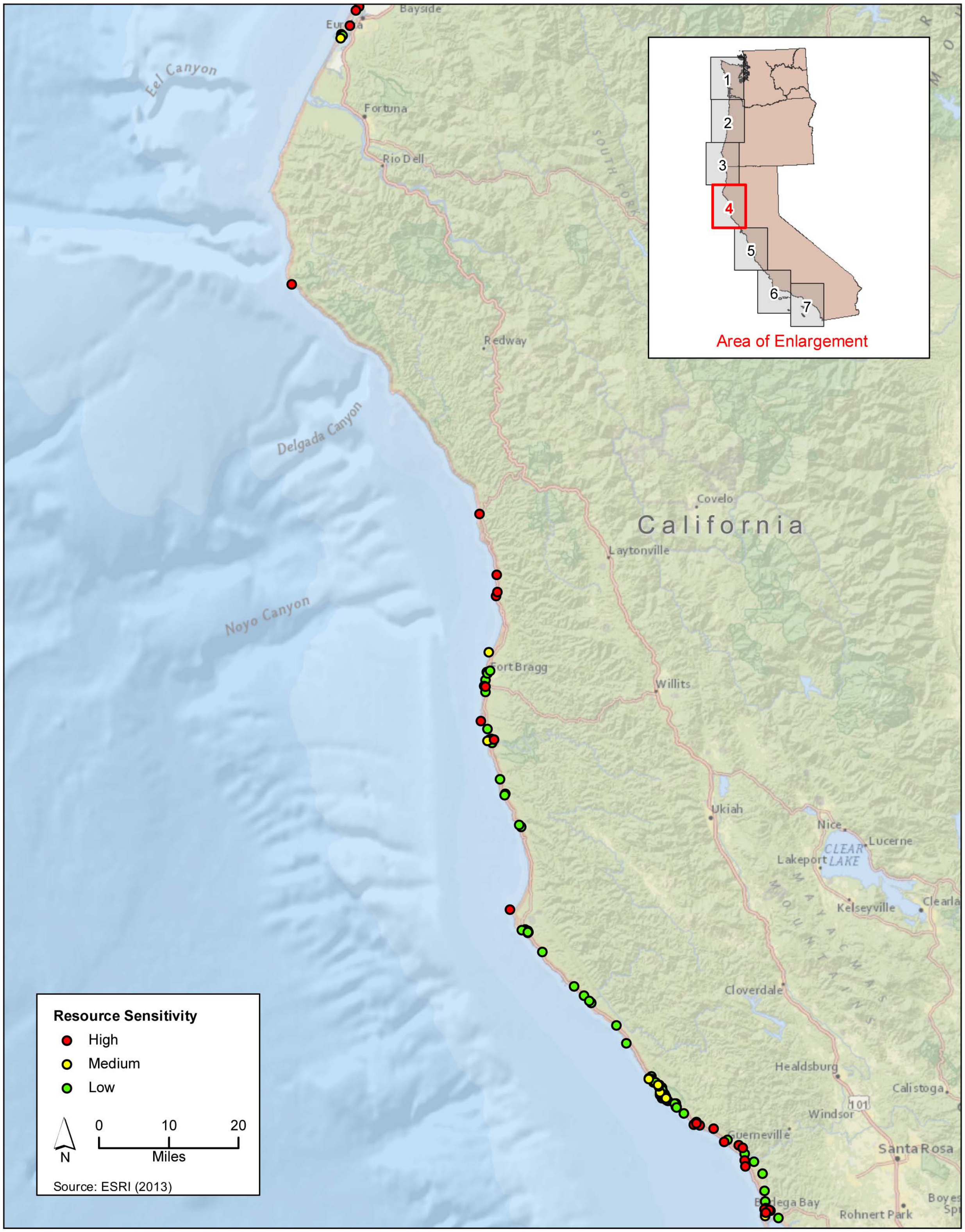


Figure 70. Coastal sensitivity map (continued).

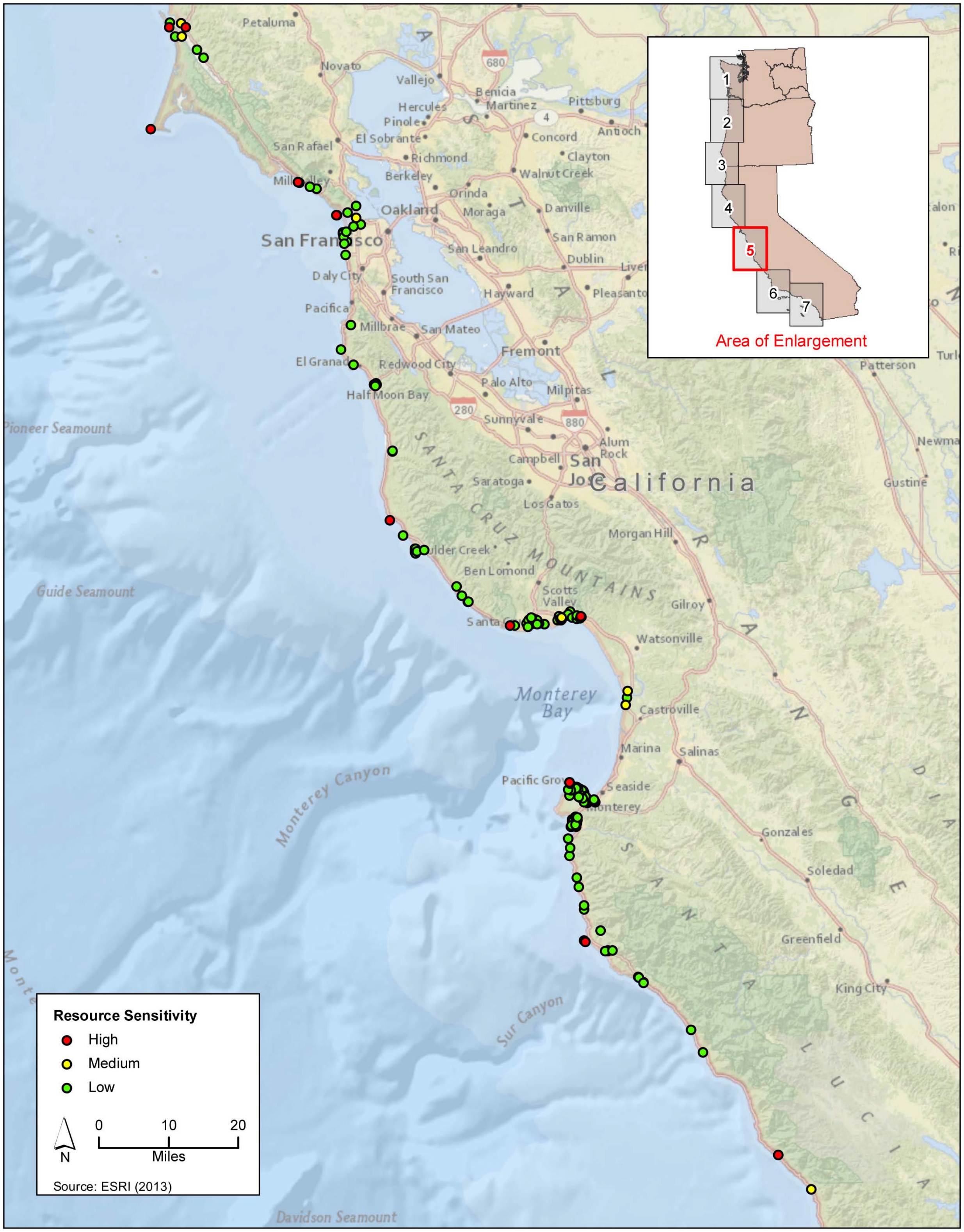


Figure 71. Coastal sensitivity map (continued).

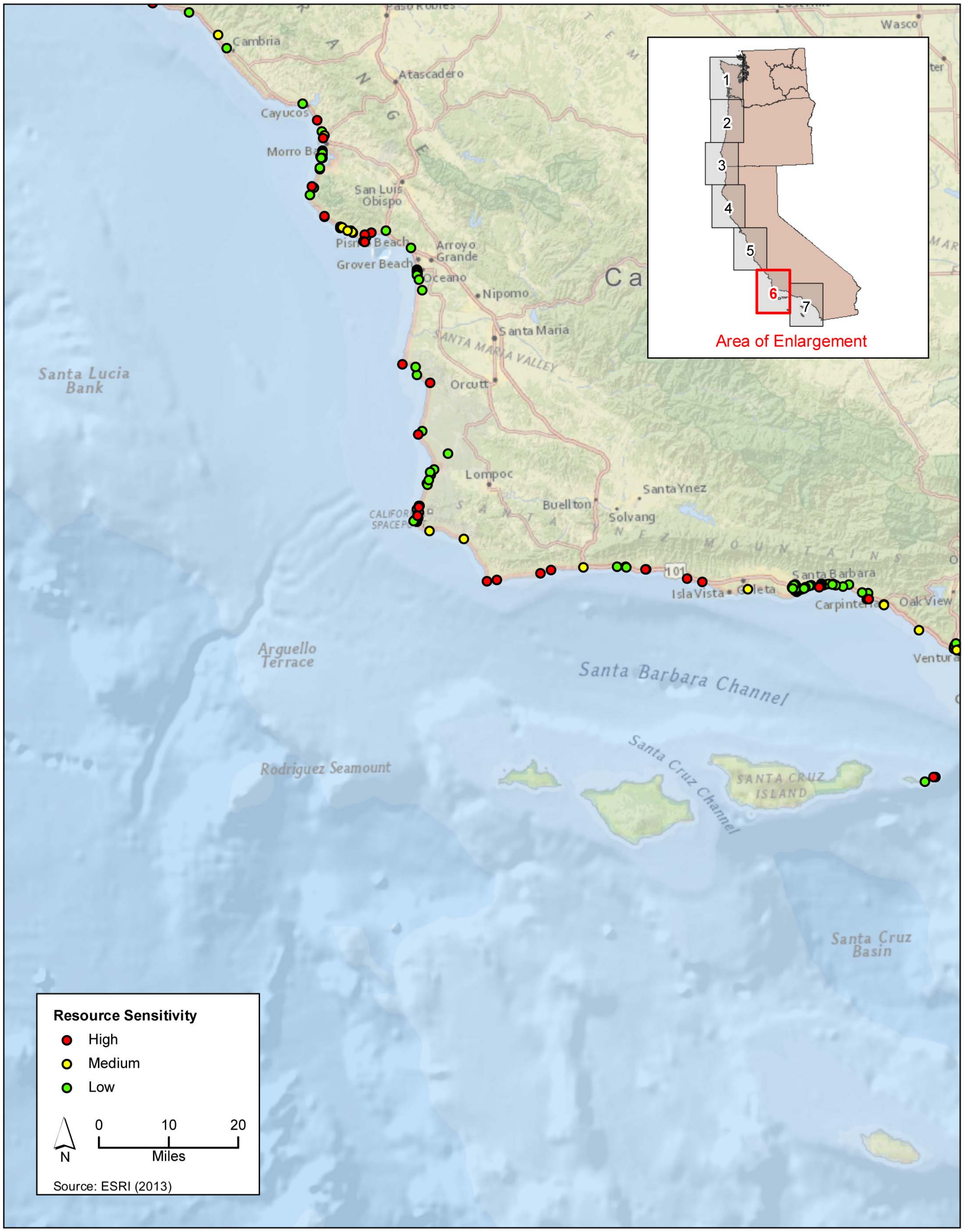


Figure 72. Coastal sensitivity map (continued).

Figure 73. Coastal sensitivity map (continued).

### 4.4.3. Property Types Susceptible to Visual Impacts

As previously stated, each listed or eligible property depends on certain characteristics and aspects of retained integrity that enable it to convey its historic or cultural identity. Determining which are most important to a particular property requires an understanding of the property's significance and its essential physical features. For example, for the introduction of an offshore wind farm to have an adverse effect on a cultural property, the view from the property to the Pacific Ocean must be a characteristic that qualifies it for the NRHP, one that expresses the resource's or district's significance. For the purposes of this study, ICF cultural resources staff looked at all types of historic built and archaeological resources, and traditional cultural properties found along the coast, and identified for which types the view of the Pacific Ocean is an essential physical feature. Depending on the distance from the shore and the orientation or pattern of the proposed wind farm, these are properties that may be adversely affected. For properties that could be adversely affected, the effects from introduction of offshore development could be mitigated to no adverse effect or no effect by the distance from shore and possibly the pattern or orientation of the installation.

It is assumed that the views from the cultural resources described below have been unaltered since the resources' periods of significance. If view-altering development has been introduced outside of the resource's period of significance, the resource's integrity of setting, feeling, and association with that view will have been compromised and the view may no longer be a character-defining feature. In the case of built resources, if a resource has been moved, even if it retains a view, it would lack integrity of location and possibly setting. If these changes have occurred, the viewscape has already lost integrity, and, consequently, the introduction of offshore development would not affect the resource.

The indirect effects on the following property types are only considered under Section 106. As previously stated, under Section 106, a property can be adversely affected yet retain enough integrity to still be considered historic. Under CEQA, for project impacts to be considered adverse, the qualities of the resource must be materially altered to the extent that the resource is no longer considered historic. Even for resources for which the ocean view is a prominent and distinctive character-defining feature, the alteration of the view would not materially impact these resources to the extent that they would no longer be considered historic. Therefore, no coastal properties would be adversely affected under CEQA.

#### *4.4.3.1. Prehistoric and Native American Properties*

##### 4.4.3.1.1. Traditional Cultural Properties

A number of TCPs within the project area are listed on the NRHP. Traditional cultural properties encompass viewsheds surrounding specific points on land and require these viewsheds to retain a sense of place and integrity of setting. Offshore development visible from TCPs would have a high visual impact on traditional cultural properties.

##### 4.4.3.1.2. Archaeological Districts

Archaeological districts are made up of a number of archaeological sites that may have cultural significance for a number of reasons. These sites may be culturally important for their setting and require uninhibited views of the ocean, or they may not require views of the ocean at all. To determine a district's sensitivity to alterations of the ocean view, the significance of the ocean view to the property needs to be determined. Therefore, offshore development visible from shore may have high, medium, or low impacts on archaeological districts.

#### 4.4.3.1.3. Petroglyphs/Pictographs

Petroglyphs and pictographs may require uninhibited views of the ocean making this view integral to their setting and integrity. Offshore development visible from locations with rock art would have a high visual impact on these resources.

#### 4.4.3.1.4. Shell Middens/Mounds

In general, shell middens and shell mounds in and of themselves do not require a particular view or setting because they are simply disposal locations on the landscape. However, the potential for middens to include human remains makes the properties more sensitive to offshore visual obstructions. Offshore development would have a low to medium impact on shell middens and mounds.

#### 4.4.3.1.5. Trails/Linear Features

Trails and other linear features located along the coast may require uninhibited views of the ocean, making the view necessary for their integrity of setting. However, trails are commonly routes of travel not requiring these views. Offshore development visible from shore would, therefore, have a low visual impact on trails or linear features. Nevertheless, offshore development would have a high impact on trails and linear features that exist to provide uninhibited views of the ocean.

#### 4.4.3.1.6. Cemeteries/Burials

Native American burials, particularly in a formalized setting, may require an uninhibited view of the ocean to retain their cultural significance and feeling. As such, offshore development would have a high visual impact on formalized burial grounds. Isolated human remains likely do not require uninhibited views of the ocean to retain their cultural significance, as such offshore development would have low impact on these property types. Formalized historic-era cemeteries do not commonly require an uninhibited view of the ocean to retain their integrity; thus, offshore development would have a low impact on these resources.

#### 4.4.3.1.7. Lithic Scatters

Lithic scatters are not considered eligible for the NRHP because of their setting or views of the ocean. Offshore development would have a low impact on these resources.

#### 4.4.3.1.8. Culturally Modified Trees

Culturally modified trees are those that have been modified during bark harvesting. Those retaining dendroglyphs do not require uninhibited views of the ocean. Offshore development would have a low impact on these resources.

#### 4.4.3.1.9. Rock Alignments/Stacked Rock Features

Rock alignments and stacked rock features may require an uninhibited view of the ocean, especially those erected for ceremonial and spiritual purposes. However, stacked rock features erected as hunting blinds or game drives likely do not require a view of the ocean. As such, offshore development may have a high impact on spiritually important rock alignments and stacked rock features but a low impact on properties not requiring a view of the ocean.

#### 4.4.3.1.10. Isolated Features

Isolated features, such as cooking pits, do not require uninhibited views of the ocean. Offshore development would have a low impact on these resources.

#### 4.4.3.1.11. Landscape Modifications

Landscape modifications do not require uninhibited views of the ocean. Offshore development would have a low impact on these resources.

#### 4.4.3.1.12. Quarries

Quarries do not require uninhibited views of the ocean. Offshore development would have a low impact on these resources.

#### 4.4.3.1.13. Isolated Artifacts

Isolated artifacts do not require uninhibited views of the ocean. Offshore development would have a low impact on these resources.

#### 4.4.3.1.14. Caches

Caches do not require uninhibited views of the ocean. Offshore development would have a low impact on these resources.

#### 4.4.3.1.15. Fish Weirs/Traps

Fish weirs and traps are built along the coast to take advantage of tides and the presence of fish. These property types do not require uninhibited views of the ocean. Offshore development would have a low impact on these resources.

#### 4.4.3.1.16. Villages

Villages are often set in locations that are advantageous for resource collection but also in settings that afford uninhibited views of surrounding area including the ocean. The setting is often culturally significant; therefore, offshore development visible from shore would have a high impact on villages that require an unimpeded view of the ocean.

#### 4.4.3.1.17. Rock Shelters

Rock shelters exist in locations that do not require uninhibited views of the ocean. These sites are simply opportunistic locations where voids in rock allow access for humans. As such, offshore development would have low impact on these resources.

#### 4.4.3.2. *Historic-Era Built Resources*

Historic built resources change over time, consequently losing some historic physical features or characteristics. It is not necessary for these properties to retain all of their historic features to still be considered historic properties. While the introduction of offshore development is unlikely to diminish the integrity of a property for which a view is an essential physical feature to the extent that the property would no longer be considered historic, the loss of any essential historic feature is considered to be an adverse effect under Section 106.

For an ocean view to be considered an essential historic feature, the view would have had to have influenced the initial siting of the property, for instance, for defense purposes or for aesthetic qualities. Some resources may have been initially constructed for utilitarian reasons, such as roads or bridges, but the setting is nevertheless an essential feature of the resource's significance, causing the alteration of the view to potentially adversely affect the property. The visual effect of offshore development on the following property types is based on probability; each historic property or potentially eligible resource may or may not be adversely affected due to multiple dependencies; consequently, each property needs to be individually considered for potential adverse effects. National Historic Landmarks or National Historic Landmark Districts are to be protected from project effects to the maximum extent possible and are to be given special consideration.

##### 4.4.3.2.1. Residential

###### *4.4.3.2.1.1. Early U.S. Expansion*

Residential properties from early U.S. expansion efforts are rare resource types, but some remnants exist from the eighteenth century. Residential buildings on the Ranchos in California were constructed of adobe, while pioneer settlements in the Pacific Northwest primarily consisted of rustic log cabins or simple wood-frame structures. Although the significance of this kind of property is most likely for its association with historic events and its rare type of construction, for some, ocean views may be a distinctive character-defining feature. While the introduction of offshore development would not diminish the integrity of these properties to the extent that the property would no longer be considered historic, this kind of alteration may adversely affect these kinds of properties under Section 106.

###### *4.4.3.2.1.2. Early Coastal Communities*

Along the west coast many small-scale coastal communities established throughout the nineteenth and early twentieth centuries were formed around industrial activities, such as fishing or timber. These properties are generally eligible or listed for their historic association with settlements located on the coast for practical reasons, such as access to fishing/shipping wharfs, seafood processing plants, or timber mills. However, many of the homes, both those that are modest and those that were built by the captains of coastal industry, were sited to take advantage of the ocean view, either for the aesthetic value or for spotting incoming ships associated with their coastal industry. While the introduction of offshore development would not diminish the integrity of these properties to the extent that the property would no longer be considered historic, this kind of alteration may adversely affect these kinds of properties under Section 106.

Other coastal communities were initially established for recreation, particularly in central and southern California. The kinds of residences in these communities were primarily located and designed for beach access and potentially the ocean view, built either as summer homes for the wealthier inhabitants or cottages used by local workers. Consequently an uninhibited ocean view may be considered a significant historic feature. While the introduction of offshore development may diminish the integrity of setting and feeling, it would not diminish the integrity of these properties to the extent that the property would no longer be considered historic. Nevertheless, this kind of alteration may adversely affect these kinds of properties under Section 106.

###### *4.4.3.2.1.3. Early to Mid-Twentieth Century Coastal Communities*

Suburban residential communities began to form on the outskirts of established urban areas. These suburbs consist of single-family houses, duplexes, and multi-story apartment buildings in a variety of architectural styles. Ocean adjacency is characteristic of these kinds of communities, and many of these residences were sited to include an ocean view. Consequently, an uninhibited ocean view may be considered a significant historic feature. While the introduction of offshore development may diminish the integrity of setting and feeling, it would not diminish the integrity of these properties to the extent that the property would no longer be considered historic. Nevertheless, this kind of alteration may be considered an adverse effect under Section 106.

Some coastal communities, particularly in southern California, grew as residential enclaves serving larger coastal and inland cities. Some may have been initially established as summer retreats or with amusement attractions. The homes were generally designed in the popular styles of the time, and the layouts were organized and the buildings sited to maximize the beach access or the ocean view. While it is unlikely these residences would be found to be individually eligible for the NRHP, they may be contributors to a larger historic district, for which the quality of the view is a historic feature. Consequently, an uninhibited ocean view may be considered a significant historic feature, and the introduction of offshore development may diminish the integrity of setting and feeling. Nevertheless, such development would not diminish the integrity of these properties or districts to the extent that the properties or districts would no longer be considered historic. However, this kind of alteration may adversely affect these kinds of properties under Section 106.

###### *4.4.3.2.1.4. Elite Architect-Designed Coastal Homes*

From the late nineteenth century the wealthy built residential estates along the Pacific coast. These large-scale homes, often part of a larger compound, were specifically designed for their site and constructed to take advantage of ocean views. Many were designed by well-known architects, such as Frank Lloyd Wright, Julia Morgan, and Irving Gill. The uninhibited ocean view is characteristic of these kinds of properties, and the introduction of offshore development has the potential to diminish their integrity of setting and feeling. These custom, usually architect-designed, homes or estates were designed to maximize the ocean view, making the quality of the view an influencing factor in the design. These homes are generally eligible or listed on the NRHP for being the work of a master and/or because they possess high artistic values. While the introduction of offshore development would not diminish the integrity of these properties to the extent that they would no longer be considered historic, this kind of alteration may be considered an adverse effect under Section 106.

#### 4.4.3.2.2. Commercial

Commercial buildings located within the study area include a range of building types representing a variety of economic activities. Hotels and restaurants may have been designed to maximize the ocean view, the view being a prominent and distinctive aspect influencing the design of these buildings. Although the integrity of the setting and feeling of these properties may be adversely affected, they would retain their integrity of design, workmanship, materials, overall setting, location, general feeling, and association. Therefore, the introduction of offshore development would not affect the integrity of these types of properties to the extent that they would no longer be considered historic. Nevertheless, this kind of alteration may adversely affect these kinds of properties under Section 106.

The balance of the commercial building types, including retail stores, banks, and office buildings, were located to support the community rather than to take in the ocean view. If individually eligible for listing on the NRHP, it is unlikely that the view is an important character-defining feature that contributes to the significance of these kinds of commercial built resources. They would, therefore, as individual properties, not be adversely affected by offshore development. They may be contributors to a larger historic district, for which the quality of the view is a significant historic feature. While the introduction of offshore development would not diminish the integrity of such a district to the extent that it would no longer be considered historic, this kind of alteration may adversely affect these kinds of properties under Section 106.

#### 4.4.3.2.3. Institutional

##### *4.4.3.2.3.1. Schools and Research Facilities*

Educational built resources vary widely throughout the study area, but mostly consist of early to mid-twentieth century public elementary and high schools, and large college campuses. It is unlikely that these kinds of built resources would be adversely affected by offshore development. These properties are generally associated with communities, irrespective of the ocean view. The integrity of design, workmanship, materials, overall setting, location, general feeling, and association would be retained. Therefore, these kinds of properties, if individually significant, would not likely be adversely affected under Section 106 by the introduction of offshore development.

However, these properties may be contributors to a larger historic district, for which the quality of the view is a significant historic feature. While the introduction of offshore development would not diminish the integrity of such a district to the extent that it would no longer be considered historic, this kind of alteration may adversely affect these kinds of districts under Section 106.

##### *4.4.3.2.3.2. Hospitals*

Similar to schools, it is unlikely that individual historically significant hospitals would be adversely affected by offshore development. These properties are generally associated with communities, irrespective of the ocean view; therefore, the quality of the distant view would not be considered an essential feature qualifying it for the NRHP. The integrity of design, workmanship, materials, overall setting, location, general feeling, and association would be retained. Consequently, if individually significant, these kinds of properties would not likely be adversely affected under Section 106 by the introduction of offshore development.

However, they may be contributors to a larger historic district, for which the quality of the view is a significant historic feature. While the introduction of offshore development would not diminish the integrity of such a district to the extent that it would no longer be considered historic, this kind of alteration may adversely affect these kinds of districts under Section 106.

An exception would be if the facility was a sanitarium or other health retreat, sited and designed to exploit the view for its calming, soothing effect. The uninhibited ocean view may be considered a significant historic feature of this property, and the introduction of offshore development could diminish the integrity of setting, feeling, and association. However, it would retain its integrity of design, workmanship, materials, overall setting, location, general feeling, and association. While the introduction of offshore development would not diminish the integrity of these properties to the extent that they would no longer be historic, this kind of alteration may adversely affect these properties under Section 106.

##### *4.4.3.2.3.3. Government*

It is unlikely that government or civic buildings would be adversely affected by offshore development. These properties are generally associated with communities, irrespective of the ocean view. Although they may have been sited to capitalize on an ocean view, the view would not likely be a prominent and distinctive aspect of the historic significance of the building; and the quality of the view would not be considered an essential feature. Therefore, these kinds of properties would not likely be adversely affected under Section 106 by the introduction of offshore development.

However, they may be contributors to a larger historic district, for which the quality of the view is a significant historic feature. While the introduction of offshore development would not diminish the integrity of such a district to the extent that it would no longer be considered historic, this kind of alteration may adversely affect these kinds of districts under Section 106.

#### 4.4.3.2.4. Industrial

These are properties associated with the timber, fishing, shipping and trade, and oil industry, including harbors and marinas. The introduction of offshore development would not adversely affect these kinds of properties. The ocean adjacency is character-defining for these kinds of industrial properties and a prominent and distinctive aspect; the quality of the view would not be considered an essential feature. The integrity of design, workmanship, materials, setting, location, feeling, and association would not be diminished. Therefore, these kinds of properties would not likely be adversely affected under Section 106 by the introduction of offshore development.

#### 4.4.3.2.5. Agricultural

The introduction of offshore development would not adversely affect agricultural properties. These kinds of resources are generally not dependent on being located adjacent to the ocean, other than convenient transportation for their products—ranches and farms are found throughout Washington, Oregon, and California. The quality of the view would not be considered an essential feature. The integrity of design, workmanship, materials, setting, location, feeling, and association would not be diminished. Therefore, these kinds of properties would not likely be adversely affected under Section 106 by the introduction of offshore development.

#### 4.4.3.2.6. Religious

##### *4.4.3.2.6.1. Missions*

The missions of eighteenth-century California represent some of the earliest Spanish settlement in the west. There are only two within the study area, one of which, Mission San Carlos Boromeo in Carmel, is a National Historic Landmark. The settings for both of these historic properties have been significantly altered since their periods of significance. The introduction of offshore development would not adversely affect the significance of these properties. These kinds of resources are not dependent on being located adjacent to the ocean—as is evidenced by the fact that most of the missions are not within the study area but farther inland. Practicality and access dictated the placement of these missions. The integrity of design, workmanship, materials, setting, location, feeling, and association would not be diminished. Therefore, these missions would not likely be adversely affected under Section 106 by the introduction of offshore development. However, because Mission San Carlos Boromeo is a National Historic Landmark, it is to be given special consideration, and any alterations are to be avoided to the maximum extent possible.

##### *4.4.3.2.6.2. Churches and Cemeteries*

Churches are located throughout the study area and span back to the earliest European settlements. Churches are usually individually eligible for their architecture and are generally not dependent on being located adjacent to the ocean—historically significant churches are found throughout Washington, Oregon, and California. However, some built adjacent to the coast may have been sited and/or designed to exploit the view. The uninhibited ocean view may be considered a significant historic feature of this kind of property, and the introduction of offshore development could diminish the integrity of setting, feeling, and association. However, the property would retain its integrity of design, workmanship, materials, overall setting, location, general feeling, and association. While the introduction of offshore development would not diminish the integrity of these properties to the extent that they would no longer be considered historic, this kind of alteration may adversely affect these kinds of properties under Section 106.

Additionally, even if the view is not a historically significant feature of a church or cemetery, the property may be a contributor to a larger historic district, for which the quality of the view is a significant historic feature. While the introduction of offshore development would not diminish the integrity of such a district to the extent that it would no longer be considered historic, this kind of alteration may adversely affect these kinds of districts under Section 106.

An example of a church that may be adversely affected by the introduction of offshore development is the Wayfarer's Chapel and gardens in Rancho Palos Verdes, California. The setting, including the ocean view, is an essential feature of this Frank Lloyd Wright Jr.–designed property. While the introduction of offshore development would not diminish the integrity of these kinds of properties to the extent that they would no longer be considered historic, this kind of alteration may adversely affect these kinds of properties under Section 106.

### 4.4.3.2.7. Military

#### *4.4.3.2.7.1. Early Eighteenth-Century Exploration to the Endicott Era*

The earliest military outposts date from the late-eighteenth to early-nineteenth century European settlements, such as the Spanish Presidios and Russian forts; the Endicott era introduced coastal defense structures in the late nineteenth century through the 1920s. These military posts and installations were designed to maximize the ocean view for early detection of ocean-going threats, making the view a character-defining feature. The uninhibited ocean view is a historic feature of these kinds of properties and the introduction of offshore development could diminish the integrity of association and setting. While the introduction of offshore development would not diminish the integrity of these properties to the extent that they would no longer be considered historic, this kind of alteration may adversely affect these kinds of properties under Section 106.

#### *4.4.3.2.7.2. Military Bases*

Aerospace and defense became dominant industries in the early to mid-twentieth century, with Navy, Army, Air Force, and Marine bases established along the coast. The uninhibited ocean view is generally not a significant historic feature of these kinds of properties unless they were specifically sited to watch for coastal invasions. Even if this is or was the purpose of the facility, most are very large and are overall utilitarian in design, and the majority of built resources within the boundaries are not associated with the ocean view. For such military facilities, the introduction of offshore development may, but is unlikely to, diminish the integrity of setting of these properties. If the introduction of an offshore development is found to adversely affect this type of property under Section 106, it would not affect the integrity to the extent that they would no longer be considered historic; they would retain their integrity of design, workmanship, materials, overall setting, location, feeling, and general association.

#### *4.4.3.2.7.3. Coast Guard/Lighthouses*

Multiple lighthouses are listed on the NRHP. These facilities were designed for uninhibited views of the ocean, making the view a character-defining historic feature. The introduction of offshore development could diminish the integrity of setting and feeling. However, they would retain their integrity of design, workmanship, materials, overall setting, location, general feeling, and association. While the introduction of offshore development would not diminish the integrity of these properties to the extent that they would no longer be considered historic, this kind of alteration may adversely affect this property type under Section 106.

### 4.4.3.2.8. Recreation

#### *4.4.3.2.8.1. Coastal Resorts and Piers*

Coastal resort communities began to form in the mid- to late-nineteenth century to escape from urban life and serve as beach recreation destinations. For resorts designed to capitalize on the ocean view, an uninhibited view can be considered a significant historic feature. The introduction of offshore development could diminish the integrity of setting and feeling. However, they would retain their integrity of design, workmanship, materials, overall setting, location, general feeling, and association. While the introduction of offshore development would not diminish the integrity of these properties to the extent that they would no longer be considered historic, this kind of alteration may adversely affect this property type under Section 106.

The ocean view from beach-front properties that were designed to maximize access to and use of the beach, as well as the view from fishing piers, is more incidental. These properties would retain integrity of design, workmanship, materials, setting, location, feeling, and association; therefore, they would not be adversely affected under Section 106 by the introduction of offshore development.

#### *4.4.3.2.8.2. Retreats*

For this kind of property, an uninhibited ocean view could be considered a character-defining feature, a significant historic feature that influenced the siting and design of the retreat. The introduction of offshore development could diminish the integrity of setting and feeling of this type of property; however they would retain integrity of design, workmanship, materials, overall setting, location, general feeling, and association. While the introduction of offshore development would not diminish the integrity of these properties to the extent that they would no longer be considered historic, this kind of alteration may adversely affect this property type under Section 106.

#### *4.4.3.2.8.3. Sports and Leisure*

Various recreational sport facilities are located within the project area, ranging from golf courses to public pools. Golf courses may be associated with larger coastal resorts, where an uninhibited ocean view can be considered a character-defining feature, a significant historic feature that influenced the siting and design of resort. The introduction of offshore development would not diminish the integrity of these properties to the extent that they would no longer be considered historic; this type of property would retain integrity of design, workmanship, materials, overall setting, location, general feeling, and association. However, this kind of alteration may adversely affect this property under Section 106.

#### *4.4.3.2.8.4. Parks and Open Space*

Conservation efforts on the Pacific coast date to the early twentieth century with grassroots movements and state park programs. This is a very broad category of properties. Many national and Washington, Oregon, and California state parks contain historic properties of a variety of types. Therefore, it cannot be determined, in general terms, if these parks would be adversely affected by the introduction of offshore development under Section 106. Similarly, parks with no historic component, but that have been in the system for 50 years or more, may be historically significant as part of the initial system of establishing public open space. Unobstructed distant views of the ocean from such open-space parks may be a character-defining feature. The introduction of offshore development would not diminish the integrity of these properties to the extent that they would no longer be considered historic because they would retain integrity of design, workmanship, materials, overall setting, location, general feeling, and association. Nevertheless, this kind of alteration may adversely affect this type of property under Section 106.

#### *4.4.3.2.8.5. Surfing Sites*

Unobstructed views from surfing sites are a character-defining feature, but not likely a prominent and distinctive aspect of the historic significance of such properties that qualifies them for the NRHP, provided wave patterns are not altered by offshore development. While the integrity of the setting and feeling of these surfing sites may be somewhat diminished, they would retain integrity of design, workmanship, materials, overall setting, location, general feeling, and association. Therefore, the introduction of offshore development would not diminish the integrity of these properties to the extent that they would no longer be considered historic. However, this kind of alteration may be considered an adverse effect under Section 106.

### 4.4.3.2.9. Transportation

#### *4.4.3.2.9.1. Roads and Railroads*

The Pacific Coast Highway, the main roadway within the study area, and the coastal railways were built over time to connect coastal settlements; to access coastal resources, such as timber, fish, and agricultural products, and facilitate the shipping of these products; and, in some concentrated areas, to connect a series of estates and associated recreational facilities or retreats, such as the 17-mile drive in Monterey County, California. Some of these stretches of road connect a series of related historically significant properties—buildings, structures, and objects—and are considered to be historic districts, such as the Carmel to San Simeon Highway, a stretch of California State Highway 1. Although practicality initiated the construction of these roads, the builders of some stretches recognized the value of the viewscape and included turnouts that allow the traveler to pull off the road and appreciate the view, thus making the view a character-defining feature of these resources. There are no railroads as linear districts in the NRHP within the study area; however, it is likely that some may be found eligible, with their viewsheds identified as character-defining features.

While the introduction of offshore development would diminish the integrity of the feeling and setting of these linear resources, they would retain their integrity of design, workmanship, materials, overall setting, location, general feeling, and association. Despite the diminishment of integrity, the integrity of these properties will still be adequately sufficient to be considered historic. Nevertheless, this kind of alteration may adversely affect these kinds of properties under Section 106.

#### *4.4.3.2.9.2. Bridges and Railroad Trestles*

Bridges in the study area include rail and automobile bridges dating back to the mid- to late-nineteenth century. These are iconic bridges such as the Golden Gate Bridge and the Bixby Bridge in California and less well-known bridges such as those that may be part of a series of trestles or smaller bridges associated with larger linear historic districts, such as the afore-mentioned Carmel-to-San Simeon Highway with its 36 bridges. As with the highways and railways, these bridges and trestles were built for transportation. For roadway bridges, the associated view in some cases may have influenced the design, leading to the inclusion of pedestrian access and car pull-outs. Consequently, the views from many of these bridges are character-defining features. By their nature, railroad bridges and trestles would not be designed with view pull-outs. However, as contributors to their associated railroads, or as individually eligible resources, the viewshed could be considered a character-defining feature. While the introduction of offshore development would diminish the integrity of the feeling and setting of these linear resources, they would retain their integrity of design, workmanship, materials, overall setting, location, general feeling, and association. Despite this diminishment of integrity, the integrity of these properties will still be adequately sufficient to be considered historic. Nevertheless, this kind of alteration may adversely affect these kinds of properties under Section 106.

## 4.5. Recommendations for Further Identification of Coastal Properties

This study has identified and located coastal built historic resources, traditional cultural properties, and archaeological resources in Washington, Oregon, and California within 1 mile of the Pacific coast. Resources included in this database are those listed in and previously found eligible for the NRHP, the CRHR, and the WHR. Many built resources, archaeological resources, and TCPs may not be listed in a state or national register. Regardless of eligibility status, all resources were categorized and then analyzed by type for their potential to be visually affected by future offshore development. The study also identified areas where sensitive property types are concentrated. No fieldwork was conducted; consequently, the ocean view from these resources has not been confirmed, their current condition has not been verified, and properties not previously determined to be historic have not been surveyed and evaluated. There may also be resources beyond the 1-mile study area that have ocean views for which the viewshed is significant.

It is recommended that, once BOEM determines which areas are most likely candidates for future offshore development projects, they initiate Section 106 and follow the guidelines set forth in 36 CFR 800. This includes performing intensive surveys to field verify the quality of views from historic built resources, archaeological resources, and TCPs; determine if these resources have retained integrity; survey those built resources of sufficient age that have not yet been evaluated for historic significance; and survey for yet-unidentified archaeological properties. Continuing the Section 106 process, the SHPOs, as appropriate, should be consulted, and consultation with relevant interested parties should be reinitiated and continue throughout the decision-making process. In particular, BOEM, as part of the U.S. Department of the Interior, is committed to fulfilling its Tribal consultation obligations as directed by Executive Order 13175 and following the Department of the Interior Policy on Consultation with Indian Tribes. During the course of future projects, once the historic, prehistoric, and traditional cultural properties that have been determined to be adversely affected are established, the resolution of the effects needs to be cooperatively agreed upon and memorialized in an agreement document between relevant agencies and interested parties.

# 5. INVENTORY OF UNDERWATER CULTURAL HERITAGE

## 5.1. Maritime Historical Background

### 5.1.1. Maritime History

#### *5.1.1.1. Possible Asian Exploration of the Pacific Coast*

When discussing the maritime heritage of the west coast, the well-known explorations of the Spanish immediately come to mind. However, historical scholarship indicates that there is a potential that the first non-Native Americans to explore the Pacific coast of the United States might have been the Chinese. In 1761, historian Joseph de Guignes argued that Hui Shen and a group of Chinese Buddhist missionaries visited the Pacific coast of North America in 499 (Needham 1971). In the mid-twentieth century, attorney and code breaker Henriette Mertz (1972) also supported the idea of Chinese exploration off the Pacific coast. Figure 74 provides a portion of a map from 1776 showing the Pacific Northwest with a Chinese name "Fou-Sang" that would indicate there had been a Chinese presence in the area. Recently, journalist Rowan Gavin Paton Menzies argued that the fleets of Chinese Admiral Zheng visited the Pacific coast prior to Columbus' exploration (Menzies 2002). However, other historians, like Finlay (2004), have criticized Menzies' historical research.


Figure 74. A portion of the 1776 Zatta map of the Pacific Northwest showing Fusang (From Geographicus 2012).

Brooks (1875) and Davis (2000) claim that early Japanese shipwrecks along the Pacific coast suggest the possibility of Japanese exploration of the Pacific coast and shipwrecks that could have occurred. The extent of Chinese or Japanese exploration of the Pacific coast is unknown; however, there is very little evidence that either group established any trading posts or settlements along the coast. It would not be until the Spanish arrived in the 1500s that settlements with port facilities and regular maritime activities were established.

#### *5.1.1.2. Early Exploration and Settlement by the Spanish*

The west coast, and California in particular, was first explored and surveyed by the Spanish during two voyages in the 1540s. In 1539, Hernan Cortes, the Viceroyal of New Spain, authorized Francisco de Ulloa to explore the Baja Peninsula. De Ulloa, then, disproved the myth that California was an island. A few years later, Juan Rodriguez Cabrillo, a Spanish explorer working for the Spanish Empire, conducted an extensive survey of the coast of modern-day California north to the present-day Oregon border. Cabrillo died during the voyage, but his crew returned to Mexico with a basic map of the California coast. Although the Spanish had a good understanding of the geography of the coast, they did not attempt to colonize the coast until 1769, over 200 years after the initial discovery. There were several reasons for the minimal presence of Spanish settlement in California, including a lack of finances in the Spanish Empire to back expansion of settlements, and a perceived lack of important resources like gold and silver (Myers 2004). Of course, settlers would later realize the richness of California and the northwest in natural resources.

While the Spanish initially failed to capitalize on their knowledge of the California coast, the development by Spain of the Manila Galleons, which transported Chinese porcelain, silk, ivory, spices, and other exotic goods from Asia to Spanish settlements in Mexico, resulted in the expansion of the west coast into the global trade (Figure 75). In 1565, Spanish sailors discovered the eastbound sailing route from the Philippines to Acapulco. That year, the 40-ton bark *San Luis* reached the California coast (Gearhart et al. 1990; Schurz 1939). This success ushered in a new era, where large ships would traverse the Pacific, and on the return from China the galleons traveled to Acapulco, Mexico, via the Philippines, to unload their cargo.

While Acapulco was the normal port of entry for Asian goods, the Spanish realized that ports and safe harbors farther north along the California coast would offer other options to the galleons in the case of storms, privateer attacks, or other problems (Hecht 2003). The Spanish Manila Galleons continued to transport trade goods between Asia and Mexico from 1565 to 1815, when Cortez de Cadiz opened the Philippines to free trade from non-Spanish vessels.

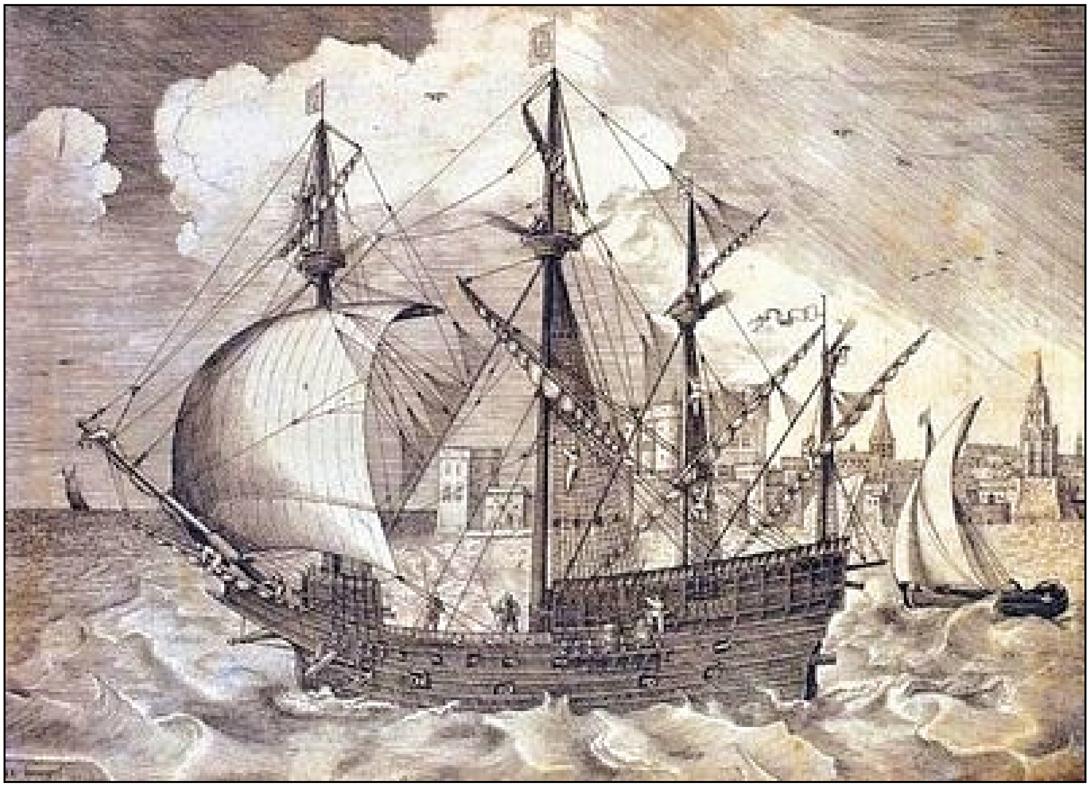

Figure 75. A Spanish galleon engaged in trade with China (From Geo-Mexico 2012).

#### *5.1.1.3. The British Response to Spanish Exploration of California*

In response to Spanish expansion, the English countered Spain's claims to the New World territory. From 1577 to 1580, Sir Francis Drake conducted England's first circumnavigation of the globe (Figure76). At the time, England was behind the other European nations with regard to its maritime power. His successful mission paved the way for the growth of Britain's maritime influence. During his trip, Drake attacked Spanish ships and outposts and claimed land in the name of the Crown. At the port of Nova Albion (near present-day San Francisco), Drake laid claim to present-day California, Oregon, and Washington for England. However, his fleet was not equipped for colonization, so Drake did not place any settlers along the coast (Von der Porten and Russell 2011). His fleet continued its course west across the Pacific and returned to Plymouth in September 1580, completing the first British circumnavigation, and beginning a period of British maritime dominance that would last until the twentieth century.

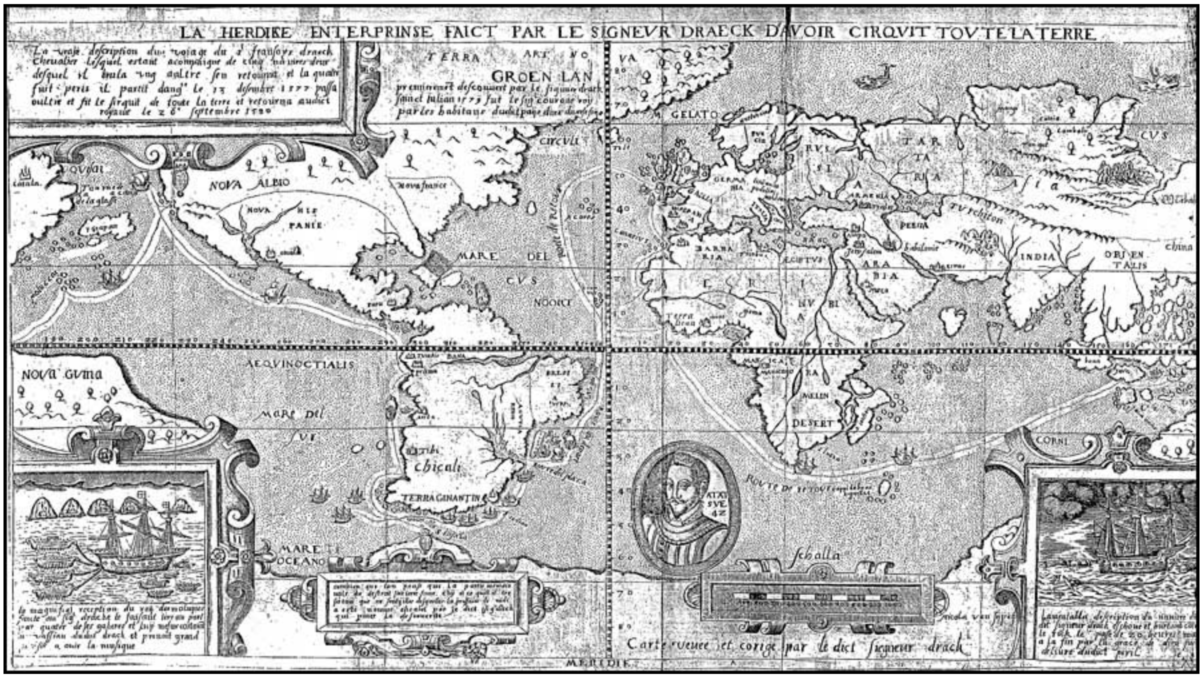


Figure 76. Map of Sir Francis Drake's circumnavigation of the globe, 1577–1580 (From Reformation Online n.d.).

With the success of Drake's mission, the British, mainly using privateers, began attacking Spanish galleons all over the world. For example, between 1568 and 1588, British privateer Thomas Cavendish burned 119 Spanish vessels in the Pacific, including the 700-ton Spanish galleon, *Santa Ana,* near present-day Baja, Mexico. The galleon was described by the bishop of the Philippines as the "the richest ship to ever leave these isles" (Niemann 2002: 17).

#### *5.1.1.4. Spanish Charting of the Coast*

Fearing the continued loss of treasure ships to the British, the Spanish government decided it needed to develop new ports along the California coast to provide alternative harbors for the ships crossing the Pacific (Gearhart et al. 1990). In 1591, Viceroy Luis de Velasco Enrique wrote to King Philip II of Spain, stating his desire to discover and survey the ports of California. Because of a lack of funding for the mission, the Spanish Crown authorized a private expedition headed by Sebastião Rodrigues Soromenho, a Portuguese sailor, to chart the new ports along the coast. In exchange for Soromenho funding the mission, he was to receive concessions enabling him to make a profit on his venture (Chapman 1921).

In 1595, Soromenho boarded the Spanish galleon, *San Agustin*, in Manila to cross the Pacific. On November 4, 1595, he first sighted the Pacific coast at about 42° latitude; however, he was probably closer to 41°, near present-day Eureka, California. On November 5, the ship spotted Drake's Bay near Point Reyes, which Soromenho renamed the "Bay of San Francisco," although he and his men also called it "Bahia Grande" (Great Bay). Unfortunately, while exploring the harbor, on November 30 *San Agustin* was driven on shore and wrecked. The party constructed a smaller boat and returned to Spanish settlements on the Baja Peninsula. Interestingly, Soromenho continued to chart the coast, even in the smaller rescue boat (Chapman 1921).

After Soromenho's mission, the Spanish government assigned the task of charting the coast to Sebastian Vizcaino, a Spanish navigator and merchant who had been active in the trade from the Philippines. He charted the coast from Cabo San Lucas to Cabo Mendocino. During his voyage, he rediscovered and named the port of San Diego, and charted the port of Monterey. He also located a strong river that he named Rio Santa Ines, and thought it might have been the fabled Strait of Anian that was part of a mythical Northwest Passage that would link the Pacific and the Atlantic Ocean (Hayes 2001). Figure 77 provides a map of California from 1650 showing the coast of California. Note that California is still shown as an island, even though earlier studies of the coast had proven otherwise.

Figure 77. Map of California as an island, ca. 1650 (From Library of Congress 2013f).

### 5.1.1.5. The Expansion of the Russian Empire into the Pacific

With the Spanish maintaining their empire in North America, the Russian Empire, under Peter the Great, was expanding in the Pacific. Starting in the 1720s, Vitus Bering led explorations of Alaska and the islands of the northern Pacific. During his 1741 voyage, Bering purchased otter pelts in Alaska and sold them to Chinese merchants. The high price of furs inspired the Russians to begin massive hunting of the otters. Their geographic interests therefore expanded. The Russians began hunting in the Aleutian chain and finally south toward the areas claimed by Spain (Huculak 1971).

By the 1760s, it appeared that the Russians were preparing to expand their colonization to the North American mainland. The Spanish realized that the coast of California was a likely site for that expansion. To counter the Russians, the Spanish established a harbor at San Blas, east of

Cape San Lucas (Gearhart et al. 1990). Like other places in the Americas, the Spanish utilized a series of missions at strategic locations along the coastline and inland to create a permanent Spanish presence and convert the native populations to Catholicism. In addition to the new missions, in 1774, the Spanish government authorized new voyages under Juan Jose Perez along the coast as a way to expand the Spanish sphere of influence. Quickly, the Spanish realized the Russians were not an immediate threat to their colonies along the coast, but other Western nations were eyeing the west coast and its resources (Gearhart et al. 1990).

### 5.1.1.6. The Arrival of the British and the Americans

As Spain continued to consolidate its holdings on the west coast, the British Empire saw the potential to place the Pacific Rim under its sphere of influence. In 1778, Captain James Cook, the famed British sailor and explorer, mapped the coast from California to the Bering Strait as part of his third voyage (Hayes 2002). The voyage also exposed the British to the economic potential of the fur trading industry in the north after Cook's sailors took some of the pelts they received along the west coast and traded them for huge profits in Asia. This realization spurred further British exploration of the area.

In 1792, the British government sent George Vancouver to survey the Pacific coast from 30° to 60° latitude, as well as to search for the Northwest Passage. Vancouver explored Puget Sound, and claimed the area for Britain, giving it control of the coast between the Russians' holdings in Alaska and the Spanish in the south. The British quickly expanded their interior fur trading from the Hudson's Bay Company in Canada to the Pacific coast.

In addition to the expansion of the British, the newly created United States also began eyeing the potential of the west coast. Soon after the American colonies obtained their independence, American merchants took a great interest in the Pacific for trade opportunities. In 1784, *Empress of China*, a trading ship from New York, began regular trips to Canton in China (Figure 78). The next year, the first American whaling ship was operating in the Pacific bringing whale oil back to the east coast. Finally, in 1787, American commercial ships began transporting cargo from New York and Boston to the Pacific Northwest via the Cape of Good Hope (Blume 2011). These efforts by the merchants of the newly independent nation integrated themselves into the economy of the Pacific, and this occurred even before America purchased the Louisiana Territory or had any claim to ports along the Gulf of Mexico coast.

Soon after the United States purchased the Louisiana Territory, and had its first claims to the Gulf coast, they began to further explore the Pacific. From 1838 to 1842, the U.S. Navy sanctioned the United States Exploring Expedition to chart the Pacific Ocean (Philbrick 2003). One part of the expedition included the charting of the northwest coast of the United States, including the Columbia River (Viola 1989).

In addition to the English and the Americans, Charles Wolcott Brooks (1875) discusses claims that Japanese shipwrecks along the Pacific coast from the late eighteenth and early nineteenth centuries would indicate that the Japanese were exploring there. More recently, Davis (2000) also suggests the possibility of Japanese exploration of the Pacific coast and shipwrecks that could have occurred.

Figure 78. 1784 painting of *Empress of China* (From New York History Walks 2012).

#### *5.1.1.7. The Fur Trade*

The first major economic pursuit along the west coast was the development of the maritime fur trade. Fur trading was a staple of English and French colonial economies along the east coast and the Great Lakes of North America. The discovery and exploitation of the fur trade would help to make the region more desirable for colonization by other Western powers and would serve as a catalyst for the development of the maritime landscape of the region.

The first European nation to develop the maritime fur trade was Russia. By the 1740s, Russian expeditions were gathering sea otters to trade with the Chinese. Similar to how the English and the French conducted their trade in the eastern part of North America, the Russians used Native Aleuts to hunt the otters, and the Russians served as middlemen in the trade. However, the Russians required the Aleuts and the other tribes to bring the pelts as a tribute rather than the free market system of the colonial powers. The slow reproductive cycle of the sea otter resulted in minimal repopulation of the hunting grounds, forcing the Russians to explore new areas for the valuable pelts (Gibson 1992). By the 1760s, the Russians were exploring the west coast of North America from Alaska to California.

South of the Russians, the Spanish were less successful in establishing a maritime fur trade. At first the Spanish did not attempt to exploit this new resource, but by the 1780s, Spanish missionaries were purchasing pelts near Baja and selling them to the Chinese (Ogden 1975). When great profits were realized for this venture, the Spanish colonial government began a major effort to establish a fur trading industry on the west coast. However, they had little success (Ogden 1975).

While the Spanish struggled to develop fur trading, the British quickly established a new center for the fur trade at Nootka Sound, near present-day Vancouver Island, Canada. After the initial contact during Cook’s third voyage, British captain John Meares established a small trading outpost at Nootka Sound in 1788 (Bélanger et al. 2011). Between 1785 and 1794, 35 British ships conducted trade missions to Nootka Sound, making it the center for the British fur trade (Gearhart et al. 1990). The Americans also entered the maritime fur trade in the late 1780s, when American merchants came to Nootka Sound to trade pelts (Dolin 2010).

Even though the Americans were no longer part of the British Empire, and had lost many of the advantages of trade, they were allowed to use Nootka Sound. Also, because of the expansion of the United States across North America, the Napoleonic Wars, and the free trade style of the American merchants, the U.S. soon became the dominant Western nation in the maritime fur trade. Between 1785 and 1794, the British exercised their control of the industry, and the Americans only assigned 15 trading vessels to Nootka. However, over the next 10 years, 50 American ships traded at Nootka compared to only nine British ships. This does not take into account the American merchants who began to trade directly with the Native American tribes, skipping the British trading post (Gearhart et al. 1990).

Unlike Nookta Sound, which was an international trading center, the Spanish would not allow foreigners to trade in California ports. Americans and Russians established several working agreements in the early 1800s to hunt and trade along California’s coast. These agreements used Russian-supplied hunters and American ships to operate illegally in the dangerous Spanish lands. This agreement illustrates the decline of the British and Spanish influence in the area, as well as the ascendancy of the American presence (Dolin 2010). By 1812, the Russians would establish a fur-trading outpost at Fort Ross, 50 miles north of San Francisco (Gibson 2011).

Lying 30 miles west of present-day San Francisco, the Farallon Islands, though seemingly uninhabitable, were the site of an early Russian settlement. Russian fur hunters settled here in the early nineteenth century to take advantage of the abundance of seals and other fur bearing creatures that lived on the island. Hansen (1940) reported that, in the span of three seasons, the hunters harvested some 200,000 fur seals. Understandably, these excessive harvests were unsustainable, and by the 1820s, the seal population was depleted. This local pattern was repeated at the many fur hunting grounds of the Pacific coast until the fur trade all but vanished as a coastal maritime activity.

Even as the Russians expanded into California, the fur trade industry was reaching its end. The European nations hunted the sea otter almost to extinction. While the sea otter trade was tremendously profitable for well over 100 years, its real impact was opening the west coast to maritime trade, the establishment of several ports, and the survey of the coast, which would be crucial as the region continued to grow.

#### *5.1.1.8. Spanish Hides and Tallow*

In the eighteenth and early nineteenth centuries, the Spanish established a chain of missions throughout California, and numerous ranchos appeared. By the 1820s, a thriving cattle industry in the Mexican territory of California contributed to the growth of maritime trade. The principal items of the trade were the hides and tallow that were processed from the cattle. The American vessels, *Alert*, *Pilgrim*, and *Sachem*, were examples of many ships that profited in the trade

(Dana 1937). *Sachem* journeyed to California in 1824 and returned to its home port of Boston with a cargo of hides and tallow that garnered high profits in the local market. The hides and tallow trade, though never huge, were the main economic activities, and the principal maritime activities, of California until the time of the Gold Rush. Between the 1800s and the 1840s, an estimated 200 vessels were involved in this trade, and approximately 5 million hides left California (Gearhart et al. 1990).

#### *5.1.1.9. The Rise of the Whaling Fleets*

Whalers from the eastern coast of the United States became more familiar with the Pacific coast around the turn of the nineteenth century. Their distribution across the Pacific gave rise to small settlements along the coast that owed their existence to providing victuals and supplies to the fleet. Eventually, the major whaling fleets of the northeastern United States migrated to the west coast. Their prosperity gave rise to what is known as the golden era of whaling, a period reaching roughly from the late 1820s to the 1850s. Whaling vessels formed nearly 10 percent of the American merchant fleet. Though diminished at mid-century, the whaling industry would regain strength around the turn of the twentieth century (Gearhart et al. 1990).

#### *5.1.1.10. The Emergence of the Lumber Industry*

A bona fide lumber industry arose on the west coast in the early nineteenth century and would have a lasting influence on maritime trade and activity well into the twentieth century. While the earliest explorers of the coast noted the abundant timber resources of the region, particularly in present-day Washington and Oregon, the first concentrated effort to provide lumber as a market item began with the British, specifically, the Hudson's Bay Company, in Hawaii in the 1800s. Several decades passed until the company expanded its lumber operations to the west coast. Puget Sound was their main focus for harvesting timber for trade. The company established a trading post on the Sound in 1833, and, from this headquarters, they explored and harvested the timber resources of the area. This activity was greatly challenged by the growing American influence in the region. Interest in the timber trade was one factor that contributed to the United States' constant pressure to wrest the region from the hands of the British. The United States accomplished this goal in 1845 from the 49th parallel south (Gearhart et al. 1990).

#### *5.1.1.11. The Mexican War on the Coast of California*

In the mid- to late 1840s, the United States fulfilled a decades-long dream and a crowning achievement of their policy of Manifest Destiny when they secured much of the Southwest and California from Mexico. Primarily a series of land expeditions and clashes, the Mexican-American War had a naval component along the coast of California. The U.S. Navy captured Mexican vessels, most of which were involved in the hides and tallow trade. The vessels involved were USS *Savannah*, USS *Portsmouth*, USS *Warren*, USS *Levant*, USS *Cyane*, USS *Shark*, and USS *Erie*. With the exception of *Erie*, which was a storeship, all of these vessels were heavily armed and prepared for battle. Nevertheless, the naval action took the shape of a blockade of the coast and was successful at disrupting Mexican trade. Moreover, this immense naval presence effectively demonstrated American dominance of the west coast (Delgado 1990).

### 5.1.1.12. The Gold Rush

The war against Mexico was scarcely over when gold was struck at Sutter's Mill in 1848. Hides and tallow, whaling, and lumber certainly shaped the maritime history of the west coast, but the discovery of gold and the ensuing Gold Rush was a watershed event. Easterners rushed to California and especially to San Francisco, which until then was a somewhat sleepy port that supplied whaling fleets and exported cattle products. The region was ill-equipped to supply the crush of people who came to search for gold farther in the interior. This condition presented an incredible opportunity for maritime interests, and the activity of the Gold Rush propelled San Francisco to the ranks of the major ports of the United States (Delgado 1990).

Maritime traffic of the west coast was greater during the time of the Gold Rush than in any previous period. The lack of supplies and almost every conceivable item a settler might need or want translated to a boon for eastern shippers, and they crowded the port of San Francisco. Not only did they bring supplies for sale, they brought many thousands of prospectors in any vessel on which passage could be obtained. In the first full year of the Gold Rush (1849), 775 ships left the east for San Francisco, varying from full-rigged sailing vessels to steamers (Delgado 1990).

The lack of buildings and storage space in San Francisco influenced the use of ships as floating storage. Many hundreds of ships were simply abandoned in the harbor between 1848 and the early 1850s, due largely to the settlers' overarching interest in getting to the gold fields. James P. Delgado, well-known historian of the Gold Rush, recently examined the archaeology of the Gold Rush in San Francisco harbor in *Gold Rush Port* (2009). Among other conclusions, Delgado discovered that the goods that were coming into San Francisco were of a truly international variety.

The seemingly overnight development of San Francisco as an international port of renown was reflected in the makeup of the men who worked at the port. Their numbers, of course, expanded greatly during the Gold Rush. In fact, few inhabitants of San Francisco were not involved in occupations connected to maritime activities. "Whether native born American, Irish, or German, Catholic or Protestant, black, yellow, or white, San Francisco's heavily male population spent its working days on or near the wharves, warehouses, counting houses, and workshops of the waterfront district" in the 1850s and 1860s (Issel and Cherny 1986: 14).

### 5.1.1.13. The Lumber Industry Expands

The lumber industry, then in its infant stages along the west coast, set a course for great expansion as a result of the Gold Rush. While the west coast burgeoned with lumber in the latter half of the nineteenth century, supplies were much in demand during the Gold Rush. There was scarcely a vessel from the ports of the Atlantic that came to San Francisco without raw lumber and various finished wood products aboard. These products included everything from shingles to doors. Prefabricated houses also were among these cargoes (Turhollow et al. 1983).

Lumbermen also marketed harvests of timber from the San Francisco area, but the supply soon was exhausted. Therefore, prospective and active lumber interests turned to the present-day states of Oregon and Washington. The modern-day cities of the region—Seattle, Tacoma, Portland, Astoria, and so on—owe much of their early prosperity to the lumbermen who moved there to establish mills. By the end of the Gold Rush in the 1850s, these ports expanded their market for lumber. Whereas San Francisco received much of their exports during the Gold Rush, ports as far away as Great Britain were importing lumber from the Northwest in the latter half of the nineteenth century (Gearhart et al. 1990).

Puget Sound and the Columbia River virtually bled lumber exports in the mid- to late nineteenth century. This activity may not have been possible without the contribution of pilots (Figure 79). The Columbia River mouth, as well as the smaller bays of Willapa and Grays Harbor, had such contradictory channels that mariners frequently ran into trouble at these places. The Columbia bar pilots were well-experienced, knowledgeable, and brave individuals who guided an untold number of vessels in and out of the port.

Figure 79. Columbia bar pilots, 1853 (From Wright 1895).

Even the presence of pilots, lighthouses (discussed below) and increasingly better nautical charts could not diminish the chance of shipwrecks along the Washington coast, much less, the coasts of Oregon and California. R. E. Wells (1989) has researched hundreds of shipwrecks along the Washington coast. He discovered that the majority were lumber vessels and that the size of the vessels increased as the century progressed. Their propulsion also changed from sail to steam, in keeping with the broader pattern in maritime shipping.

Nearly every navigable bay along the coast of Washington and Oregon was shipping timber in the mid-nineteenth century and in the post-Civil War years. Coos Bay, located on the coast of Oregon about 180 miles south of the Columbia River and 445 miles north of San Francisco Bay, was significant in that it was one of few natural harbors between these two major areas of maritime activity. Although the bar at its entrance had an infamous reputation due to the difficulty negotiating passage through its swift waters, Coos Bay was a center of maritime-related activity. Henry H. Luse built one of the first sawmills on the bay in 1856, setting the area on a course that led to its being one of the largest lumber ports on the west coast. Luse also began a shipbuilding operation on the bay. (Jensen 2012).

The rapid expansion of the lumber shipping industry necessitated the need for government policing of the region. By the 1850s, several thousand people settled around Puget Sound, by far the most populous area in Washington Territory. In 1853, the Federal government designated the largest port on the Sound, Port Townsend, as the base of the Collector of Customs. At that time, smuggling was the greatest challenge the office faced, and thus the topsail schooner *Jefferson Davis,* a revenue cutter, was put into service. The arrival of this cutter is recognized as the beginning of the U.S. Coast Guard in the Pacific Northwest. This vessel fulfilled numerous duties: search and rescue, troop transport, official mail deliverer, and, of course, intercepting smugglers. Revenue cutters became a common sight along the west coast in the nineteenth century (Noble ca. 1989).

Portland historically benefited from lumber and also diversified as the interior of the state was further settled during the course of the post-Civil War era. Portland developed into an exit port for wheat grown in the interior and also experienced a mini-boom during the Idaho gold rush. The town grew into one of the largest cities in the west and a burgeoning port that owed much to its role as a transshipment point between ocean craft and the river steamboats that plied the Columbia River. After entering the mouth of the river, ocean-going vessels made their way to Portland. From there, the river steamers shipped their wares inland (Turhollow et al. 1983).

### 5.1.1.14. The Development of West Coast Lighthouses

The sea along the west coast, particularly from northern California to Washington, is renowned for partially submerged rocks as well as heavy precipitation, fog, and often violent winds. Navigating through this region was never simple, and the coast was much feared by sailors. In 1849, the U.S. Coast Survey examined the west coast for lighthouse sites. At the time, none existed. The Coast Survey determined that the most treacherous area—that of the Oregon and Washington coasts—required 16 light stations. The recommended sites included Cape Disappointment, so named for the difficulty of navigating the area. Between 1852 and 1858, the Federal government heavily invested in these lights, and the first was completed in 1854. Work on lights in California took place in this period as well, and light stations continued to be built along the west coast through the latter half of the nineteenth century (Noble ca.1989).

Even with the improvements in aids to navigations, shipwrecks still happened. *Brother Jonathan,* a sidewheel steamship, ran into a nor'easter on July 30, 1865, at St. George Reef off present-day Crescent City, California. In 1792, British explorer George Vancouver had called this reef-strewn area "Dragon Rocks," and many vessels have since perished here. Not long after *Brother Jonathan* had departed San Francisco, the vessel struck an uncharted reef and quickly took on water. In the span of 45 minutes, the ship sank, along with a significant cargo of gold. At least 225 people died. Aboard were such figures as General George Wright, past Commander of the Pacific for the Union forces in the Civil War; Governor Anson Henry of Washington Territory; and James Nisbet, editor of the *San Francisco Evening Bulletin*. The loss of this vessel is still one of the worst tragedies in the history of west coast shipping (Powers 2007).

Located at the "Dragon Rocks" area where *Brother Jonathan* came to grief, the St. George Reef Lighthouse was built with incredible effort and investment (Powers 2007). The site chosen was atop an isolated rock protruding from the sea, known as North West Seal Rock. Construction began in 1883 and took years to complete due to the difficult setting. Finally lit in 1892, the lighthouse station gained a reputation as the most difficult assignment in the Lighthouse Service. The fact that it remained in operation until 1975, when technology was replacing the need for lighthouses, is a testament to the bravery of those who served as much as it is an indication of the value of the lighthouse (Powers 2007).

During World War II, when the Coast Guard patrolled the coasts of the United States, lighthouse stations, including those along the west coast, became spotting stations for military land and sea operations. They also were used as radio stations (Powers 2007). In the context of these war duties, the lighthouse stations and the Coast Guard in general carried on their traditional duty of assisting mariners such as those aboard the Russian freighter *Lamut* on March 31, 1943 (Figure 80). In a gale, the vessel became stranded near Cape Flattery, Washington, at Teahwhit Head. With 52 persons aboard and the vessel incessantly smashing against the rocks, the situation was a dire emergency. Unable to reach the vessel over water, the men from the Quillayute Coast Guard Station crossed the wooded and steep terrain ashore from *Lamut* and descended the rocky cliff. Finding that their rope was too short to reach the castaways, the men tied their shoelaces together until the necessary length was achieved and then began pulling the survivors from the stricken vessel (Noble ca. 1989).

In the post-World War II era, lighthouses became obsolete. The rise of technological advances in navigation such as short-range navigation aids (SHORAN) and long-range navigation aids (LORAN) meant that mariners could essentially navigate in pure darkness if need be. Gradually, the lighthouses of the west coast were deactivated.

Figure 80. The Russian freighter *Lamut* smashed against the rocks south of Cape Flattery, Washington, April 1, 1943 (From Noble ca. 1989).

### 5.1.1.15. The Life-Saving Service of the West Coast

For many years, those concerned with maritime transportation along the coast of the United States noted the need for houses of refuge and life-saving teams along the uncharted and often treacherous shores of the country. By the 1850s, the United States Congress was sufficiently convinced to allocate funds for the development of what became known as the Life-Saving Service. The first stations appeared in the northeast and spread across the coasts of America. The main duty of the stations was to assist in the rescue of mariners in distress close to the beach (Evans 2003).

Life-Saving Stations were first established on the west coast at Shoalwater, Washington, in 1877. Life-Saving Stations typically consisted of around a half-dozen full-time crew members and a keeper. They kept surf boats on hand that were employed in what were then pioneering rescue techniques, including motorized propulsion and the use of telephones to coordinate rescues with other stations (Evans 2003). Additionally, the breeches buoy was employed. This device was a sort of cannon that shot a line to ships in distress, thereby allowing the men of the Life-Saving Service to pull distressed sailors to safety. The rescues typically were feats of heroism. In one of the more incredible acts recorded, Keeper Alfred T. Harris and his crew of the Cape Disappointment Station (established in 1878) rescued 175 passengers from the British barkentine, *Lammelaw*, which had grounded near Shoalwater Bay on October 30th, 1882. The event so impressed the British government that they awarded one of the men involved in the rescue, Alfred T. Stream, a medal (Noble ca. 1989).

Because of its central place in maritime trade, the San Francisco area had one of the highest concentrations of Life-Saving Stations in the late nineteenth and early twentieth century. The U.S. Congress authorized the establishment of the first station in the area, Station Bolinas Bay, in 1878 at what is now Golden Gate Park. Five stations followed: Southside, Fort Point, Point Bonita, Point Reyes, and Arena Cove. Station Bolinas Bay evolved into a Coast Guard Station in 1915, but after World War II, it was put out of service (United States Coast Guard 2012a).

United States Life-Saving Station #4, located at Cape Arago, was the first such station in Oregon and came into operation in 1878. Originally located on Lighthouse Island near the cape, the station was moved to the North Spit of Coos Bay in 1891 and renamed Coos Bay Life-Saving Station. At that time, Keeper Joseph Hodgson commanded a crew of eight men (United States Coast Guard 2012b).

The Life-Saving Service generally found success in rescuing of sailors and providing them shelter and first aid on the desolate shores of the west coast. The Life-Saving Service was combined with the Revenue Cutter Service to form the Unites States Coast Guard in 1915 (Evans 2003).

### 5.1.1.16. The Growth and Dominance of San Francisco

From the time of the Gold Rush to the end of the nineteenth century, San Francisco blossomed into the busiest port of the west coast and one of the most active in the nation. In the 1850s, agricultural products became common exports in the maritime trade from California. These products were shipped along the coast and also to Alaska and Hawaii. From the time of the first gold strike in California in 1848 at Sutter's Mill to the 1880s, San Francisco merchants controlled local trade with the various settlements of the Bay Area as well as coastal trade from

Panama to Alaska. Also beginning with the Gold Rush, trade with the Pacific Islands grew. San Francisco merchants came to monopolize trade with Hawaii and the Philippines.

The Bay Area's dominance in the realm of Pacific trade grew ever larger and profitable as the nineteenth century progressed (Issel and Cherny 1986). Of course, the sheer expanse of the Bay, which provided the space and water frontage necessary for numerous port towns to develop, gave the area a natural advantage. A notable legacy of the Gold Rush period was that it greatly expanded San Francisco's involvement in foreign trade. Only the long-established port cities of New York, Boston, and New Orleans claimed a larger share of U.S. foreign commerce. In terms of overall tonnage of cargo, San Francisco was sixth in the nation by 1861 (Issel and Cherny 1986). A glimpse of a page from the city's *Alta California* newspaper from January 1, 1870, indicates the great variety of regional and international port connections the Port of San Francisco maintained in this period (Figure 81).

The Pacific Mail and Steamship Company established a monthly service for freight and passengers between San Francisco and the Orient by the late 1860s. The company also sent ships to Honolulu. A competitor, the Oceanic Steamship Company, arose in the 1880s. Both companies made regular voyages to Hawaii, New Zealand, and Australia; and their success inspired many followers. From 1914 to 1939 an estimated 175 steamship companies were based in San Francisco and called on ports across the globe (Hansen 1947).

Cod fishing was one of San Francisco's earliest maritime enterprises. The first cod fishing expedition consisted of one vessel that went to the north Pacific in 1863. The fishermen returned with an abundance of cod, which was dried at Yerba Buena and sold on the streets of San Francisco. Two years later in 1865, seven vessels were active in fishing for cod. Over the next half decade, the number tripled to 21. The industry had a visible presence in San Francisco into the 1920s (Turhollow et al. 1983).

Sugar became an economic tie between San Francisco and Hawaii in the 1870s. In this period, investors established refineries in San Francisco that relied upon the sugarcane grown in Hawaii. Claus Spreckler was one of the first successful investors in the Hawaiian sugar industry. He organized the Oceanic Steamship Company in San Francisco in 1883 to make the voyages to and from Hawaii. The vessels of this fleet, including *Mariposa* and *Alameda*, brought consumer goods and lumber to Hawaii and shipped the sugar back to California. Passengers traveled in both directions. Spreckler's success encouraged others to invest in the trade with Hawaii. By 1890, the Matson Company had its own fleet. The Hawaiian sugar industry expanded into the twentieth century, maintaining a close connection to San Francisco (Turhollow et al. 1983).

Whaling fleets continued to make San Francisco their headquarters as late as the 1880s. By the start of the twentieth century, a transition to steam-powered vessels was underway in the whaling industry. Tugboats and other vessels were being outfitted so they could process the whale meat at sea. These "factory ships" replaced the old sailing vessels that the whalers had relied upon for centuries. The whaling industry in San Francisco was in decline by the 1930s. California Whaling Company was the last whaling company remaining on the Bay. They closed their doors in 1938, ending an important era of west coast maritime history (Hansen 1947).

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Figure 81. Excerpt from page 6 of the *Daily Alta California* newspaper (San Francisco), January 1, 1870, illustrating the various ports that connected with San Francisco.

By World War II, an incredible variety of goods entered and left the west coast. San Francisco exemplified this diversity. Copra, sugar, coffee, radio and television parts, paper, rubber goods, and textiles were common imports. The chief exports were industrial machines, petrochemical products, chemicals, lumber, barley, canned and cured fish, and raw cotton. San Francisco Bay (including Oakland, Crockett, Richmond, and other smaller ports) led in total tonnage among other ports of the coast. Hansen (1940) reported that of the 87 million tons of inbound and outbound cargo that cleared Pacific ports in 1940, San Francisco Bay handled 23 million tons.

The maritime involvement of the west coast ports was a tremendous asset to the economy, which supported a large land-based work force. A glimpse of a busy port in the years immediately preceding World War II is provided in Hansen's 1940 description of the Embarcadero Area of the port of San Francisco:

> The longshoremen with their white caps and felt hats, their black jackets and hickory shirts, their cargo hooks slung in hip pockets, outnumber the workers of any other craft in the maritime industry. As soon as a ship is tied up, they go aboard and as the winches begin to rattle, unloading is underway. The jitney drivers pull up alongside with their trucks; checkers keep track of every piece of cargo. Meanwhile, ship scalers are aboard cleaning out empty holds, boiler tubes and fire boxes, painting sides and stacks, scraping decks, and doing the thousand jobs required to make a vessel shipshape. (Hansen 1947: 245)

Hansen's picture of shore labor reveals how central the force was to smooth, efficient operations in the ports of the west coast. Vital as they were, the longshoremen and other laborers who often worked for ship owners were poorly paid and worked under difficult conditions. In the 1920s and 1930s at the Port of San Francisco, they began waging strikes against ship owners with the goal of rectifying their situation (Turhollow et al. 1983).

The impact of these strikes was significant and highlighted the influence that these workers had on the maritime trade of the port. In 1921 the port handled 36 percent of California's shipping. Once the strikes began, this number dropped to 21 percent. The unrest was not easily resolved and ten steamship lines withdrew from the Port of San Francisco. In the midst of this discord, the ports of Seattle, Portland, Los Angeles, and Oakland harvested business from San Francisco (Turhollow et al. 1983).

#### *5.1.1.17. The Worldliness of West Coast Ships: The Example of* Haytian Republic

The vessels involved in the world of maritime trade were a well-seasoned lot, at least those that survived the peril of the oceans. The story of *Haytian Republic*, a late nineteenth century steamship, serves as a representative example of the incredible experiences of these ships. Built in Bath, Maine in 1885, the vessel steamed to the west coast where it was put into service hauling cargo between Seattle and San Francisco. The vessel then became involved in supplying weapons to rebels in Haiti and nearly was sunk in the related action. Returning to the Pacific Northwest, the vessel was purchased by the Kodiak Packing Company and put into service shipping canned goods. Briefly retired, the vessel was purchased by the Merchants' Steamship Company. Though operating as a legitimate shipper, *Haytian Republic* actually was involved in smuggling opium and Chinese immigrants. The vessel was exposed and seized by the government and returned to Portland. Refitted and renamed as *Portland*, the vessel was sold to

San Francisco interests to haul coal in the coastwise trade. As such, the vessel survived a tremendous storm in which several other vessels perished. This hardy, experienced vessel spent its remaining days as part of the fleet of the Pacific Mail Steamship Company, sailing to Panama and the coffee ports of South and Central America (Wright 1895).

### *5.1.1.18. Shipping at the Turn of the Twentieth Century in Washington and Oregon*

At the turn of the twentieth century, Puget Sound had come to rival San Francisco in the level of maritime commerce passing through its waters. The ports of Seattle and Tacoma connected with four transcontinental railroads, greatly enhancing the business of the port. Puget Sound became a portal to the Asian market for areas as far east as Mississippi. W.F. Prosser (1903), historian and champion of the region, provided the following description of Puget Sound in the early 1900s:

> Cotton from southern states, manufactured goods and machinery from the eastern, wheat from the western, fish from Alaska, lumber from Puget Sound, and a thousand and one articles of different kinds, called for by Orientals, are being shipped from these busy ports to the millions of Japan, China, and the population marts of eastern Asia. (Prosser 1903: 102)

The leading industries of Puget Sound contributed heavily to the maritime commerce of the region. Lumber remained the lead contributor, and in the early 1900s, the supply was still considered inexhaustible. The numerous harbors of Puget Sound were sites where vessels flying international flags took on lumber. In 1890 alone, 430 cargoes of lumber were taken aboard at various points around the Sound. This number comprised 589 vessels, all of which passed the Cape Flattery lighthouse at the entrance of the Sound (Figure 82). The ports that supplied this lumber, in order of significance, were Port Blakely, Tacoma, Port Discovery, Port Ludlow, Port Gamble, Port Madison, Port Hadlock, Gig Harbor, and Utsalady (Wright 1895).

Coal also was a prominent export of Puget Sound. Coal-laden vessels shipped approximately half a million tons annually from Seattle and Tacoma in 1900 alone. The following years produced similar quantities (Prosser 1903).

The fishing industry, and canned fish in particular, produced millions of pounds of cargo from Puget Sound in the early twentieth century. The fishing fleet consisted of 100 tugboats and thousands of fish boats of every variety. They made their harvests in fresh and salt water. Fish caught in Willapa Bay, Gray's Harbor, and the fishing grounds of Alaska also made their way to Puget Sound, where they were canned and shipped down the coast and to Asia (Prosser 1903).

The coastwise trade (i.e., trade with other U.S. states and territories) featured strongly in the maritime commerce of Puget Sound. Seattle maintained long trade relationships with the neighboring Pacific coast, including Alaska and Hawaii. They also reached New York with regularity. In terms of net profit, the coastwise trade was more lucrative than the international trade (Prosser 1903).

Figure 82. Tatoosh Lighthouse at Cape Flattery (undated). Image courtesy of the State Library Photograph Collection, Washington State Archives.

As the Gold Rush of 1849 proved in California, discoveries of gold translated to increased maritime business for the port towns of the west. The Klondike strike of 1897 in the Northwest Territory and later, in Alaska, created a mini-boom for Seattle's merchants. Seattle became the chief shipping point for all of this territory and essentially replayed the fortunes of San Francisco (Prosser 1903).

The exporting of grain and flour was big business on the Columbia River in the 1890s. There were 53 vessels in its "grain fleet" in the late nineteenth century. Puget Sound had a fleet of its own, although smaller in number. The British ship *Marlboro Hill* was the largest of this fleet, weighing 2,363 tons, while the smallest vessel was the 878-ton *Cairnsmore*, also British (Wright 1895).

Though significantly inland, Portland nevertheless kept a strong connection to the sea at the turn of the twentieth century. Similar to Puget Sound, lumber flowed out of Portland. Asian markets received Oregon lumber in large quantities well into the twentieth century. The same was true for the smaller ports of Oregon. Wheat was second to lumber. Much of the wheat that cleared Portland for the sea made its way to the United Kingdom and Europe. The maritime importance of Portland is indicated by the number of steamship lines, at least 60, operating from the port in the opening decades of the twentieth century (Mears 1935).

### *5.1.1.19. The West Coast in the Spanish American War, 1898*

The Spanish American War (1898) left a noteworthy imprint on the maritime history of the west coast. Given that the main theaters of the war were located in Cuba and the Philippines, the U.S. Navy played an influential role in the trajectory of the conflict. By the time the war commenced, the west coast had two U.S. Navy Yards, one at Mare Island in San Francisco Bay and the other at Bremerton on Puget Sound.

At the start of the war, Naval commanders called the U.S. Navy battleship *Oregon*, then at Puget Sound Navy Yard, into action. Built in 1895, the ship made an epic run from the Navy Yard, through the Straits of Magellan, and on to Key West, Florida, in 47 days. This was considered an incredible achievement at the time. The vessel then was assigned to Santiago, Cuba, and became involved in the Battle of Santiago. A symbol of pride to the maritime community in Washington, the vessel was later transferred by the Federal government to the state of Oregon, which anchored it at Portland as a historical memorial in 1925 (Writers' Program 1940).

Owing to its relative proximity to the Philippines and its well-developed port infrastructure, which included a Navy Yard, San Francisco Bay was an obvious center of military activity when the United States went to war with Spain. To meet the needs of the U.S. Navy, the work of shipbuilding and repair increased at Mare Island Navy Yard, doubling the yard's workforce. Early in March of 1898, USS *Oregon*, en route to Key West, took on 400 tons of ammunition bound for Santiago, Cuba, via Cape Horn. Ordnance supply was a major support role of the yard during the conflict (Lott 1954).

Though Mare Island Navy Yard was initially put on alert for a potential invasion of the coast, the likelihood quickly diminished with American naval successes in the Caribbean and the Philippines. The San Francisco Bay area's crucial participation in the war was as "a great depot for men, freight, horses, and mules destined for the Philippines" (Turhollow et al. 1983). An estimated 30,000 soldiers passed through San Francisco en route to their stations in the Philippines. The Bay area shipping community reaped large profits and sustained steady business from the Federal government, which chartered numerous steamships from the major San Francisco companies (Turhollow et al. 1983).

### *5.1.1.20. Navigational Improvements at the Ports of the West Coast*

Responding to the cry for navigational improvements, the U.S. Congress appropriated money for the establishment of an Army Corps of Engineers Office on the west coast in 1866. The office was based in San Francisco, but the area of responsibility included the entire west coast. Their first project was at San Diego Harbor. San Francisco received most of its attention due to the Bay's preeminence in maritime commerce. For more than 100 years, the office removed rocks, dredged and straightened navigation channels, and built breakwaters and jetties. From the original San Francisco District, three additional Army Corps Districts were created for the west coast: Portland (1871), Seattle (1896), and Los Angeles (1898). (Turhollow et al. 1983.)

### *5.1.1.21. The Rise of the Port of Los Angeles*

Los Angeles, while one of the largest cities on the west coast, is different from rival cities such as San Francisco and Portland in that it is not historically situated directly on a navigable river or the sea. San Pedro Bay (25 miles south of the center of Los Angeles) was the closest protected area that ships could access to service the city. When small steamers and sailing vessels came there from San Francisco and South America bearing imports, they had to anchor offshore and use lighters to ferry their cargoes ashore. Early dredging efforts in the 1850s and thereafter largely failed until political support rallied behind the construction of a proper harbor in the late nineteenth century. By 1899, harbor developments allowed the passage of more and larger vessels and provided necessary facilities, thrusting Los Angeles deeper into international trade and setting a course to make the harbor one of the nation's largest seaports (Writers' Program 1941).

An incredible investment of money and work transformed San Pedro Bay into a modern harbor between 1920 and 1940 (Figure 83). The Federal government, in partnership with the City of Los Angeles, spent $60 million deepening channels, building breakwaters, and making other improvements that essentially wiped out the mud flats and salt marshes of San Pedro Bay in order to accommodate modern ships. The bay became known as Los Angeles Harbor. "Today, the harbor is one of the nation's five great ports, frequented by thousands of chunky freighters, trim passenger ships, and fishing vessels of many kinds," wrote the Writers' Program (1941: 220). Long Beach, located to the east, also was intensively developed for conversion into a modern port in the early twentieth century.

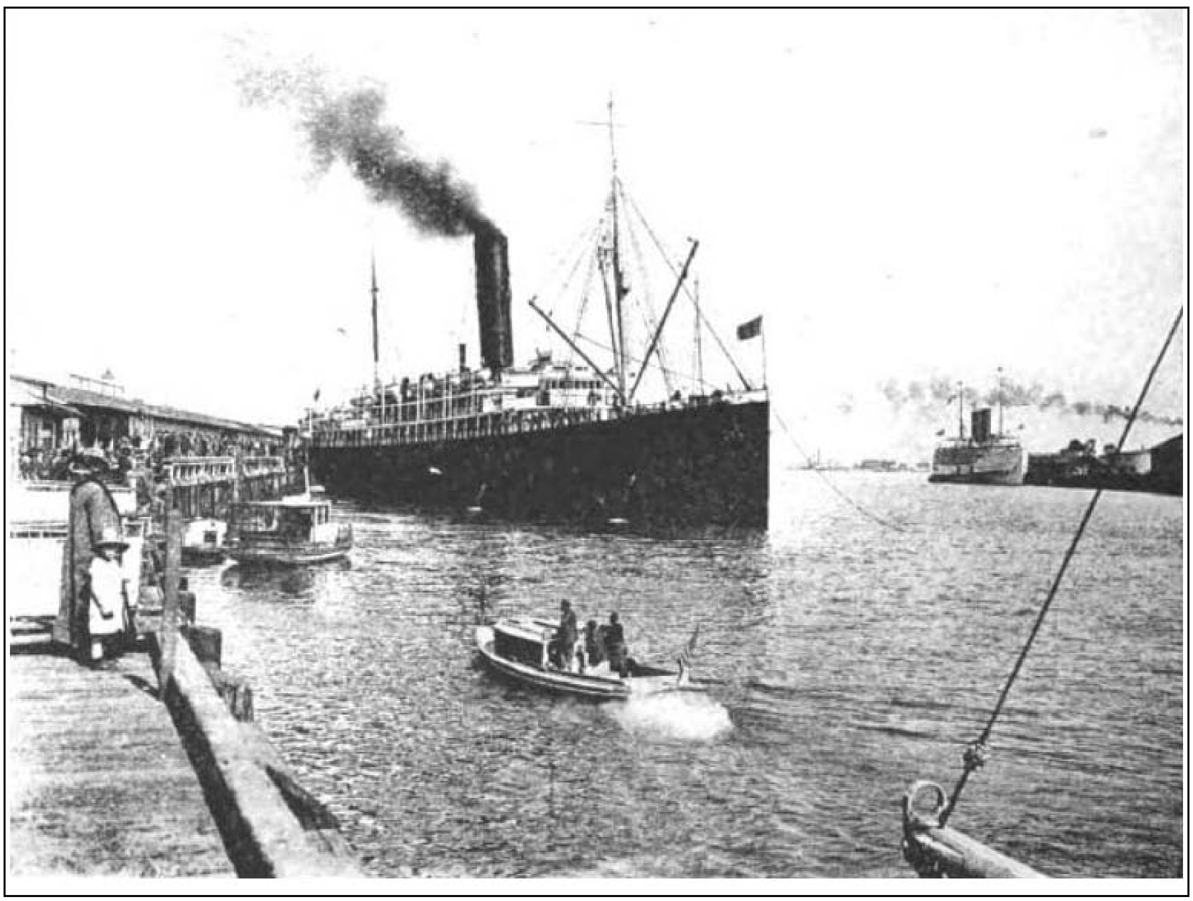


Figure 83. Vessels docking at Los Angeles Harbor in the early twentieth century (From Southern California Panama Expositions Commission 1914).

Prior to World War II, Los Angeles' chief export was petroleum, but as the war began, the port became known for shipbuilding. During the war, approximately 725 ships were built at the shipyards along the bay. The U.S. Navy and Army also chose the area for the development of installations. Big purse seiners operated as members of the Coast Guard Auxiliary, patrolling the coast and fishing at the same time. In the postwar era, the port became more intensively involved in the fishing industry and, in fact, was the nation's largest commercial fishing port. More than 700 boats supplied tuna, sardines, and mackerel to the canneries, vitamin-producing, and fish-oil producing plants of the Los Angeles area (Writers' Program 1941).

Wilmington and San Pedro were the main towns that kept the port alive. Wilmington was established with the intent to handle heavy freight of large, oceangoing ships. San Pedro was home to many fishermen. "The maritime workers of San Pedro include Jugoslavs [sic], Czechs, Italians, Portuguese, Mexicans, and Scandinavians; the last are one of the largest groups" wrote the Writers' Program in 1941, adding the following colorful, maritime-themed passage:

> San Pedro has long talked of the sea and its lore, and old tars tell and retell tales of dope-running, rum-running, alien-smuggling, spy scares, police and gang raids on gambling dens operated on barges offshore, weird murders on yachts bound for the 'isles of somewhere,' buried treasure, such mysterious vanishings as that of the Belle Isle off the Galapagos in 1935, and many a shipwreck since the day in 1828 when a 'Santa Anna' blew the brig *Danube* ashore here, the first to be piled up in the harbor (Writer's Program 1941: 221).

#### *5.1.1.22. World War I and the West Coast*

Compared to other parts of the nation that benefited from the war boom, the trans-Pacific trade of Washington and Oregon was injured during World War I. High freight costs, the threat of German submarine attacks, and the impressments of the American mercantile fleet into war service created a depression in the usual trade activities. The World War I-era saw Japan rise as a trans-Pacific shipper, due largely to its distance from the battlefield and ability to supply those countries that were more directly involved (Berglund 1917).

The ports of Washington, primarily Seattle and Tacoma, engaged in greater trade with Pacific Russia. The first year of World War I saw the value of United States exports to Russia grow from $1.2 million to over $23 million. Half of this was shipped from Washington. Of these exports, war supplies such as cotton, gun powder, and explosives were dominant (Berglund 1917).

The west coast was active in shipbuilding during World War I. Seattle contributed greatly to the war effort in the area of shipbuilding (Turhollow et al. 1983). Mare Island Naval Shipyard produced over 20 vessels during the years the United States participated in the war (1917–1918) (Figure 84). Among these were 15 sub chasers and five destroyers. The yard also repaired and refitted numerous vessels. The U.S. Navy seized German vessels on the high seas and took them to Mare Island. *Halsatian* was the first, and *Pommern Staateskretar Kraetke*, *Elsass*, *Setos*, and *Koenigen Der Nederlanden* came next. All were repaired, renamed, and placed into American use (Lott 1954).

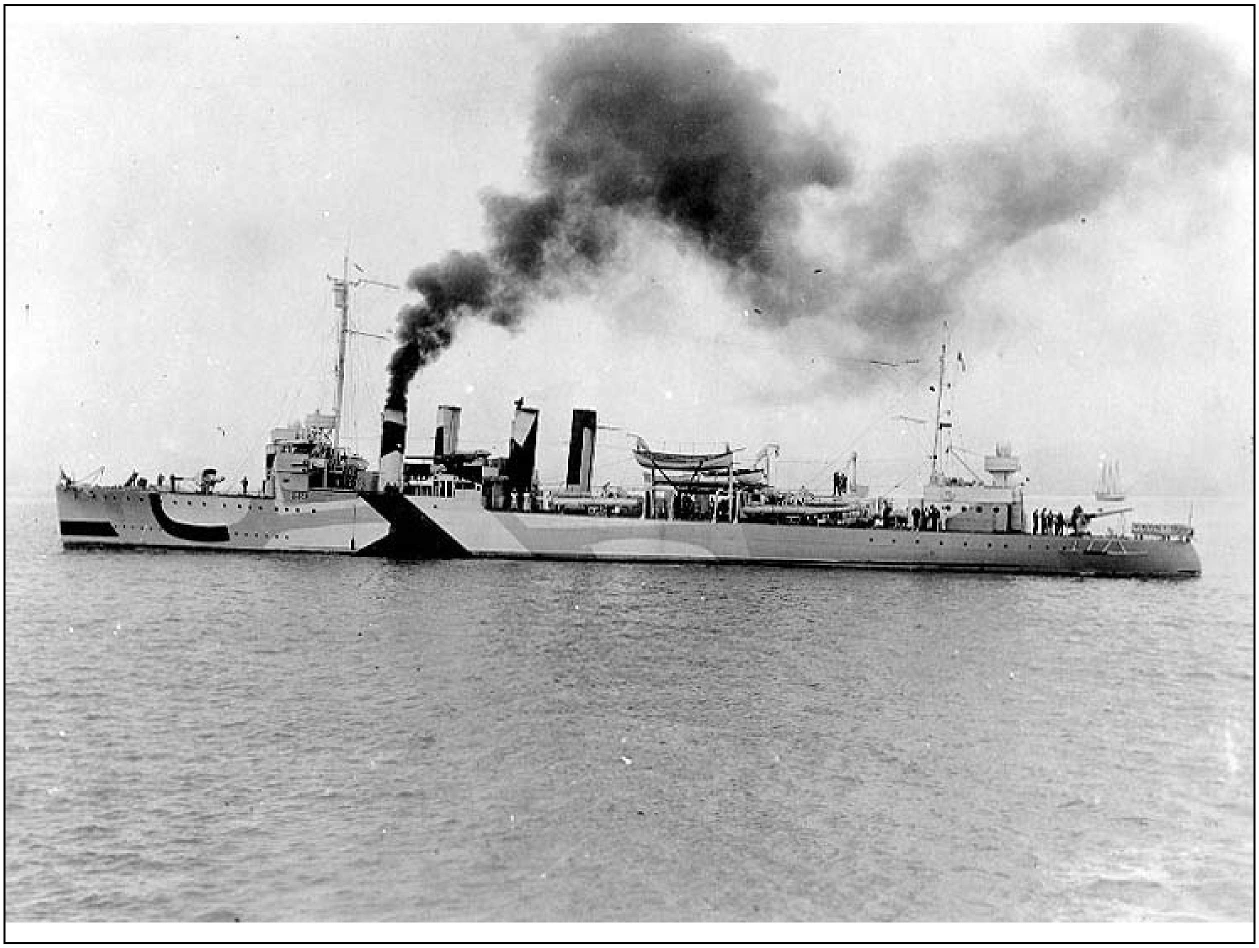


Figure 84. USS *Ward*, a destroyer built at Mare Island Navy Yard during World War I in 1918, shortly after commissioning. Image courtesy of the U.S. Naval History and Heritage Command.

#### *5.1.1.23. Prohibition and the U.S. Coast Guard on the West Coast*

In the 1920s, the U.S. Coast Guard was heavily involved in stemming the flow of illegal liquor into the ports and coves of the west coast. Much of the smuggled booze came from Canada. Liquor smuggling was never as large a problem in Washington, Oregon, and California as it was on the Atlantic coast, but in the major port areas of Seattle, San Francisco, Los Angeles, and San Diego, the demand was large enough to warrant considerable attention from the Coast Guard (Willoughby 1964). At times, the aggressiveness of the rum runners, and the resolve of the U.S. Coast Guard to interdict them, lead to deadly clashes on the water. The Coast Guard cutter *Arcata*, an armed vessel, sent a shot across the bow of a rum-running speedboat in June of 1924 on Mutiny Bay near Seattle (Figure 85). The speedboat returned fire, inspiring the cutter to return in kind. The cutter's bullets struck the fuel tank of the speedboat, which exploded. After the damaged boat was beached, the Coast Guard found contraband liquor and illegal Chinese immigrants. The Coast Guard's war against the rum runners continued along the west coast until the repeal of Prohibition in 1934 (Noble ca.1989).

Figure 85. The United States Coast Guard Cutter *Arcata* at the turn of the twentieth century (From Willoughby 1964).

### *5.1.1.24. The West Coast and World War II*

During World War II, the numerous shipyards of the west coast became heavily involved in shipbuilding and repair. San Francisco Bay's proximity to the Pacific theater of the war, together with its long history of involvement in maritime matters, made it a natural leader in the buildup for the conflict. In fact, no port area was busier than San Francisco Bay, which cleared more military cargo than any other port in the nation following Pearl Harbor and also led the nation in shipbuilding for the war. Moreover, San Francisco served as a Port of Embarkation for military troops headed to the Pacific (Hansen 1947).

Shipbuilding and repair activity at Mare Island Naval Shipyard dramatically increased during World War II as the nation rushed to build a Navy that could cover two oceans. One of the notable repairs was to the USS *Shaw*, which was badly damaged during the attack on Pearl Harbor. The tattered skeleton of the vessel was towed from Pearl Harbor to Mare Island and converted into practically a new ship. During the course of the war, the shipyard occasionally repaired Soviet submarines and ships of the Royal Navy (Lott 1954).

Beyond San Francisco, west coast shipyards were buzzing with activity through the war. At the Port of Los Angeles, three shipyards were larger producers for the war effort. The Todd Shipyard at San Pedro built large auxiliary ships. Calship and Consolidated Steel, both at Wilmington, turned out transports, cargo ships, and station tankers. Todd-Pacific's shipyard at Tacoma and two others at Seattle produced 58 escort carriers, 46 destroyers, and various large auxiliary vessels, transport craft, and gas tankers. Puget Sound Navy Yard conducted mostly ship repairs, but managed to produce 18 destroyers and destroyer escorts, as well as five auxiliary vessels. In Oregon, at Astoria and Portland, six shipyards built patrol craft, minesweepers, and small auxiliary vessels. Most impressively, these yards produced 161 Landing Craft Infantry (LCI) and Landing Craft Support (LCS) ships (Lindbergh and Todd 2004).

#### *5.1.1.25. Post-World War II Developments in West Coast Maritime History*

Fishing was California's fourth largest industry in the 1950s. San Francisco, Monterey, San Pedro, and Point Loma (San Diego) were the fishing centers of the California coast. Of these, San Pedro (i.e., Los Angeles) was the leader in California and, possibly, all of the United States. Around 1955, well over 2,000 fishing boats were based out of San Pedro, manned by approximately 6,000 fishermen. The fleet brought in an estimated 1 billion pounds of fish per year, a figure thought to exceed that of contemporary east coast ports of Boston, Gloucester, and New Bedford (Speroni 1955).

As in many other parts of America at the time, European immigrants were well-represented among the fishermen involved in the industry. Speroni (1955) studied fishermen's festivals in California in the mid-1950s. Italians, Sicilians, Slavonians, and Portuguese were the main sponsors, indicating the presence of these nationalities in the industry.

After World War II, ocean transportation experienced rapid changes. One of the most notable changes was the shift toward shipping cargoes in multiple, large containers that could easily be transferred to railcars or trucks in port (Kuby and Reid 1992). Containerization emerged in the 1950s, the main impetus being to reduce the rising cost of loading and unloading cargo. In 1956, *Ideal X* sailed from New York to Houston with 58 containers on specially rigged decks, one of the first voyages of a container ship. On the west coast, this method of shipping began during the Korean War. Many port authorities and shipping companies were slow to adopt and facilitate containerization (Hayut 1981).

Containerization influenced changes in vessels and at the ports themselves. The size and drafts of ships dramatically increased to accommodate these cargoes and, as a consequence, ports had to deepen their harbors for berthing, channels had to be dredged deeper, and port operations had to be rearranged. Those ports that were not able to adapt to these new circumstances lost their attractiveness to large shipping companies (Hayut 1981). However, they maintained a role in handling smaller, traditionally-sized cargoes (Natkiel and Preston 1986).

The ports of the west coast were quick to adapt to containerization. Whereas in 1967 the east coast had two container ports—New York and Baltimore—the west coast had four. The ports of Los Angeles, Oakland, Seattle, and Long Beach had begun the shift to container terminals in the 1950s, following the lead of the first container port, New York. Portland became the fifth container port of the west coast in 1967. San Diego, Sacramento, Tacoma, and Longview developed in the years that followed. As the 1970s progressed, Seattle, Oakland, Los Angeles, and nearby Long Beach became the busiest of the west coast container terminals (Hayut 1981). Of these, Oakland grew to be the largest (Turhollow et al. 1983).

Notably absent from the list of container ports was San Francisco. Long the premiere port of the west coast, San Francisco was eclipsed in importance in the 1960s in large part due to its inability to completely embrace containerized operations. The physical location of the port, traffic issues, and transportation impossibilities were the major reasons that container terminal development was not feasible on a large scale. Comparatively, the port of Oakland had the available water frontage and access to inland transportation; therefore, it quickly rose as the major port on San Francisco Bay in the 1970s. Though San Francisco did not play a large part in the container revolution, the port nevertheless remained important. Through the late twentieth century the port carried on its long history as a port town, specializing in break bulk and dry bulk cargo, ship repair, and ferry services (Turhollow et al. 1983).

## 5.1.2. Maritime Resource Types

### *5.1.2.1. Early Historic Vessels*

The first European vessels to enter the Pacific coast region of North America carried Spanish explorers in the sixteenth century, the first of whom was Juan Rodriguez Cabrillo in 1542. See Section 5.1.1.2 for a discussion of Spanish exploration of the coast. Cabrillo sailed from modern-day Guatemala aboard three caravels. Starting from humble roots as a coastal fishing vessel in the Iberian Peninsula during the thirteenth century, the caravel rose to prominence and wide-scale use by the fifteenth century. Though originally dedicated to fishing and cargo transport, the caravel was later used in the exploration of western Africa and the Americas. Caravels were typically small (35 to 100 tons), fast ships commonly used by early explorers (Figure 86). Traditionally rigged with lateen sails, they were re-rigged with a square sail on the main mast and a lateen sail on the mizzen allowing the vessels greater versatility. The caravel was preferred by explorers due to its speed and maneuverability, being able to sail both in open water and up navigable waterways (Gardiner 1994).

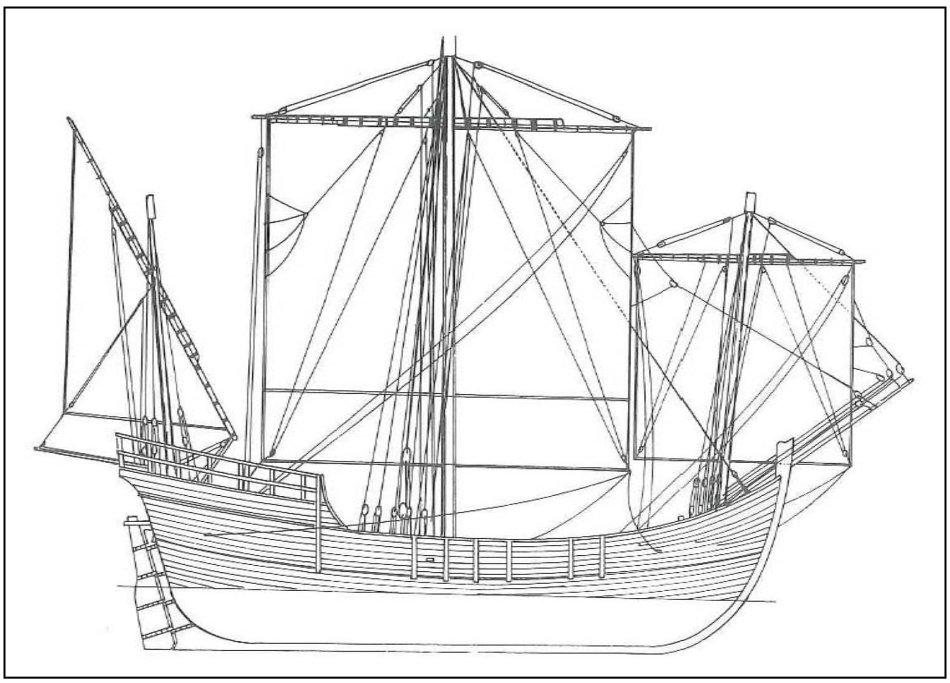


Figure 86. Sail plan and reconstruction of a caravel (From Gardiner 1994).

In 1565 the Spanish developed a trans-Pacific trade route utilizing galleons sailing from Manila in the Philippines to the Spanish city of Acapulco in Mexico (Mathers and Shaw 1993). The galleon is often regarded as the workhorse of the Spanish fleet during the Age of

Exploration. They varied in size but were usually large, sturdy, three-masted vessels with high sides, a tall stern castle, a lower forecastle, and a protruding beak at the bow (Figure 87). Galleons were typically armed to protect their cargoes (Gardiner 1994).

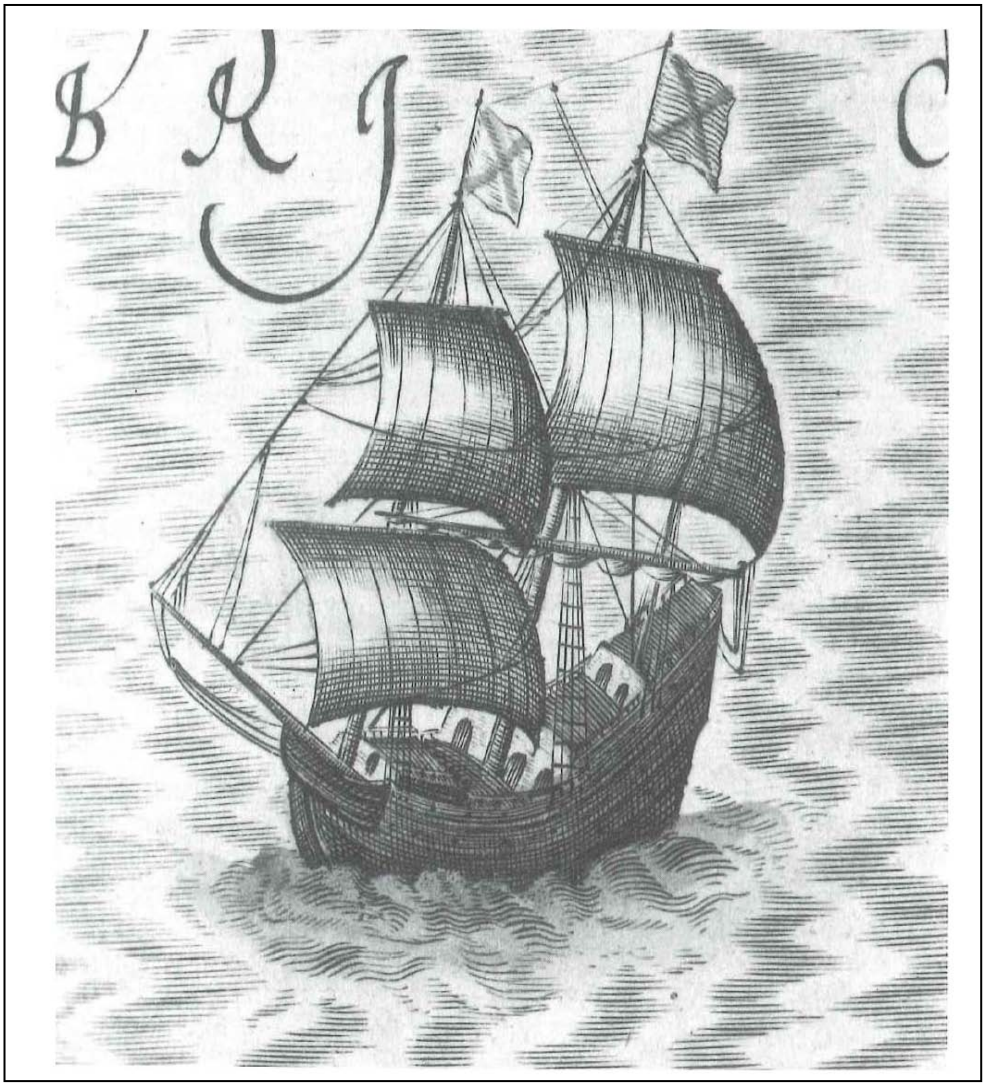


Figure 87. An illustration of a Spanish galleon from 1600 (From Gardiner 1994).

#### *5.1.2.2. Vessels Used for Fur Trade and Exploration*

Despite being under Spanish control, the west coast of the United States did not witness extensive growth or development until the late eighteenth century, nearly the eclipse of Spanish rule. During the seventeenth and eighteenth centuries, most of the maritime activity was restricted to localized Spanish traffic between the settlements and the occasional galleon. Early explorations from other western nations introduced new vessels in the late eighteenth century. British explorers and entrepreneurs seeking furs and wealth began surveying the Pacific Northwest in the late 1700s.

These early forays marked the introduction of western powers and ship types into the Pacific coast region. With British and French traders and explorers came a whole new range of vessel types. Brigs, brigantines, barks, barkentines, sloops, ships, schooners, and a number of smaller, auxiliary craft were introduced onto the Pacific coast during this time. These vessels served a variety of functions, from naval craft to exploration to trade.

Brigs and brigantines were dual-masted vessels ranging from 30 to 200 tons that originated during the early eighteenth century (Figure 88). The brig and brigantine, similar to the bark and barkentine, are defined separately based on their rigging elements. The brig was rigged with square sails on both the fore and main masts, with a small gaff rig on the main. On the brigantine, a fore-and-aft sail replaced the square sails on the mainmast but retained the gaff rig (Gibbs 1987).

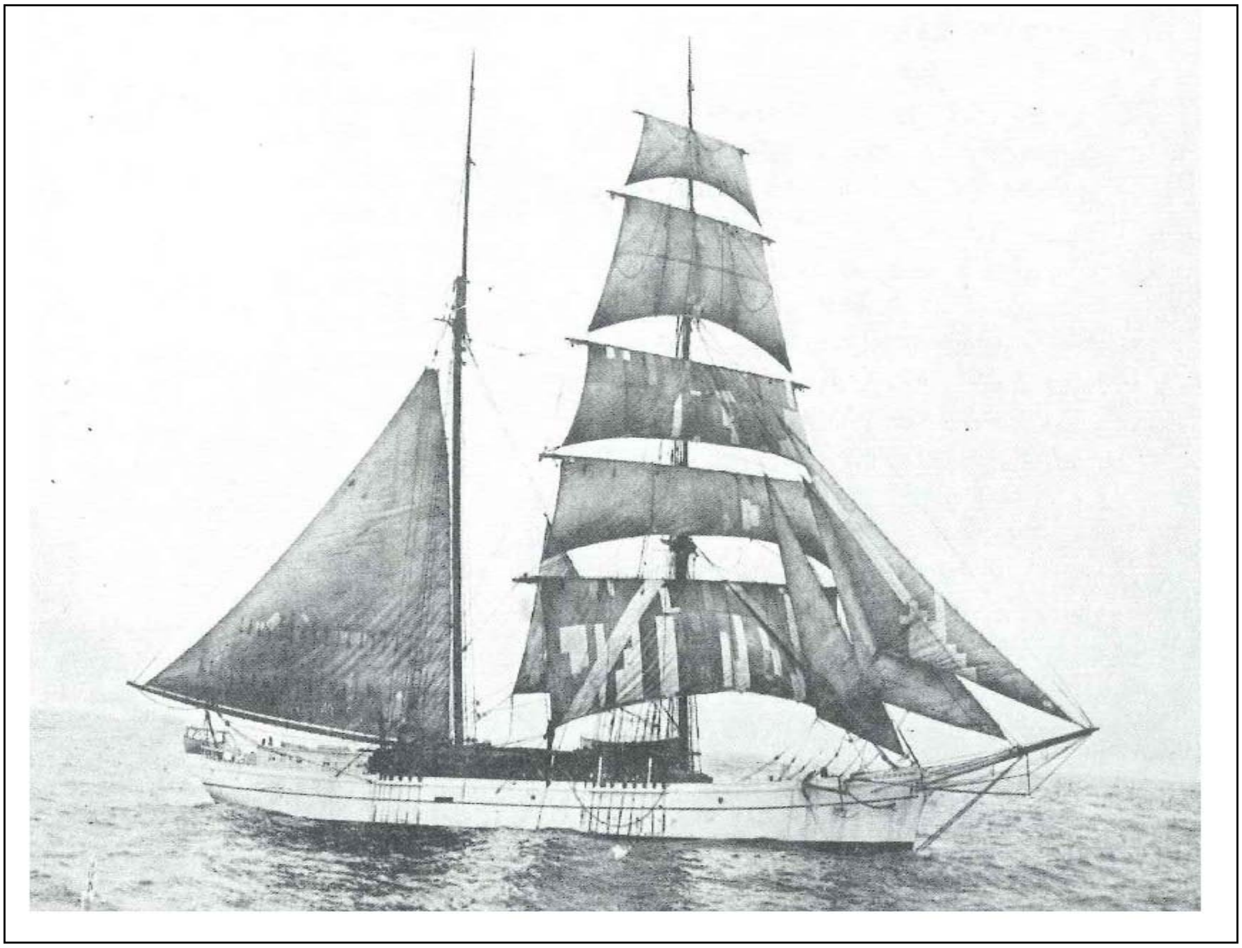


Figure 88. Brigantine *William G. Irwin* in 1912 (From Gibbs 1987).

One of the earliest accounts of a brig along the Pacific coast is that of *Eleanora*, an American brig of 190 tons from New York. *Eleanora* entered the Pacific coast region under the command of Simon Metcalf in search of furs in 1787 or 1788 (Ruby and Brown 1976). Brigs were common vessels for both private and naval industries. Significant brigs in the Pacific coast history include *Isabella*, a supply brig under the employ of the Hudson's Bay Company that sank in Columbia River in 1830, and *Frolic*, which conducted trade with China and ultimately wrecked on the north coast of California in 1850 (Smith 2005).

Accompanying *Eleanora* was *Fair American*, a small schooner of 28 tons captained by Metcalf's son, Thomas Metcalf. Schooners were commonly defined as multi-masted vessels, with fore-and-aft sails on both masts (Figure 89). Schooners were particularly popular in the coastal trade and as offshore fishing vessels. Later schooners were built with multiple masts, but the sail arrangement remained the same (Gibbs 1987).

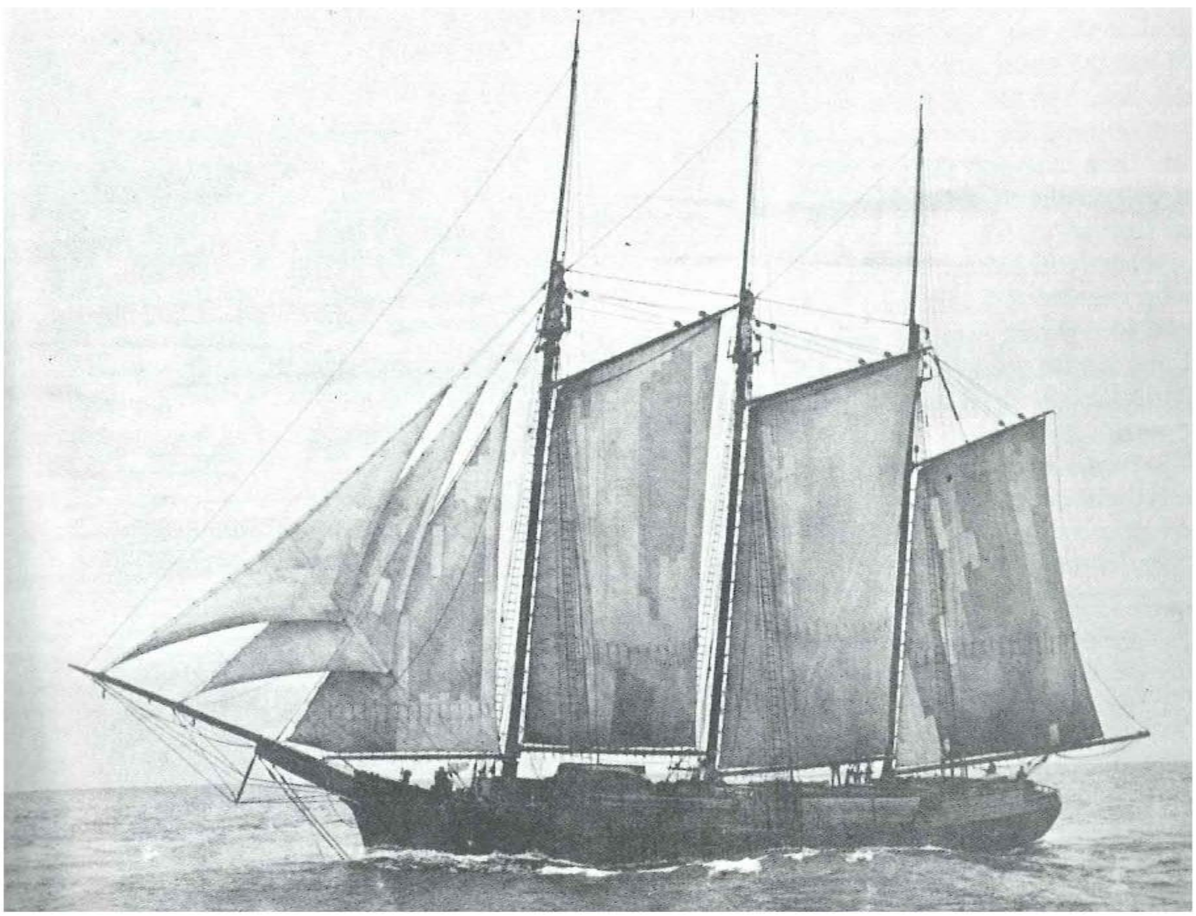


Figure 89. Schooner *Andy Mahoney* ca. 1905 (From Gibbs 1987).

Another common vessel type that entered the area during this period was simply referred to as a ship, or a fully rigged ship. The term ship historically refers to a square-rigged vessel of three or more masts. Significant fully rigged ships that appeared on the Pacific coast during this period included Robert Gray's *Columbia Rediviva* and George Vancouver's *Discovery* (Gibbs 1964).

Sloops were also common vessels during this period. The sloop was a small, one-mast vessel typically ranging from 25 to 70 tons burden. Sloops were rigged with one main gaff sail, a lower square sail, two to three headsails, and a square topsail (Chapelle 1988) (Figure 90). A sloop should not be confused with a sloop-of-war, which was distinct from the mercantile sloop. A sloop-of-war was a naval designation for any warship that had a single gun deck and carried less than 20 guns. Sloops-of-war were employed in the Pacific Northwest during the early nineteenth century for both military and exploration activities. One notable sloop-of-war in the Pacific coast region was USS *Peacock*, an American sloop-of-war that sank in the Columbia River in 1841.


Figure 90. Sloop *Cinderella* ca. 1890. From Library of Congress (2013b).

Originally the term bark applied to nondescript vessels that did not fit easily into common categories. In 1769, William Falconer defined the term in *The Universal Marine Dictionary* as "a common name given to ships, particularly those which carried three masts without a mizzen-top sail" (Falconer 2006). However, by the end of the eighteenth century the term bark had taken on a specific meaning. Beginning sometime in the late eighteenth century, a bark referred to a vessel that carried three or more masts, where the fore and main masts were outfitted with square sails, and the aft-most mast carried a fore-and-aft sail. A barkentine differed from a bark simply in the fact that only the foremast carried square sails (Gibbs 1987) (Figure 91). Barks and barkentines were common vessels on the Pacific coast, largely employed for trade and transport. The use of barks and barkentines continued into the twentieth century, when sailing technology was ultimately replaced.

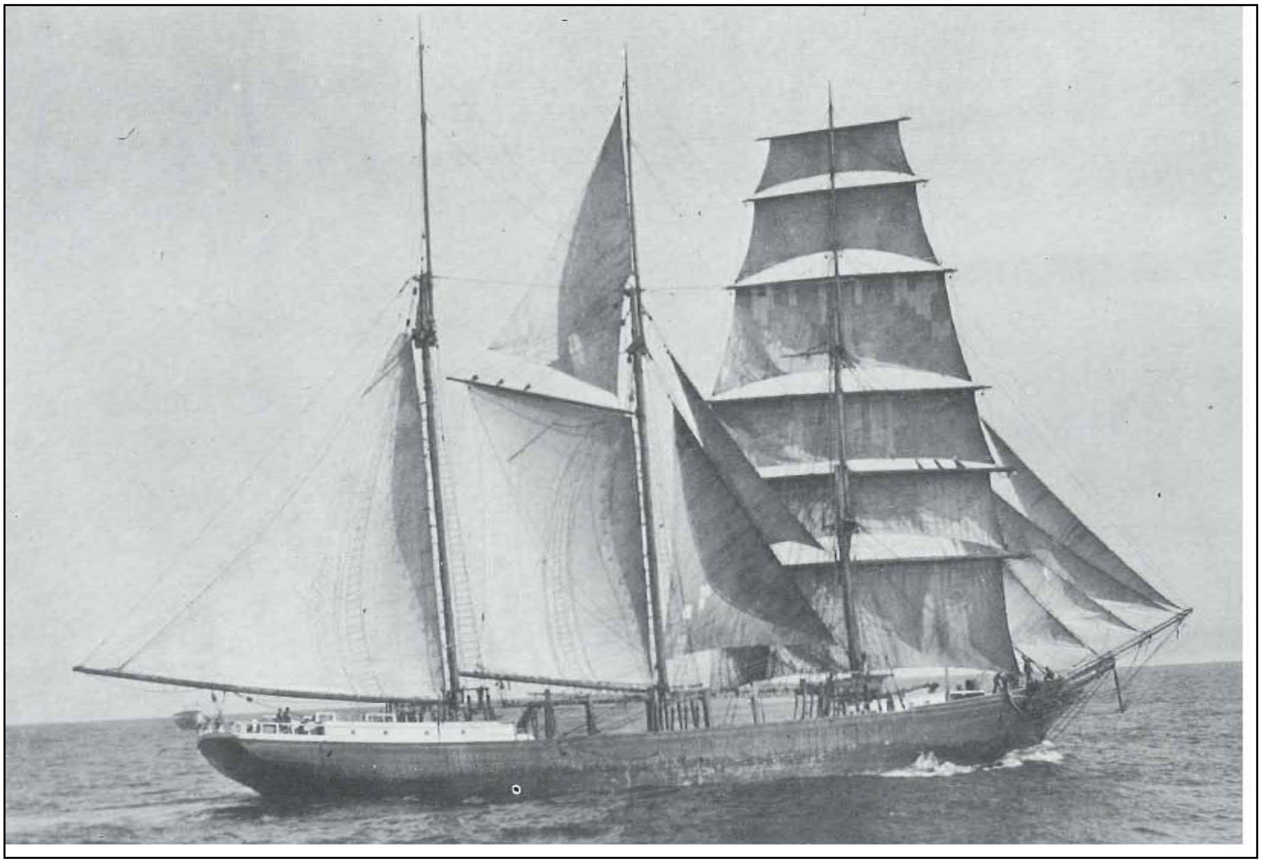


Figure 91. Barkentine *Irmgard* (From Gibbs 1987).

### *5.1.2.3. Vessels Used for the California Gold Rush and Lumber Industry*

The California Gold Rush was one of the more important events in Pacific coast history and marked an influx of new population and variety of vessel types. Many sailing vessels were used, but the steamship became the preferred and iconic vessel during this time. Developed earlier in the nineteenth century, the first steamship to enter the Pacific coast region actually arrived 10 years prior to the Gold Rush. The *Beaver* was a small brig-rigged, sidewheel steamship, originally employed by the Hudson's Bay Company to service trading posts between the Columbia River and British Columbia (Delgado 1993). It was not until the California Gold Rush, however, that steamships came into heavy use in the Pacific.

A large majority of vessels operating during the mid-nineteenth century were sidewheel steamships, which was the preferred vessel type for open-sea travel. As the name implies, a sidewheel steamship employed two large paddlewheels mounted on either side of the hull, positioned amidships of the vessel (Figure 92). Early steamships of this type were typically ship-rigged in case they were forced to rely upon sails for auxiliary power. This was a necessity before refueling stations became common. Even after the 1840s many steamships continued to carry some form of canvas for various reasons. The steam engine assemblies and technology altered and changed throughout the steam era.

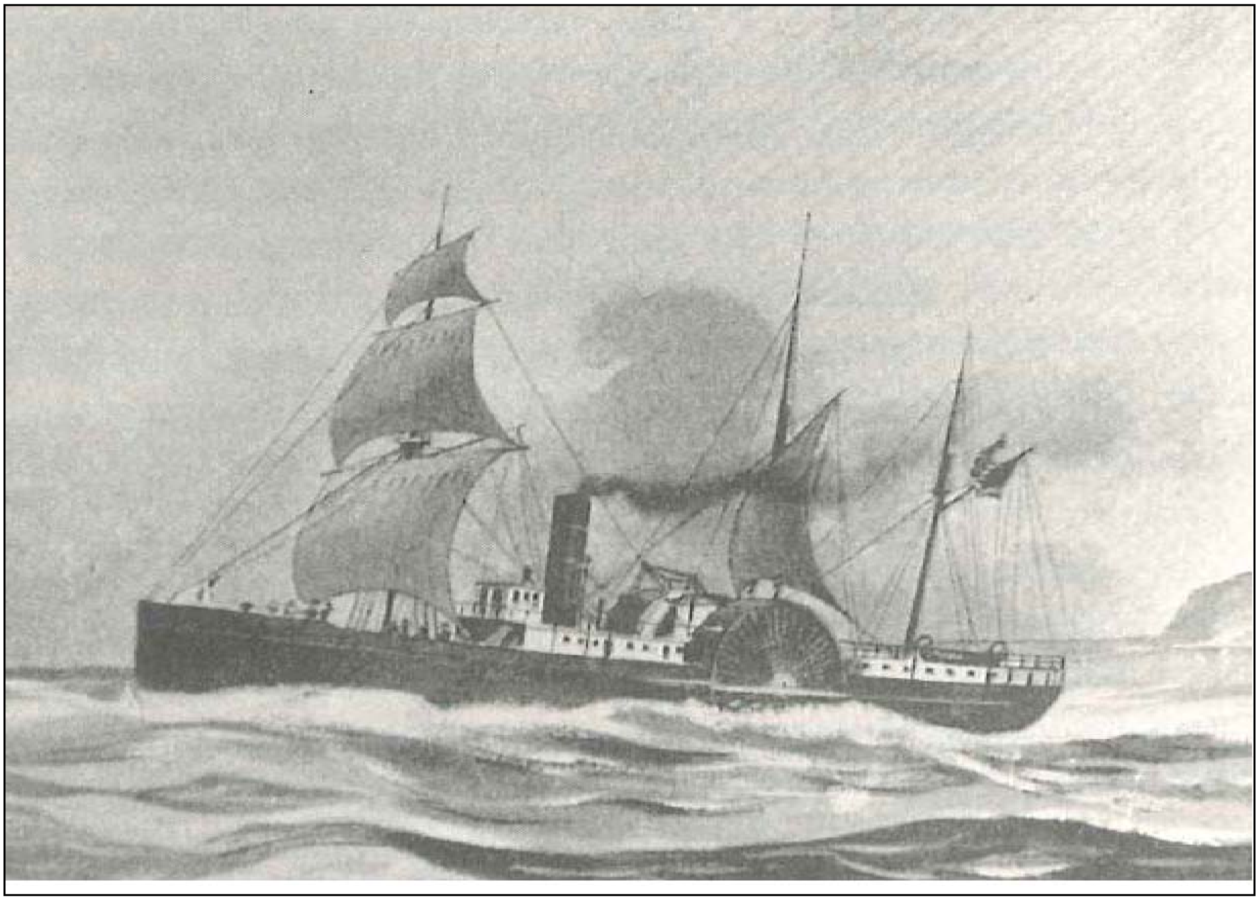


Figure 92. Artist's depiction of the sidewheel steamship *Brother Jonathan* (From Belyk 2001).

With the massive influx of people came a marked increase of expansion, development, and settlement. Industries sprang up overnight to support these new populations. With new development came new shipping opportunities and increased ship construction and innovation. The coastwise trade exploded during this period. Lumber was shipped to San Francisco, Sacramento, and other developing towns from logging centers in northern California, Oregon, and Washington.

Many of the ships in use at this time were derivations of earlier types. Barks, barkentines, brigs, brigantines, schooners, ships, and sloops all remained in use during this period, though their size increased with time. Schooners, in particular, were enlarged, with additional masts added. Some of the later schooners sported multiple masts and were used heavily in the coastal lumber trade (Russell 2005).

Vessel types were also adjusted to fit the unique requirements of the Pacific coast terrain. The shallow harbors and dangerous terrain did not always suit larger vessels. During the timber boom of the mid-nineteenth century in California, a small schooner was developed to safely navigate the small harbors of the north coast, commonly referred to as "dogholes." The doghole schooner was a regional craft, built in California during the second half of the nineteenth century, particularly during the 1860s. These schooners were small two-masted vessels, typically gaff-rigged with a gaff topsail and could sail into the small doghole ports and receive loads of timber without smashing against the rocky shoreline (McNairn and MacMullen 1945) (Figure 93).

Figure 93. Doghole schooners off Little River, California, ca. 1860s (From MacDonald 1999).

Later, doghole schooners were replaced by steam schooners. As the name implies, the steam schooner originated by simply adding a steam engine to a small schooner (Figure 94). These steamships were driven by a propeller mounted on the stern rather than the bulky sidewheels that preceded them. The addition of the steam engine allowed for a more regular service that was no longer dependent on favorable winds. The first purpose-built steam schooner was *Newsboy*, launched in 1888. Both traditional and steam schooners remained in use into the twentieth century but were ultimately replaced by steel vessels (McNairn and MacMullen 1945).

Figure 94. Steam schooner *Alcazar* near Point Arena, California. Courtesy of Kelley House Museum.

#### *5.1.2.4. Twentieth Century and Modern Vessels*

The trends in shipbuilding that were established in the nineteenth century carried over into the twentieth. Steam powered schooners and other vessels were often preferred over pure sailing vessels, though larger and grander sailing ships were still built for coastal and transpacific trade. The steam schooner saw many design changes, with the aft end appearing more like a traditional steam vessel featuring larger super structures and less emphasis on the sailing implements. Even so, this was not to last. World War I created a demand for new ships but also heralded the steel ship industry and, subsequently, the end of the wooden sailing vessel (Russell 2005).

As the modern era emerged on the west coast, ship design and construction evolved to meet demand. An increased naval presence at bases from San Diego to Seattle introduced a fleet of modern warships onto the Pacific coast. These centers played a particularly emphatic role during World War II in the Pacific Campaign. The twentieth century bears witness to the full range of modern vessels, from aircraft carrier to transport vessels in the Navy and small fishing vessels to massive international tanker vessels in domestic craft.

## 5.2. METHODOLOGY FOR ASSESSING UNDERWATER MARITIME RESOURCES

### 5.2.1. Literature Search and Data Acquisition Methodology

This section discusses the historical research effort that SEARCH Historians performed as part of this study. The overall goal of this research was to collect information on shipwrecks that occurred in the waters off California, Oregon, and Washington. The following sections discuss (a) the search conducted in primary (or archival) sources, (b) the search conducted in secondary sources, (c) the research inquiry campaign that was undertaken, and (d) the direction that future research on the subject should take.

The research effort for the present study used the 1987 and 1990 POCS studies as a starting point. Section 4 of Volume 4 of the 1990 study provides a detailed discussion of the research methods employed and, most importantly, the sources of information used. The 1990 study relied on primary (i.e., unpublished) sources in archives. It also relied on secondary sources and shipwreck databases available at the time. In order to prevent duplication, the present study avoided the various sources of information consulted in 1990.

Archival research was the main thrust of the historical research for the present study. The National Archives and Records Administration (NARA) was determined to hold the largest collection of shipwreck records for the study area. The Washington, DC, branch of NARA was targeted as it had extensive and unique holdings relating to west coast shipwrecks. The Riverside, California, NARA branch (formerly known as Laguna Niguel) also proved to have shipwreck records that could not be found elsewhere. The National Archives branch in San Bruno, California, was not visited for this study because the 1990 POCS study extensively reviewed their shipwreck records. Also, the National Archives branch in Seattle was not visited. The Seattle archive did not appear to have an extensive collection of shipwreck records. The bulk of Seattle's collection appears to be accessible on microfilm at the Washington, DC, branch of the National Archives.

When searching records of shipwrecks, SEARCH Historians followed certain criteria. They focused on identifying total, rather than partial, losses that occurred off the shores of California, Oregon, and Washington. Shipwrecks that were reported to have occurred in coves, harbors, bars, or other near-shore sites were inventoried if they were discovered during research or included in previous databases; however, researchers did not intentionally target these sites as they are not located on the Pacific OCS. When records were vague as to the specific location or condition of the wrecked vessel, the researcher used his own judgment in deciding if that shipwreck should be added to the database. Additionally, the historians did not discriminate between large and small vessels. Each type was entered into the database. Accompanying details for shipwrecks also were entered into the database.

### 5.2.2. Archival Primary Sources

#### *5.2.2.1. National Archives and Records Administration (Washington, DC)*

All of the records consulted at NARA's Washington, DC, branch for the present study fell under the Records of the U.S. Coast Guard (Record Group 26), an extensive collection that spans most of American history. This Record Group includes the records of the Federal agencies that preceded the Coast Guard: the Revenue Cutter Service, the Bureau of Lighthouses, and the

Life-Saving Service. Fortunately, many of the documents in Record Group 26 that deal with shipwrecks have been consolidated into their own series. SEARCH Historians found 157 shipwreck accounts at NARA Washington, DC, the vast majority of which were new to the database. Nevertheless, there remains incredible potential to identify more west coast shipwrecks in Record Group 26 at the NARA Washington, DC, archives. Records of interest to future studies are discussed in Section 5.4.1.1, Guide for Future Archival Research.

##### 5.2.2.1.1. Register of Wreck Reports Received from Life-Saving Stations, 1897–1905

The many Life-Saving Stations that were located along the coast of the United States in the eighteenth and early nineteenth centuries were ever watchful for distressed vessels. With each event, the keeper of the station made a report. The reports, generally known as "Wreck Reports," were standardized forms that the respondent answered concerning the incident. The NARA Washington, DC, branch of the National Archives has many of these original Wreck Reports. They provide bountiful information on shipwrecks.

The Register of Wreck Reports Received from Life-Saving Stations (1897–1905) are essentially registers or lists of shipwrecks that had been reported from Life-Saving Stations. These were useful to consult because they often allude to Wreck Reports that did not survive to the present. Therefore, they are a valuable supplement to the Wreck Reports themselves and assisted in identifying 33 shipwrecks. Five volumes of the registers were examined for the present study. All finds were added to the database.

##### 5.2.2.1.2. U.S. Coast Guard Reports of Assistance, 1917–1938

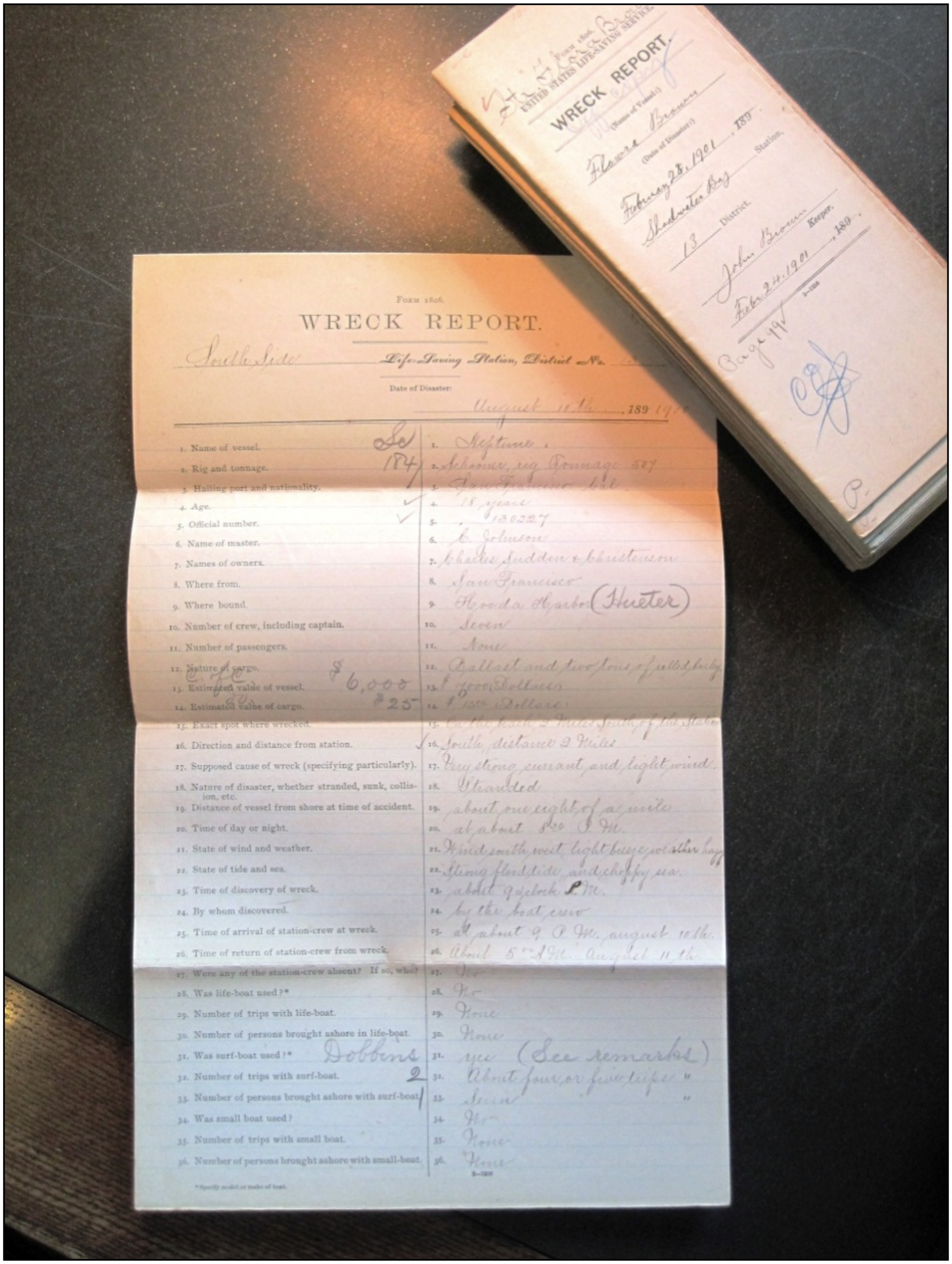
The U.S. Coast Guard Reports of Assistance (1917–1938) are similar to the Wreck Reports produced by the Life-Saving Service. These records are available in Microfilm Publication T919 and consist of 19 rolls of microfilm. Only three rolls pertained to the area of interest (17, 18, and 19). Each of these rolls was reviewed and 35 shipwrecks were identified.

##### 5.2.2.1.3. U.S. Coast Guard Casualty and Wreck Reports, 1913–1939

An additional Microfilm Publication (T925) consists of the U.S. Coast Guard Casualty and Wreck Reports (1913–1939). These records are contained on 21 rolls of microfilm. Each roll of film contains several hundred Wreck Reports. Whereas the Wreck Reports in other collections are arranged by geographic region, these are arranged chronologically. This organizational method slowed the process of identifying shipwrecks. In the interest of devoting time to better organized collections, the historians elected to review only four rolls of the U.S. Coast Guard Casualty and Wreck Reports. A total of 32 shipwrecks were identified in this collection.

##### 5.2.2.1.4. Wreck Reports from Stations, 1901–1915

A series within Record Group 26 is known as the Wreck Reports from Stations (1901–1915). These reports are the records that various keepers created to document shipwrecks in their areas of purview along the west coast. The reports are arranged roughly in chronological order. These records were an important focus of the NARA Washington, DC, research. All Wreck Reports pertaining to Washington, Oregon, and California in this series were reviewed (Figure 95). These reports were found in Boxes 19, 24, 28, 33, 34, 38, 43, 49, 56, 57, 63, 70, 71, and 79. A total of 57 shipwrecks were identified.



Form 1806.
UNITED STATES LIFE-SAVING SERVICE.
WRECK REPORT.
(Name of Vessel.)
Flavre Brown
(Date of Disaster.)
February 23, 1901, 189
Shoalwater Bay Station.
13 District.
John Brown Keeper.
Febr 24. 1901, 189.
Page 99

FORM 1806.
WRECK REPORT.
South Side Life-Saving Station, District No.
Date of Disaster:
August 10th, 189 1900

| | |
|---|---|
| 1. Name of vessel. | 1. Neptune. |
| 2. Rig and tonnage. | 2. Schooner rig Tonnage 587 |
| 3. Hailing port and nationality. | 3. San Francisco Cal. |
| 4. Age. | 4. 18 years |
| 5. Official number. | 5. 130227 |
| 6. Name of master. | 6. C. Johnson |
| 7. Names of owners. | 7. Charles Sudden & Christenson |
| 8. Where from. | 8. San Francisco |
| 9. Where bound. | 9. Hooda Harbor (Hueter) |
| 10. Number of crew, including captain. | 10. Seven |
| 11. Number of passengers. | 11. None |
| 12. Nature of cargo. | 12. Ballast and two tons of [illegible] |
| 13. Estimated value of vessel. $6,000 | 13. $7000 Dollars |
| 14. Estimated value of cargo. $25 | 14. $1000 Dollars |
| 15. Exact spot where wrecked. | 15. [illegible] 2 Miles South of the Station |
| 16. Direction and distance from station. | 16. South distance 2 Miles |
| 17. Supposed cause of wreck (specifying particularly). | 17. Very strong current and light wind |
| 18. Nature of disaster, whether stranded, sunk, collision, etc. | 18. Stranded |
| 19. Distance of vessel from shore at time of accident. | 19. about one eight of a mile |
| 20. Time of day or night. | 20. at about 8 P.M. |
| 21. State of wind and weather. | 21. Wind south west light breeze [illegible] |
| 22. State of tide and sea. | 22. Strong flood tide and choppy sea. |
| 23. Time of discovery of wreck. | 23. about 9 o'clock P.M. |
| 24. By whom discovered. | 24. by the boat crew |
| 25. Time of arrival of station-crew at wreck. | 25. at about 9 P.M. August 10th |
| 26. Time of return of station-crew from wreck. | 26. About 5 A.M. August 11th |
| 27. Were any of the station-crew absent? If so, who? | 27. No |
| 28. Was life-boat used?* | 28. No |
| 29. Number of trips with life-boat. | 29. None |
| 30. Number of persons brought ashore in life-boat. | 30. None |
| 31. Was surf-boat used?* Dobbins | 31. yes (See remarks) |
| 32. Number of trips with surf-boat. 2 | 32. About four or five trips " |
| 33. Number of persons brought ashore with surf-boat. | 33. Seven " |
| 34. Was small boat used? | 34. No |
| 35. Number of trips with small boat. | 35. None |
| 36. Number of persons brought ashore with small-boat. | 36. None |

*Specify model or make of boat.

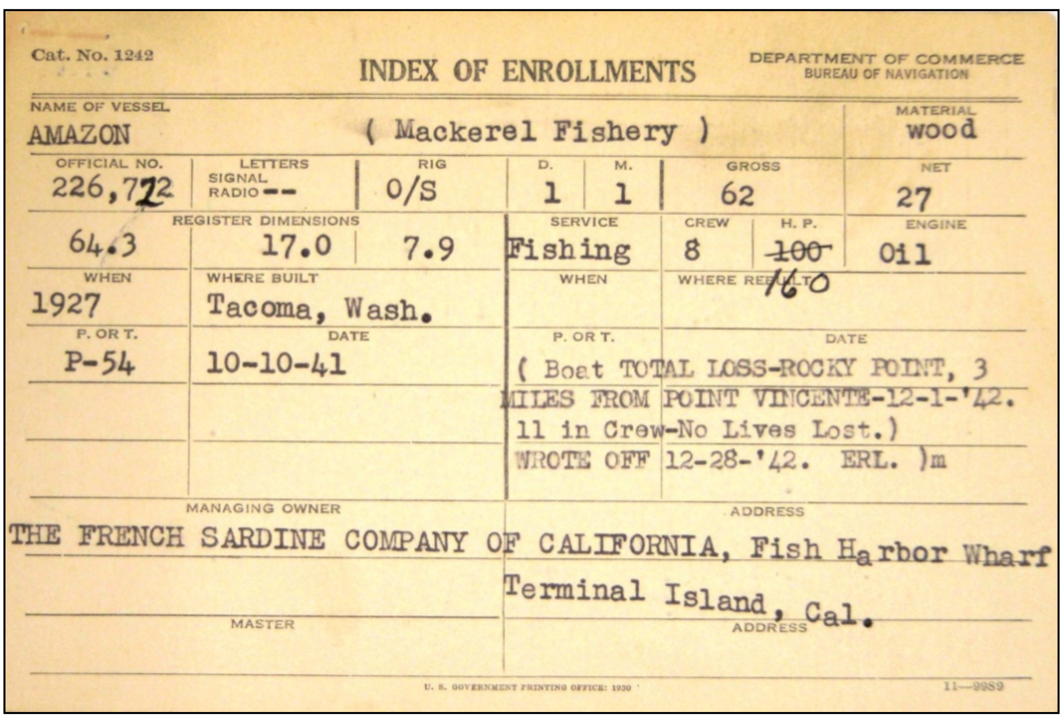
Figure 95. Example of a Wreck Report (From South Side Life Saving Station 1900).

### 5.2.2.2. *National Archives and Records Administration (Riverside CA)*

The NARA branch at Riverside, California (formerly located at Laguna Niguel) was the main focus of the west coast archival research for the present study. Consultation with Monique Sugimoto, an Archivist at Riverside, indicated that shipwreck records were available in Record Groups 26 and 36. Research in these records resulted in the identification of 206 shipwrecks, the majority of which were vessels based out of the port of Los Angeles. This addition to the database was significant because many of the records reviewed at NARA Washington, DC, had little, if any, coverage of shipwrecks in the Los Angeles area. Moreover, NARA Riverside holds potential for future research on west coast shipwrecks, as is discussed in Section 5.4.1.1., Guide for Future Archival Research.

#### 5.2.2.2.1. Index of Maritime Documents, 1936–1965

Record Group 26 (Records of the United States Coast Guard) at NARA Riverside contains the records of the Eleventh Coast Guard District, which includes the state of California. Within the Eleventh District records is a series for the Port of Los Angeles/Long Beach known as the Index of Maritime Documents, or Marine Documents Index. These records consist of index cards that list, for each vessel: name, official number, home port, rig, vessel service type, owner, owners address, name of master, and other details. Most importantly, the index cards note if a ship had been wrecked or lost and where the event occurred (Figure 96). The Index of Maritime Documents spans from 1936 to 1988 and consists of 34 boxes of index cards. (It should be noted that, as of June 2012, the Finding Aid for this series misstates the number of boxes). SEARCH reviewed nine of the 34 boxes in this series due to time constraints. A total of 180 shipwrecks were identified.


Cat. No. 1242
INDEX OF ENROLLMENTS
DEPARTMENT OF COMMERCE
BUREAU OF NAVIGATION

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| NAME OF VESSEL: AMAZON | ( Mackerel Fishery ) | | | | | | | MATERIAL: wood |
| OFFICIAL NO.: 226,712 | LETTERS SIGNAL RADIO: -- | RIG: O/S | D.: 1 | M.: 1 | GROSS: 62 | | | NET: 27 |
| REGISTER DIMENSIONS: 64.3 | 17.0 | 7.9 | SERVICE: Fishing | | CREW: 8 | H. P.: ~~100~~ 160 | | ENGINE: Oil |
| WHEN: 1927 | WHERE BUILT: Tacoma, Wash. | | WHEN: | | WHERE REBUILT: | | | |
| P. OR T.: P-54 | DATE: 10-10-41 | | P. OR T.: | | DATE: | | | |

( Boat TOTAL LOSS-ROCKY POINT, 3 MILES FROM POINT VINCENTE-12-1-'42. 11 in Crew-No Lives Lost.)
WROTE OFF 12-28-'42. ERL. )m

MANAGING OWNER: THE FRENCH SARDINE COMPANY OF CALIFORNIA
ADDRESS: Fish Harbor Wharf Terminal Island, Cal.
MASTER:
ADDRESS:

U. S. GOVERNMENT PRINTING OFFICE: 1930 11—9989

Figure 96. Example of an index card noting the total loss of a vessel, in this case *Amazon* (From Marine Safety Office 1988).

##### 5.2.2.2.2. Wreck Reports from the Port of Los Angeles, 1883–1918

Record Group 36 (Records of the United States Customs Service) at NARA Riverside contains a series for the Port of Los Angeles entitled Wreck Reports. These Wreck Reports cover the 1883–1918 period. Similar to Wreck Reports found at other archives, these reports were filed by ship masters when (1) the total damage to the vessel was more than $300, (2) the vessel was a total loss, or (3) there was a loss of life. The reports provide information on the vessel and, often, details of the shipwreck and any subsequent rescue efforts. This series consisted of one box, the entirety of which was reviewed. A total of 23 shipwrecks were identified.

##### 5.2.2.2.3. Vessel Accident Casualty Reports from San Luis Obispo, 1932–1947

Record Group 36 (Records of the United States Customs Service) at NARA Riverside contains a series from the Port of San Luis Obispo entitled Vessel Accident and Casualty Reports. These reports cover the 1932 through 1947 period and are basically identical in nature to Wreck Reports. The series relating to San Luis Obispo consisted of one box. All reports within the box were reviewed. A total of three shipwrecks were identified.

#### *5.2.2.3. Coos Historical and Maritime Museum (North Bend, Oregon)*

One of the many institutions SEARCH contacted for information on shipwrecks was the Coos Historical and Maritime Museum in North Bend, Oregon. Hannah Cooney, Museum Assistant, was generous enough to share with SEARCH (via e-mail) an inventory of 58 shipwrecks known to have occurred in Coos County. The shipwrecks on the list dated from 1852 to 1953. Most were documented in previous studies; therefore, they did not significantly contribute to the overall database of shipwrecks.

### 5.2.3. Secondary Source Review

#### *5.2.3.1. The Mariners' Museum Library (Newport News, Virginia)*

The Mariners' Museum Library in Newport News, Virginia has an extensive collection of maritime history resources, including the publications known as the Merchant Vessels of the United States. Under slightly varying names, the U.S. government has maintained this published list of registered American merchant vessels since 1868. The Merchant Vessels issues are vital sources for obtaining specifics on the ownership, tonnage, physical dimensions, propulsion systems, and type of hull construction of American vessels. From 1906 until 1947, the annual publication included a list of vessels lost. The previous study (Gearhart et al. 1990 [Volume IV: History]) examined, and added to the BOEM database, all of the shipwrecks listed in the 1906–1947 issues, with the exception of the 1908, 1911, 1912, 1940, and 1942 issues, which researchers could not locate.

The research at the Mariners' Museum had the goal of closing this gap. Librarian Patti Hinson determined that the 1908, 1911, 1912, and 1942 issues were available. SEARCH Historian Travis Fulk acquired copies of the shipwreck lists from these issues, and pertinent wrecks were added to the database. The 1940 volume was not available at the Mariners' Museum Library and was not found elsewhere.

The Mariners' Museum Library was useful in closing additional gaps left by the 1990 study (Gearhart et al. 1990 [Volume IV: History]). The 1990 researchers extensively consulted the volumes commonly known as the Annual Reports of the United States Life-Saving Service in compiling their database. Published from 1876 until 1914, these annual reports provide information on shipwrecks reported at the many Life-Saving Stations along the coasts of the United States and often include a description of each incident. Several of these Annual Reports were not available to the 1990 research team (1877, 1879, 1880, 1888, 1889, and 1891). Fortunately, these issues were available at the Mariners' Museum with the exception of the 1880 volume, which was available for review online. There were 116 shipwrecks identified in these issues, 25 of which were unique to the database.

#### *5.2.3.2. Heather MacFarlane Collection (Ventura, California)*

SEARCH consulted veteran California shipwreck researcher Heather MacFarlane in Ventura, California. Ms. MacFarlane has a large collection of shipwreck sources gained from many years as a maritime archaeological consultant. She generously shared her sources, and any new shipwrecks identified were added to the database. Of the 601 shipwrecks in her collection, 518 were unique shipwrecks that were not identified elsewhere.

#### *5.2.3.3. Other Published Works*

Since the research for the 1990 OCS report was done, several published inventories of west coast shipwrecks have appeared. SEARCH acquired these and added 13 new shipwrecks to the database. The most important new studies were *A Guide to Shipwreck Sites Along the Washington Coast* (Wells 1989). Though published around the same time as the 1990 OCS study, Wells' book had shipwrecks that were unknown to the 1990 study. Two other sources of particular usefulness to the present study were Jim Gibbs' *Oregon's Seacoast Lighthouses: An Oregon Documentary* (1992) and David H. Grover's *The Unforgiving Coast: Maritime Disasters of the Pacific Northwest* (2002).

#### *5.2.3.4. Museums, State Historic Preservation Offices, Libraries, Archives, and Other Institutions*

In preparing the shipwreck research strategy, SEARCH contacted 24 maritime history-related repositories to determine the extent of shipwreck records of interest to the study. These inquiries are summarized in Appendix C, which lists the repository and the responses received. Of these repositories, only five provided a substantial amount of information and 17 reported no information or no substantial shipwreck information. The table in Appendix C also notes two archives that were heavily utilized during the research for the preceding 1990 OCS Study.

### 5.2.4. West Coast Maritime Archaeologists, Historians, Shipwreck Researchers, and Interested Individuals

In preparing the shipwreck research strategy, SEARCH also contacted 30 individuals who have conducted maritime archaeology or maritime history projects on the west coast. Six individuals responded, collectively providing SEARCH a number of reports, academic works, and two shipwreck databases. The remaining 24 individuals either did not respond to the SEARCH inquiry or did not report information relevant to this study. This inquiry campaign is summarized in Appendix C, which lists the individuals and the responses received.

## 5.3. RESULTS OF INVENTORY OF UNDERWATER HERITAGE

SEARCH utilized two existing BOEM maritime archaeological resource databases—Atlantic and Gulf of Mexico OCS—as templates to create the POCS maritime archaeological resource database. Initial guidance from BOEM helped formulate the starting framework of the database, and requests for alterations from BOEM throughout the review process were incorporated into the design of the database as they were received. With assistance from BOEM, SEARCH surveyed resource managers, consultants, and users familiar with the two template databases. Constructive criticism and desired alterations received in the survey were considered when designing the framework and features of the Pacific OCS database. The current database builds upon previous inventories (e.g., Gearhart et al. 1990; Pierson et al. 1987) in that it combines multiple datasets, many of which have been created and/or updated since the previous studies, into a single source. The current database greatly improves organization and efficiency, while increasing functionality, user friendliness, and ease of update. It attempts to capture the majority of data that might exist for a resource and therefore provides the user with additional attribute fields for research and resource management purposes that previously were not available. A user guide for this database is included as Appendix D in this report.

### 5.3.1. Data Organization

Data fields in the main Vessel Form are organized into five themed tabs:

- General Vessel Information
- Spatial Information
- Vessel Description
- Wreck Site Information
- Documentation

General Vessel Information includes data identifying each shipwreck, its general location, its cause and date of loss, and NRHP eligibility status. Specific reported and verified spatial data is included in the Spatial Information tab. A distinction between reported and verified spatial data is made so that database users can determine whether or not a particular shipwreck has been confirmed through physical examination or remote-sensing technologies, or has merely been reported in the literature at a certain location. Vessel Description presents the physical characteristics and construction details of each vessel. If the physical remains of a vessel have been located, environmental conditions at the site are presented in the Wreck Site Information tab. The Documentation tab presents the sources utilized to complete each form, or that are available for additional information (e.g., site investigation reports, remote-sensing data, published or unpublished literature, and electronic databases). If any source is available on the internet, a hyperlink to the appropriate web address is included.

A series of coded relational tables is utilized to facilitate standardization, ease of use, and file size management. Data fields that can be standardized (e.g., vessel type, planning area, spatial datum, etc.) are coded and included in the main vessel form as dropdown selections. The particular coded selection made during data entry references the appropriate relational table for the corresponding description. Under BOEM direction, SEARCH streamlined and clarified many of the existing relational tables from the Atlantic and Gulf of Mexico OCS databases for inclusion in the Pacific OCS database. Additional tables appropriate to the Pacific OCS database were created.

#### *5.3.1.1. Imagery*

A major difference between the POCS database and the earlier Atlantic and Gulf of Mexico OCS databases is the method for which imagery is stored and queried. SEARCH separated imagery from the main vessel form and created a linked Imagery Form in order to improve organization, storage, and access to imagery files. The Imagery Form is organized into six themed tabs:

- Vessel Photographs/Sketches
- Diver/AUV/ROV Photographs
- Magnetometer Contour Images
- Multibeam Bathymetry Images
- Sonar Images
- Sub-Bottom Profiler Images

The Imagery Form is linked to the Vessel Form, via the Record Number, and allows the user to create new Imagery Forms, view and query images, and edit existing forms related to a particular vessel record. As many as four image files, with accompanying date and source information, can be added to each themed tab. Additional images can be linked to the Vessel Form with multiple Imagery Forms.

#### *5.3.1.2. Geographic Information System Integration*

The POCS database is compatible with GIS applications. Those records that have available spatial data, whether it is verified or reported, can be integrated into a GIS. The database fields are converted to an attribute table linked to the spatial data. By using the identify tool within a GIS application, the user can query any spatially positioned resource and access the data included in the database.

### 5.3.2. Database Results

To date, 5,813 vessel records have been created in the database. Some duplication of records may exist due to multiple sources and variations in spelling. Duplicates will be addressed as quality control continues. As additional sources of information become available, the number of records will increase. Many data fields within records remain empty due to lack of available information during the research phase of the project. Continued research efforts and future information will populate some of these fields. There are 574 records (approximately 10 percent) that provide either verified or reported spatial data. SEARCH has included vessels in the database without available spatial data to facilitate future data entry, should spatial information become available. This will negate the need to create and populate a new record, and only the additional spatial data will need to be appended in the database.

## 5.4. RECOMMENDATIONS FOR FURTHER IDENTIFICATION OF MARITIME RESOURCES

### 5.4.1. Supplemental Historic Research

The biggest need identified through the current project is the ability to carry out further historical research on the shipwrecks identified in the database. Very few shipwrecks in the database have been verified or groundtruthed offshore, and as anomalies and vessels are identified the need for more historical research is apparent. Site-specific historical research should be conducted for any high probability identified anomalies. The shipwreck database should be used as a starting point for research at this time and not taken as the definitive answer. The database should be maintained and updated on a regular basis as new information is added or deleted or duplicate records are combined.

#### *5.4.1.1. Guide for Future Archival Research*

The 1990 Study noted that to compile a truly comprehensive list of shipwrecks for the study region would take a herculean effort. Though the present study has greatly added to the inventory of shipwrecks, this statement still applies. Should further expansion of the BOEM west coast shipwreck database be sought, this section will serve as a guide for archival research.

Future research should continue in the records of the U.S. Coast Guard and its predecessor agencies, which are housed in the National Archives (NARA) and its branches. These records are simple to use and abundant. The following list is a starting point for future research that certainly will yield a high return. Additionally, the U.S. Coast Guard Historian's Office in Washington, DC, has quite a large collection of shipwreck records (news clippings, photographs, reports, and so on) that the 1990 OCS Study and the present study were not able to consult.

Digital newspaper repositories also are a source likely to yield new shipwrecks. The California Digital Newspaper Collection has digitized numerous historical newspapers from California. A similar online repository is available for Oregon in the Historic Oregon Newspapers collection. Other digital newspaper archives of interest include Ancestry.com, Newspaper Archive.com, and the Library of Congress' Chronicling America website.

- NARA Washington, DC, Record Group 26: Records of the U.S. Coast Guard, U.S. Coast Guard Casualty and Wreck Reports, 1913–1939, T925 [microfilm]
    - Rolls 5 through 21 have not been reviewed
- NARA Riverside, Record Group 26, Records of the United States Coast Guard. Port of Los Angeles/Long Beach. Index of Maritime Documents
    - This series holds great potential for finding additional shipwrecks for the Los Angeles area. Future research should focus on boxes 10 through 34
- NARA Riverside, Record Group 36, Records of the United States Customs Service, Port of San Diego, Wreck Reports, 1885–1934
    - This series has not been reviewed

- NARA Seattle, Record Group 41, Records of the Bureau of Marine Inspection and Navigation, 1774-1982
  - This series has not been reviewed

### 5.4.2. BOEM Survey Requirements and Recommendations

BOEM survey requirements detailed in Notice to Lessees and Operators (MMS 2006) of Federal Oil and Gas Leases in the Pacific Outer Continental Shelf Region call for the use of a marine magnetometer and a side-scan sonar to be towed at specific water depths (within 6 meters of the sea floor using magnetometer) within specified line spacing parameters (40 meters). Often on the POCS this tow depth requirement can be difficult to attain due to the ever-changing terrain. New AUV technology that combines the AUV with a marine magnetometer and high-resolution side-scan sonar (Kozak 2013; Marine Magnetics 2013) can ensure that all BOEM survey requirements are met with every line of data. AUVs can accurately survey large areas offshore at a defined height off the seabed with very little top-side vessel support, making for a more efficient and safer method of marine survey. AUVs can also work in a variety of environments from shallow water to very deep water. AUVs are recommended for historic surveys that meet the BOEM survey requirements.

A follow on study is recommended to identify high-probability areas on the POCS and establish equipment requirements that would be most appropriate for identifying historic resources. Similar studies have been conducted by the Gulf of Mexico Region that resulted in the identification of archaeological high probability lease blocks (Pearson et al. 2004). These lease blocks have also been updated recently with industry surveys as well as follow-on BOEM studies (BOEM 2011). A study of this nature would serve to continue to update and expand the POCS shipwreck database by identifying specific shipwrecks and high probability anomalies and would further refine the geographic positions in the database. Marine surveys could also be conducted using the latest AUV technology as described above to test their effectiveness in real world situations. Based on the results of the updated study a predictive model could be established on the POCS that would recommend survey instrumentation and strategies that would be most effective in identifying historic resources. It is important to remember, however, that although higher probability areas can be identified based upon remote-sensing data and research into historic shipping routes, past weather patterns, and port locations, vessels can wreck anywhere at any time. Low probability does not equate to a lack of cultural resources, but rather necessitates indepth review of project area environment, proposed activities, and potential impacts to determine proper investigative methodologies and resource management if warranted.

# 6. CONCLUSION

The goal of this study is to assist BOEM in the identification and location of underwater and coastal cultural resources along the Pacific coast to enable them to consider what effects the installation of energy facilities on the POCS may have on these resources.

Research has identified where submerged prehistoric archaeological resources may occur based on predictive modeling, where at least 10 percent of identified shipwrecks lie based on archival research, and where significant or potentially significant coastal cultural resources exist, including prehistoric and historic archaeological resources, traditional cultural properties, and historic built resources, also based on archival research. Although submerged prehistoric and maritime resources may be directly impacted, coastal resources have the potential to be visually impacted by offshore development. These coastal properties were further analyzed by type to determine where an ocean view is a character-defining feature, making them susceptible to this kind of visual impact.

In addition to written background narratives of geology, paleoenvironmental conditions, and prehistoric and historic contexts for these diverse property types, the findings of this study have been assembled into databases, geo-referenced maps, and shape files indicating coastal and submerged resources and areas of potential cultural resources sensitivity, provided separately. This study differs from previous studies with the employment of a series of GIS methodologies to organize geospatial data related to the POCS bathymetry, enabling the generation of new models of coastal landscape evolution resulting in the ability to predict the location of submerged prehistoric resources within the POCS study area.

The information provided through this effort, and included in this document, provides a wealth of baseline information to assist the BOEM Historic Preservation Program in identifying types of cultural resources that need to be considered through NEPA and NHPA reviews in support of future offshore renewable energy applications. The early identification of potential resource and use conflicts in siting decisions is crucial to facilitating successful future projects. Understanding the general distribution of cultural resources and resource types, as well as areas of high cultural resources sensitivity, will help BOEM identify areas along the POCS that are suitable for renewable energy activities. On a project level, understanding cultural resources types and distribution will help inform early decisions on site selection for individual projects.

Additionally, information obtained from tribal representatives and other knowledgeable experts has informed BOEM of the types of traditional cultural properties that exist along the Pacific coast of California, Oregon, and Washington. Knowledge of areas important to tribes, in advance of individual projects, will help determine appropriate ways to advise applicants about these areas to inform alternative site selection.

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# Appendix A

# Outreach Efforts Completed for the Coastal Properties Inventory

[DATE] **[Sample Letter--Pacific Coast Archaeologists and Ethnographers]**

[NAME]
[ADDRESS]
[ADDRESS]

**Subject: Bureau of Ocean Energy Management Pacific Coast Cultural Resources Study**

Dear [NAME],

We invite you to participate in a cultural resource study of the Pacific coastline, which we are conducting for the Bureau of Ocean Energy and Management (BOEM). Our goal is to compile an inventory of archaeological, architectural, and ethnographic resources along the coastlines of California, Oregon, and Washington that could be impacted by future offshore renewable energy development. Below, we outline the objectives of the study and describe how your participation would be of great assistance.

The Department of the Interior's Bureau of Ocean Energy Management (BOEM) is conducting a study titled: "Inventory and Analysis of Coastal and Submerged Archaeological Site Occurrence, Pacific Outer Continental Shelf (OCS)." It has been over 20 years since a cultural resources study was completed on the Pacific OCS for BOEM. The current study is being completed in an effort to protect submerged and coastal cultural resources, including archaeological sites, architectural resources, and Native American Sacred Sites and Traditional Cultural Properties (TCPs), from potential indirect, primarily visual effects of potential renewable energy development within the Pacific OCS Region. As part of our preliminary research we have identified you as someone who has knowledge of the cultural resources of the study area, and who can make a valuable contribution to this study.

At this time, there is no BOEM undertaking as defined by Section 106 of the National Historic Preservation Act (NHPA), thus there is no undertaking to discuss in terms of specific project impacts. This is a study to establish an inventory, and the results will guide future management decisions. The information BOEM receives will be used to determine areas of sensitivity so that future project licensing decisions can avoid, as much as possible, impacts to significant resources. As BOEM moves forward with new responsibilities for offshore renewable energy on the Pacific OCS, there is a critical need to develop an inventory of known and reported submerged and coastal historic properties, sacred lands, and TCPs that might be impacted by offshore development.

**Study Area**

The study area covers the entire Pacific coastline of California, Oregon and Washington, plus rocks and islands, extending offshore to the edge of the continental shelf, which may extend as much as 10 miles offshore in some areas. Generally the study area also extends 1 mile inland; however, we understand that some significant cultural resources whose viewsheds encompass coastal waters may be located farther inland. Note that BOEM's jurisdiction begins 3 miles offshore and extends to the edge of the Pacific OCS. Potential future development would only occur within this jurisdiction, meaning that any coastal or near-coastal resources identified as part of the inventory would not be directly impacted, but could be indirectly impacted through alteration of the view shed.

**Cultural Resources Study Objectives**

Future project planning will address archaeological and architectural resources, as well as Native American traditional practices. As a result, BOEM is seeking input from archaeologists, ethnographers and Native American Tribes and individuals who are knowledgeable of the cultural resources in the study area, and who may be interested in providing information on resources of concern. Again, our primary interest is in cultural resources along the coastline that could be subject to visual impacts from offshore development.

**Cultural Resources Data Gathering Objectives**

*Archaeological Resources*

For archaeological resources, our first objective is to identify those sites along the Pacific coast that have values beyond Criterion D (data potential) of the NRHP, since we are primarily concerned with indirect impacts. However, because archaeological sites are typically not considered to have character defining features that are subject to visual impacts, simply reviewing site records will not be a fruitful exercise, though we are conducted a records search as well. We believe that identifying those prehistoric sites within the study area that may have aspects of significance beyond NRHP criterion D requires a more targeted approach that includes reaching out to archaeologists and ethnographers with expert knowledge of cultural resources along the coast, as well as Native American Tribes.

Our second objective is to compile location specific information about TCPs and Sacred Lands, as gathered through bibliographic sources and Native American outreach. We will review the characteristics of the identified properties and assess whether, based on the available information, these resources have the potential for visual impacts from off-shore development. Types of properties might include burial sites, resource gathering locales, or other locations with associated sacred or religious values. Where possible, we will gather information on the characteristics of the resources and the values ascribed to them. In concert with the research to identify TCPs, BOEM will discuss these sites with the appropriate Native American groups to obtain additional information to support their inclusion as a resource that could be visually impacted by offshore development.

*Architectural Resources*

The final category of resources we will address are built resources that could be subject to indirect impacts from offshore development, meaning that the view of the coastline and sea is an important contributing element to their significance. These might include resources like lighthouses, military properties, and nautical properties.

Please contact me if you are interested in providing information for this study. With your cooperation, we hope to obtain information on as many significant coastal cultural resources as possible, with the ultimate the goal of avoiding or minimizing visual impacts to these resources. Please let us know if there are other individuals you believe we should contact as well.

All experts will be acknowledged for their contribution to this study, and all data will be properly cited and attributed. We understand that the sharing of cultural resources information is a sensitive topic. BOEM is committed to ensuring the confidentiality of all location and other sensitive information regarding cultural resources. We are working in close coordination with the Regional Historic Preservation Officer for BOEM, Mr. Dave Ball, and ICF and BOEM will ensure that <u>any information you provide to us will remain subject to the confidentiality provisions of NHPA Section 304.</u>

If you have questions or need clarification, or have additional information or suggestions, please do not hesitate to contact me by phone, at (858) 444-3904, or by email, at mbever@icfi.com.

Thank you for your assistance in this matter.

Sincerely,

Michael R. Bever, PhD, RPA
Project Director / Archaeology Manager
Attachment

[DATE] **[Sample Letter--California Tribes and Tribal Representatives]**

[NAME]
[ADDRESS]
[ADDRESS]

**Subject: Bureau of Ocean Energy Management Pacific Coast Cultural Resources Study**

Dear [NAME],

The Department of the Interior's Bureau of Ocean Energy Management (BOEM) is conducting a study titled: "Inventory and Analysis of Coastal and Submerged Archaeological Site Occurrence, Pacific Outer Continental Shelf (OCS)." It has been over 20 years since a cultural resources study was completed on the Pacific OCS for BOEM. The current study is being completed in an effort to protect submerged and coastal cultural resources, including Native American Sacred Sites and Traditional Cultural Properties (TCPs), from potential indirect, primarily visual effects of potential renewable energy development within the Pacific OCS Region. As part of this study, BOEM requested that the Native American Heritage Commission (NAHC) conduct a Sacred Lands File Search and provide a list of Native American contacts for the study area, which is quite extensive. The NAHC provided your name as a tribal representative or interested individual who is knowledgeable of the cultural resources in the study area and who may be interested in providing information on TCPs or other resources that might be indirectly impacted by potential future projects.

At this time there is no BOEM undertaking as defined by Section 106 of the National Historic Preservation Act (NHPA), thus there is no undertaking to discuss in terms of specific project impacts. This is a study to establish an inventory, and the results will guide future management decisions. The information BOEM receives will be used to determine areas of sensitivity so that future project licensing decisions can avoid, as much as possible, impacts to significant resources. As BOEM moves forward with new responsibilities for offshore renewable energy on the Pacific OCS there is a critical need to develop an inventory of known and reported submerged and coastal historic properties, sacred lands, and TCPs that might be impacted by offshore development.

## Study Area

The study area covers the entire California coastline plus rocks and islands extending offshore to the edge of the continental shelf, which may extend as much as 10 miles offshore in some areas. Generally the study area also extends 1 mile inland; however, we understand that some significant cultural resources whose viewsheds encompass the coastal waters off California may be located farther inland. Note that BOEM's jurisdiction begins 3 miles offshore and extends to the edge of the Pacific OCS. Potential future development would only occur within this jurisdiction, meaning that any coastal or near-coastal resources identified as part of the inventory would not be directly impacted, but could be indirectly impacted through alteration of the view shed.

## Cultural Resources Study Objectives

Future project planning will address Native American traditional uses.  As a result, BOEM is seeking comments from Native American Tribes and individuals that are knowledgeable of the cultural resources in the study area and who may be interested in providing information on TCPs and other resources of concern.

*Archaeological Resources*

Our first objective is to identify archaeological resources along the California coast that are significant not simply for their scientific data potential, but hold important cultural values to Native Americans. These values may include factors such as the presence of burials or indicators that a resource may also have traditional value to Native Americans.  We believe that identifying those prehistoric sites within the study area that may have aspects of significance beyond the National Register of Historic Places (NRHP) criterion D (data potential) requires a more focused approach that includes reaching out to Native Americans with knowledge of archaeological resources along the California coast. In addition, this inventory is primarily concerned with resources that could be adversely impacted by offshore development, meaning that the visual setting of the resource should be a key aspect of its importance.

We are currently conducting a targeted records search of archaeological properties along the California coast. Archaeological sites identified as holding important cultural values to Native Americans will be the subject of additional research to assess whether they could be visually impacted by offshore development.

*Traditional Cultural Properties and Sacred Lands*

Our second objective is to compile location specific information about TCPs, Sacred Lands, and other places of concern, should you choose to share this information. The NAHC has identified Sacred Lands along the coastline within the counties that may be of concern to you. With your assistance, we hope to obtain information on as many significant coastal cultural resources as possible with the goal of avoiding or minimizing visual impacts to these resources.

Your input is very important to BOEM, and is crucial for the successful completion of this study. We are working in close coordination with the Regional Historic Preservation Officer for BOEM, Mr. Dave Ball, and ICF and BOEM will ensure that <u>any information you provide to us will remain</u> <u>subject to the confidentiality provisions of NHPA Section 304.</u>

We invite and welcome your participation in this project. If you have questions or need clarification on any of the information we have given you, or have information or suggestions regarding Native American issues to contribute to the study, please do not hesitate to contact me by phone, at (858)444-3904, or email (mbever@icfi.com). You may also contact Mr. Dave Ball, Regional Historic Preservation Officer for BOEM, at (805) 389-7593, or david.ball@boem.gov.

I look forward to hearing from you in the near future, and thank you for your assistance.

Sincerely,

Michael R. Bever, PhD, RPA
Project Director / Archaeology Manager

Attachment

[DATE] **[Sample Letter--Pacific Northwest Tribes and Tribal Representatives]**

[NAME]
[ADDRESS]
[ADDRESS]

**Subject: Bureau of Ocean Energy Management Pacific Coast Cultural Resources Study**

Dear [NAME],

The Department of the Interior's Bureau of Ocean Energy Management (BOEM) is conducting a study titled: "Inventory and Analysis of Coastal and Submerged Archaeological Site Occurrence, Pacific Outer Continental Shelf (OCS)." It has been over 20 years since a cultural resources study of this scale was completed on the Pacific OCS for BOEM. The current study is being completed in an effort to ultimately protect submerged and coastal cultural resources, including archaeological sites and Native American sacred sites and Traditional Cultural Properties (TCPs), from potential indirect, primarily visual effects of potential renewable energy development within the Pacific OCS Region. We stress that this inventory effort is not related to a specific project, or an Undertaking under Section 106 of the National Historic Preservation Act (NHPA). Our project is focused on information gathering only. Formal consultation, should any development be proposed in the future, would occur separately and at later date.

As part of this study, BOEM requested that we contact tribal representatives or interested individuals who are knowledgeable of the cultural resources in the study area and who may be interested in providing information on TCPs or other resources that might be indirectly impacted by potential future projects. As mentioned, this is a study to establish an inventory, and the results will guide future management decisions. The information BOEM receives will be used to determine areas of sensitivity so that future project licensing decisions can avoid, as much as possible, impacts to significant resources.

As BOEM moves forward with new responsibilities for offshore renewable energy on the Pacific OCS there is a critical need to develop an inventory of known and reported submerged and coastal historic properties, sacred lands, and TCPs that might be impacted by offshore development. Importantly, BOEM recognizes that this outreach is just an initial step in a long term process, and the intention here is to open a dialog for future discussion.

**Study Area**

The study area covers the entire Pacific coastline of Washington, California and Oregon, plus rocks and islands, extending offshore to the edge of the continental shelf, which may extend as much as 10 miles offshore in some areas. Generally the study area also extends 1 mile inland; however, we understand that some significant cultural resources whose viewsheds encompass the coastal waters off Oregon and Washington may be located farther inland. Note that BOEM's jurisdiction begins 3 miles offshore and extends to the edge of the Pacific OCS. Potential future development would only occur within this jurisdiction, meaning that any coastal or near-coastal resources identified as part of the inventory would not be directly impacted, but could be indirectly impacted through alteration of the view shed.

**Cultural Resources Study Objectives**

Future project planning will address Native American traditional uses. As a result, BOEM is seeking comments from Native American Tribes and individuals that are knowledgeable of the cultural resources in the study area and who may be interested in providing information on TCPs and other resources of concern.

*Archaeological Resources*

We recognize that archaeological resources have important values for tribal communities beyond those of simple information potential (along the lines of criterion D of the National Register of Historic Places [NRHP]), and that resources that hold these values are precisely the types of resources that could be impacted by offshore development. Our first objective, then, is to identify those resources along the Pacific coast that hold important cultural values to Native Americans. These values may include factors such as the presence of burials or indicators that a resource may also have traditional value to Native Americans. We also recognize that identifying these types of archaeological sites within the study area requires a broader approach that includes reaching out to Native Americans with knowledge of archaeological resources along the Pacific coast. In addition, this inventory is primarily concerned with resources that could be adversely impacted by offshore development, meaning that the visual setting of the resource should be a key aspect of its importance.

We are currently conducting a targeted records search of archaeological properties along the Pacific coast. Archaeological sites identified as holding important cultural values to Native Americans will be the subject of additional research to assess whether they could be visually impacted by offshore development.

*Traditional Cultural Properties and Sacred Lands*

Our second objective is to compile location specific information about TCPs and other places of concern, should you choose to share this information. With your assistance, we hope to obtain information on as many significant coastal cultural resources as possible with the goal of avoiding or minimizing visual impacts to these resources.

Your input is very important to BOEM, and is crucial for the successful completion of this study. We are working in close coordination with the Regional Historic Preservation Officer for BOEM, Mr. Dave Ball, and ICF and BOEM will ensure that <u>any information you provide to us will remain subject to the confidentiality provisions of NHPA Section 304.</u>

We invite and welcome your participation in this project. If you have questions or need clarification on any of the information we have given you, or have information or suggestions regarding Native American issues to contribute to the study, please do not hesitate to contact either of us by phone or email. Our contact information is below. You may also contact Mr. Dave Ball, Regional Historic Preservation Officer for BOEM, at (805)389-7593, or david.ball@boem.gov.

We look forward to hearing from you in the future, and thank you for your assistance.

Sincerely,

Stacy Schneyder, MA
MPA Senior Archaeologist
ICF International
Assoc. Phone: (503)525-6166
sschneyder@icfi.com

David Ellis,
Principal
Willamette Cultural Resources
Phone: (503)281.4576
davee@willamettecra.com

Table A-1
Pacific Coast Archaeologists and Ethnographers Contacted

| **Name / Affiliation** | **Results** |
|---|---|
| Jeanne E. Arnold<br>Professor of Anthropology,<br>University of California, Los Angeles | No reply |
| Richard Bailey<br>Archaeologist, Spokane District,<br>U.S. Bureau of Land Management | No reply |
| Clinton Blount<br>Principal, Albion Environmental, Inc. | No reply |
| Gary Breschini<br>Principal, Archaeological Consulting | No reply |
| Kevin Bruce<br>Heritage Program/Cultural Resources,<br>Willamette National Forest,<br>U.S. Forest Service | No reply |
| R. Scott Byram<br>Researcher,<br>Archaeological Research Facility,<br>University of California, Berkeley | No reply |
| Brian Byrd<br>Principal, Far Western Anthropological Research Group, Inc. | No reply |
| Richard L. Carrico<br>Faculty, Department of American Indian Studies and Recuerdos Research,<br>San Diego State University | No reply |
| Dave Conca<br>Cultural Resources Program Manager,<br>Olympic National Park,<br>U.S. National Park Service | Ozette Indian Village National Historic Landmark (45-CA-24, 45-CA-31, and Ozette Island) is the only resource within Olympic National Park meeting the study criteria. Resource accepted as NHL in 1980, but not listed. |
| Dave Conlin<br>Chief, Submerged Resources Center,<br>National Park Service | No reply |
| James P. Delgado<br>Director of Maritime Heritage,<br>National Marine Sanctuaries,<br>U.S. National Oceanic and Atmospheric Administration | NOAA just announced program to characterize and interpret cultural resources located in the following marine sanctuaries: Channel Islands, Monterey Bay, Gulf of Farallones, Cordell Bank, and Olympic Coast. Interested in mutual sharing of information. |
| Douglas Deur<br>Professor of Anthropology, Portland State University | No reply |

Table A-1. Pacific Coast Archaeologists and Ethnographers Contacted (continued)

| **Name / Affiliation** | **Results** |
|---|---|
| Janet Eidsness<br>Tribal Historic Preservation Officer,<br>Blue Lake Rancheria Tribe | Offered to send ideas about research avenues to explore.<br>No subsequent reply |
| David Ellis<br>Principal, Willamette Cultural Resources Associates, Ltd. | No reply |
| Jon Erlandson<br>Professor/Director<br>Museum of Natural and Cultural History,<br>University of Oregon | No reply |
| Richard Fitzgerald<br>Senior State Archaeologist,<br>Archaeology, History and Museums Division,<br>California Department of Parks and Recreation | No reply |
| Lynn Gamble<br>Professor of Anthropology,<br>University of California, Santa Barbara | No reply |
| Michael Glassow<br>Professor Emeritus of Anthropology,<br>University of California, Santa Barbara | No reply |
| Pam Griggs<br>Senior Staff Counsel,<br>California State Lands Commission | No reply |
| Bill Hildebrandt<br>Owner/Principal,<br>Far Western Anthropological Research Group, Inc. | List of suggested references and important sites: CA-DNO-11, CA-HUM-129, a previously excavated ethnographic village in Trinidad, Patrick's Point ethnographic village, and Indian/Gunther Island. |
| Jack Hunter<br>District 5 Archaeologist,<br>California Department of Transportation | No reply |
| Warren Hurley<br>Archaeologist, Western Colorado Area Office, U.S. Bureau of Reclamation | No reply |
| Mark Hylkema<br>Associate State Archaeologist,<br>Archaeology, History and Museums Division,<br>California Department of Parks and Recreation | No reply |
| Steven James<br>Professor of Anthropology,<br>California State University, Fullerton | No reply |
| Chris Jenkins<br>Regulatory Branch, Seattle District,<br>U.S. Army Corps of Engineers | No reply |

Table A-1. Pacific Coast Archaeologists and Ethnographers Contacted (continued)

| **Name / Affiliation** | **Results** |
|---|---|
| John Johnson<br>Curator of Anthropology,<br>Santa Barbara Museum of Natural History | No reply |
| Terry Jones<br>Professor of Anthropology and Chair,<br>Department of Social Sciences,<br>California Polytechnic State University | No reply |
| Janet Joyer<br>Archaeologist/Manager, Heritage Program Manager,<br>Rogue River-Siskiyou National Forest,<br>U.S. Forest Service | No reply |
| Dustin G. Kennedy<br>District Archaeologist, Roseburg District,<br>U.S. Bureau of Land Management | No reply |
| James Kennett<br>Emeritus Professor of Earth Science,<br>University of California, Santa Barbara | No reply |
| Henry Koerper<br>Independent Consultant/<br>Retired Professor of Anthropology,<br>Cypress Community College | No reply |
| Kent Lightfoot<br>Professor of Anthropology,<br>University of California, Berkeley | No reply |
| Heather Macfarlane<br>Owner/Principal,<br>Macfarlane Archaeological Consultants | Provided SEARCH, Inc. with her database of shipwrecks. |
| Mitch Marken<br>Cultural Resources Leader/Principal,<br>Environmental Science Associates | No reply |
| Kristen Martine<br>Manager, Cultural Resources Program,<br>Federal Columbia River Power System (FCRPS),<br>Bonneville Power Administration | FCRPS does not maintain cultural resources-<br>related information about coastal sites. |
| Patricia Martz<br>Retired Professor of Anthropology, California State<br>University, Los Angeles | No reply |
| Patricia Masters<br>Inman and Masters Consultants | No reply |
| Carolyn McAleer<br>Coordinator, Archaeology Program,<br>Geo-Environmental Section,<br>Oregon Department of Transportation | No reply |

Table A-1. Pacific Coast Archaeologists and Ethnographers Contacted (continued)

| **Name / Affiliation** | **Results** |
|---|---|
| Helen McCarthy<br>Owner/Principal,<br>Cultural Resource Research and Consulting | No reply |
| Daniel Meatte<br>Archaeologist,<br>Washington State Parks and Recreation Commission | No reply |
| Marco Meniketti<br>Professor of Anthropology,<br>San Jose State University | No reply |
| Randy Milliken<br>Senior Archaeologist,<br>Far Western Anthropological Research Group, Inc. | No reply |
| Madonna Moss<br>Professor of Anthropology,<br>University of Oregon | Provided list of references associated with Oregon coastal sites. |
| Stephanie Neil<br>Archaeologist/Recreation Manager,<br>Hood Canal Ranger District,<br>Olympic National Forest, U.S. Forest Service | No reply |
| Nancy Nelson<br>Archaeologist, Oregon Parks and Recreation Department | No reply |
| Robert S. Neyland<br>Head, Underwater Archaeology Branch,<br>Naval History and Heritage Command,<br>U.S. Department of the Navy | Forwarded files on submerged cultural resources to BOEM for filtering down to SEARCH, Inc. |
| L. Mark Raab<br>Emeritus Professor of Anthropology,<br>California State University, Northridge | No reply |
| Bert Rader<br>Cultural Resources Management Team,<br>Portland District,<br>U.S. Army Corps of Engineers | No reply |
| Anan Raymond<br>Regional Archaeologist for Region 1 and Region 8,<br>U.S. Fish and Wildlife Service | No reply |
| Torben C. Rick<br>Curator, North American Archaeology,<br>Department of Anthropology,<br>National Museum of Natural History,<br>Smithsonian Institution | No reply |
| Steve Samuels<br>District Archaeologist, Coos Bay District,<br>U.S. Bureau of Land Management | No reply |

Table A-1. Pacific Coast Archaeologists and Ethnographers Contacted (continued)

| **Name / Affiliation** | **Results** |
|---|---|
| Robert Schwemmer<br>Cultural Resources Coordinator, Channel Islands National Marine Sanctuary | No reply |
| Stacy St. James<br>Coordinator, South Central Coastal Information Center, California State University, Fullerton | No reply |
| Lee Stilson<br>State Lands Archaeologist,<br>Washington State Department of Natural Resources | Does not have data that could benefit the project. Most TCPs have not been documented. |
| Dorothea Theodoratus<br>Principal,<br>Pacific Legacy Historic Preservation | No reply |
| Heather Ulrich<br>District Archaeologist, Salem District,<br>U.S. Bureau of Land Management | No reply |
| Rene Vellanoweth<br>Professor of Anthropology and Chair,<br>Department of Anthropology,<br>California State University, Los Angeles | No reply |
| Gary Wessen<br>Owner/Principal, Wessen and Associates | Interested in participating. Requested additional details on the type of information desired. Information provided, no subsequent response. |
| Jim West<br>Research Associate, Department of Anthropology, University of California, Davis | No reply |
| Adrian Whitaker<br>Principal,<br>Far Western Anthropological Research Group, Inc. | No reply |
| Randy Wiberg<br>Principal,<br>Holman and Associates Archaeological Consultants | No reply |
| Scott Williams<br>Manager, Archaeology Program,<br>Washington State Department of Transportation | Recommended working directly with tribes on the Washington coast. Sensitive areas on the Oregon coast include Neahkanie Mountain and Smugglers Cove. Clatsop-Nehalem Confederated Tribes should be consulted about Neahkanie Mountain. |
| Doug Wilson<br>Archaeologist, Vancouver National Historic Reserve;<br>Director, Northwest Cultural Resource Institute,<br>Fort Vancouver National Historic Site,<br>U.S. National Park Service | Replied with no additional information. |

Table A-2
California Tribes and Tribal Representatives Contacted

| Name/Tribal Affiliation | Results |
|---|---|
| Bernie Acuna<br>Gabrielino Tongva | No reply |
| Doug Alger<br>Cultural Resources Coordinator,<br>Salinan Nation Cultural Preservation Association | No reply |
| Adelina Alva-Padilla<br>Chairwoman, Santa Ynez Tribal Elders Council | No reply |
| Cindi M. Alvitre<br>Chairwoman, Ti'At Society/ Inter-Tribal Council of Pimu | No reply |
| Richard Angulo<br>Chumash | No reply |
| Christine Arias<br>Chairperson, Ohlone/Costanoan-Esselen Nation | No reply |
| Vincent Armenta<br>Chairperson, Santa Ynez Band of Mission Indians | No reply |
| Frank Arredondo<br>Chumash | No reply |
| David Belardes<br>Chairperson, Juaneño Band of Mission Indians<br>Acjachemen Nation | No reply |
| Dina Bowen-Welsh<br>Secretary, She Bel Na Band of Pomo Indians | No reply |
| Len Bowman, Jr.<br>Chairperson, Bear River Band of Rohnerville<br>Rancheria | No reply |
| Frank Brown<br>Coordinator, Inter-Tribal Cultural Resources<br>Protection Council | No reply |
| Claudia Brundin<br>Chairperson, Blue Lake Rancheria | No reply |
| Kara Brundin-Miller<br>Chairperson, Smith River Rancheria of California | No reply |
| John W. Burch<br>Traditional Chairperson, Salinan Tribe of Monterey, San<br>Luis Obispo Counties | No reply |
| Gene Buvelot<br>The Federated Indians of Graton Rancheria | Tribe is interested in participating. |
| Bennae Calac<br>Tribal Council Member,<br>Pauma Valley Band of Luiseño Indians | No reply |

Table A-2. California Tribes and Tribal Representatives Contacted (continued)

| Name/Tribal Affiliation | Results |
|---|---|
| Rosemary Cambra<br>Chairperson,<br>Muwekma Ohlone Indian Tribe of the San Francisco Bay Area | No reply |
| Linda Candelaria<br>Chairwoman, Gabrielino-Tongva Tribe | No reply |
| Gregg Castro<br>Administrator,<br>Salinan Nation Cultural Preservation Association | No reply |
| Tony Cerda<br>Chairperson, Coastanoan Rumsen Carmel Tribe | No reply |
| Shane Chapparosa<br>Spokesperson,<br>Los Coyotes Band of Mission Indians | No reply |
| Ron Christman<br>Kumeyaay Cultural Historic Committee | No reply |
| Fred Collins<br>Spokesperson, Chumash | Northern Chumash Tribal Council would like to participate. Requested a meeting to also include the Chumash Tribal Governments. |
| Erika Collins<br>Tribal Historic Preservation Officer,<br>Bear River Band of Rohnerville Rancheria | Requested additional details. Confidential map of Bear River Band aboriginal territory submitted; not included in this report. |
| Charles Cooke<br>Chumash, Fernandeño, Tataviam, Kitanemuk | No reply |
| Russ Crabtree<br>Tribal Administrator,<br>Smith River Rancheria of California | No reply |
| Alfred Cruz<br>Cultural Resources Coordinator,<br>Juaneño Band of Mission Indians | No reply |
| Andrea Davis<br>Environmental Coordinator, Wiyot Tribe | No reply |
| Ernestine DeSoto<br>Chumash | No reply |
| Robert F. Dorame<br>Tribal Chair/Cultural Resources,<br>Gabrielino Tongva Indians of California Tribal Council | No reply |
| Robert Duckworth<br>Environmental Coordinator,<br>Salinan Nation Cultural Preservation Association | No reply |
| Sam Dunlap<br>Chairperson, Gabrielino Tongva Nation | No reply |

Table A-2. California Tribes and Tribal Representatives Contacted (continued)

| Name/Tribal Affiliation | Results |
|---|---|
| Maura Eastman<br>Tribal Administrator, Wiyot Tribe | No reply |
| Janet Eidsness<br>Historic Preservation Officer, Blue Lake Rancheria | Requested additional details. |
| Anita Espinoza<br>Juaneño Band of Mission Indians | No reply |
| Jean-Marie Feyling<br>Ohlone/Coastanoan | Requested additional details. |
| Beverly Salazar Folkes<br>Chumash, Tataviam, Fernandeño | No reply |
| Jose Freeman<br>President,<br>Salinan Nation Cultural Preservation Association | No reply |
| Andrew Galvan<br>The Ohlone Indian Tribe | No reply |
| Michael Garcia<br>Vice Chairperson, Ewiiaapaayp Tribal Office | No reply |
| Glen Gary<br>Tribal Administrator, Elk Valley Rancheria | No reply |
| Shasta Gaugher<br>Tribal Historic Preservation Officer,<br>Pala Band of Mission Indians | No reply |
| LaVerne Glaze<br>Karok, Yurok | No reply |
| Matthew Darian Goldman<br>Chumash | No reply |
| Gail Green<br>Chairperson, Wiyot Tribe | No reply |
| John Green<br>Cultural and Natural Resources, Elk Valley Rancheria | No reply |
| Judith Bornar<br>Salinan | No reply |
| M. Louis Guassac<br>Kumeyaay Diegueño Land Conservancy | No reply |
| Randy Guzman-Folkes<br>Chumash, Fernandeño, Tataviam,<br>Shoshone Paiute, Yaqui | No reply |
| Nina Hapner<br>Environmental Planning Department,<br>Stewarts Point Rancheria | No reply |

Table A-2. California Tribes and Tribal Representatives Contacted (continued)

| Name/Tribal Affiliation | Results |
|---|---|
| Donna Haro<br>Xolon Salinan Tribe | No reply |
| Deborah Hut<br>Yuki | No reply |
| Jakki Kehl<br>Ohlone/Coastanoan | No reply |
| Edward Ketchum<br>Amah Mutsun Tribal Band | Would like to participate. Described Amah beliefs and ceremonial activities associated with Monterey Bay near Watsonville/Moss Landing. |
| Melvin Ketchum, III<br>Environmental Coordinator, Amah Mutsun Tribal Band | No reply |
| Walt Laura<br>Yurok | No reply |
| Clint Linton<br>Director of Cultural Resources,<br>Ipai Nation of Santa Ysabel | No reply |
| Susie Long<br>Tribal Administrator, Trinidad Rancheria/<br>Cher-Ae Heights Indian Community | No reply |
| Valentin Lopez<br>Chairperson, Arnah Mutsun Tribal Band | Requested additional details. |
| Owl Clan,<br>Dr. Kote and Lin A-Lul'Koy Lotah Chumash | No reply |
| Carmen Lucas<br>Kwaaymii Laguna Band of Mission Indians | No reply |
| Parris Lundgren<br>Tsurai Ancestral Society | Requested additional details. |
| Mark Macarro<br>Chairperson, Pechanga Band of Mission Indians | No reply |
| Paul Macarro<br>Cultural Resources Manager,<br>Pechanga Band of Mission Indians | No reply |
| Randall Majel<br>Chairperson, Pauma and Yuima Reservation | No reply |
| Kerri Malloy<br>Cultural Resources Coordinator, Trinidad<br>Rancheria/Cher-Ae Heights Indian Community | No reply |
| Trina Marine Ruano Family,<br>Ramona Garibay (Representative) Ohlone/Coastanoan, Bay<br>Miwok, Plains Miwok, Patwin | No reply |

Table A-2. California Tribes and Tribal Representatives Contacted (continued)

| Name/Tribal Affiliation | Results |
| --- | --- |
| Pauline Martinez-Arias<br>Tribal Council Woman,<br>Ohlone/Coastanoan-Esselen Nation | No reply |
| Bo Mazzetti<br>Chairperson, Rincon Band of Mission Indians | Requested additional details. |
| Robert McConell<br>Tribal Historic Preservation Officer,<br>Yurok Tribe of California | Confidential map of Yurok traditional cultural properties provided (not included in this report). |
| Buffy McQuillen<br>NAGPRA Coordinator, Yurok Tribe of California | No reply |
| Margie Mejia<br>Chairperson, Lytton Rancheria of California | No reply |
| Melochundum Band of Tolowa Indians | No reply |
| Will Micklin<br>Executive Director, Ewiiaapaayp Tribal Office | No reply |
| Lisa Miller<br>Tribal Administrator, Lytton Rancheria of California | No reply |
| Stephen William Miller<br>Chumash | No reply |
| Vennise Miller<br>Chairperson, Coastal Band of the Chumash Nation | No reply |
| Dale Miller<br>Chairperson, Elk Valley Rancheria | No reply |
| Louise Miranda-Ramirez<br>Chairperson, Ohlone/Coastanoan-Esselen Nation | No reply |
| Joseph Mondragon<br>Tribal Administrator, Arnah Mutsun Tribal Band | No reply |
| Virgil Moorehead<br>Chairperson, Big Lagoon Rancheria | No reply |
| Anthony Morales<br>Chairperson, Gabrielino/<br>Tongva San Gabriel Band of Mission Indians | No reply |
| Aylisha Diane Marie Garcia Napoleone<br>Chumash | No reply |
| Tom Little Bear Nason<br>Esselen | No reply |
| Greg Nesty<br>Environmental Coordinator, Trinidad<br>Rancheria/Cher-Ae Heights Indian Community | No reply |

Table A-2. California Tribes and Tribal Representatives Contacted (continued)

| **Name/Tribal Affiliation** | **Results** |
|---|---|
| Lei Lynn Odom<br>Chumash | No reply |
| Peggy Odom<br>Chumash | No reply |
| Kristie Orosco<br>Environmental Coordinator,<br>San Pasqual Band of Indians | Requested additional details. |
| Patrick Orozco<br>Coastanoan Ohlone Rumsen-Mutsen Tribe | No reply |
| Thomas O'Rourke<br>Chairperson, Yurok Tribe of California | No reply |
| Rebecca Osuna<br>Spokesperson, Inaja Band of Mission Indians | No reply |
| Owl Clan Qun-Tan Shup<br>Chumash | No reply |
| Bernice Paipa<br>Vice Spokesperson,<br>Kumeyaay Cultural Repatriation Committee | No reply |
| Charles S. Parra<br>Chumash | No reply |
| Melissa M. Parra-Hernandez<br>Chumash | No reply |
| Joyce Perry<br>Representing Tribal Chairperson,<br>Juaneño Band of Mission Indians Acjachemen Nation | No reply |
| Anthony R. Pico<br>Chairperson, Viejas Band of Kumeyaay Indians | No reply |
| Nelson Pinola<br>Chairperson, Manchester-Point Arena Rancheria | No reply |
| Carol A. Pulido<br>Chumash | No reply |
| Arla Ramsey<br>Tribal Administrator, Blue Lake Rancheria | No reply |
| Anthony Rivera<br>Chairman, Juaneño Band of Mission Indians<br>Acjachemen Nation | No reply |
| Rebecca Robles<br>United Coalition to Protect Panhe | No reply |
| Freddie Romero<br>Cultural Preservation Consultant,<br>Santa Ynez Tribal Elders Council | No reply |

Table A-2. California Tribes and Tribal Representatives Contacted (continued)

| **Name/Tribal Affiliation** | **Results** |
|---|---|
| Mark Romero<br>Chairperson,<br>Mesa Grande Band of Mission Indians | No reply |
| Edwin Romero<br>Chairperson, Barona Group of the Capitan Grand | No reply |
| Hawk Rosales<br>Executive Director,<br>InterTribal Sinkyone Wilderness Council | No reply |
| John Tommy Rosas<br>Tribal Administrator,<br>Tongva Ancestral Territorial Tribal Nation | No reply |
| Frank Ross<br>The Federated Indians of Graton Rancheria | No reply |
| Helene Rouvier<br>Tribal Historic Preservation Officer, Wiyot Tribe | No reply |
| John Ruiz<br>Chumash | No reply |
| Salinan-Chumash Nation Xielolixii | No reply |
| San Luis Rey Band of Mission Indians<br>Cultural Department | No reply |
| Santa Ynez Band of Mission Indians<br>Tribal Administrator | No reply |
| Greg Sarris<br>Chairperson,<br>The Federated Indians of Graton Rancheria | Would like to participate. |
| Ann Marie Sayers<br>Chairperson, Indian Canyon Mutsun Band of Coastanoan | No reply |
| Ralph Sepulveda<br>Chairperson, Stewarts Point Rancheria | No reply |
| Dave Singleton<br>Program Analyst,<br>California Native American Heritage Commission | No reply |
| Edwin Smith<br>Environmental Coordinator/Cultural,<br>Bear River Band of Rohnerville Rancheria | No reply |
| Harriet L. Stanley-Rhoades<br>Noyo River Indian Community | No reply |
| Suntayea Steinruck<br>Tribal Historic Preservation Officer,<br>Smith River Rancheria | No reply |

Table A-2. California Tribes and Tribal Representatives Contacted (continued)

| Name/Tribal Affiliation | Results |
|---|---|
| Atta P. Stevenson<br>Cultural Resources, Laytonville Rancheria/<br>Cahto Indian Tribe | No reply |
| Garth Sundberg<br>Chairperson, Trinidad Rancheria/<br>Cher-Ae Heights Indian Community | No reply |
| Michael Thom<br>Vice Chairman Administration Office, Karuk Tribe | Requested consultation with the Karuk Resources Advisory Board. |
| James Trujillo<br>Vice Chair, La Jolla Band of Mission Indians | No reply |
| Mona Olivas Tucker<br>Chumash | No reply |
| Danny Tucker<br>Sycuan Band of the Kumeyaay Nation | No reply |
| Julie Lynn Tumamait<br>Chairwoman, Barbareno/<br>Ventureno Band of Mission Indians | No reply |
| Patrick Tumamait<br>Chumash | No reply |
| Shannon Tushingham<br>Tribal Historic Preservation Officer,<br>Elk Valley Rancheria | Would like to participate. |
| Gilbert M. Unzueta, Jr.<br>Chumash | No reply |
| Emilio Valencia<br>Tribal Historic Preservation Officer,<br>Stewarts Point Rancheria | Requested additional details. Would like to participate. |
| Chief Mark Steven Vigil<br>San Luis Obispo County Chumash Council | No reply |
| Suki Waters<br>Coast Miwok, Pomo | No reply |
| Kenneth Wright<br>President, Round Valley Reservation/<br>Covelo Indian Community | No reply |
| Ya-Ka-Ama<br>Pomo, Coast Miwok, Wappo | No reply |
| Irene Zwierlein<br>Chairperson, Amah Mutsun Tribal Band | No reply |

Table A-3
Oregon Tribes and Tribal Representatives Contacted

| Name/Tribal Affiliation | Results |
|---|---|
| Agnes Castronuevo<br>Archaeologist, Confederated Tribes of the Coos, Lower Umpqua, and Suislaw Indians | Met with BOEM and other tribal representatives in January 2012. No additional information provided. |
| Diane Collier<br>Tribal Council Chair,<br>Clatsop-Nehalem Confederated Tribes | No reply |
| Robert Garcia<br>Tribal Chair, Confederated Tribes of the Coos,<br>Lower Umpqua, and Suislaw Indians | No reply. |
| Don Ivy<br>Coquille Indian Tribe | Met with BOEM and other tribal representatives in January 2012 and April 2012. No additional information provided. |
| Cheryle Kennedy<br>Tribal Chair,<br>Confederated Tribes of the<br>Grand Ronde Community of Oregon | No reply. |
| Robert Kentta<br>Cultural Resources Director,<br>Confederated Tribes of Siletz Indians | No reply. |
| Ed Metcalf<br>Tribal Chair, Coquille Indian Tribe | Met with BOEM and other tribal representatives in January 2012. No further reply. |
| Nicole Norris<br>Archaeologist/Cultural Resources Program,<br>Coquille Indian Tribe | Met with BOEM and other tribal representatives in January 2012. No additional information provided. |
| Dolores Pigsley<br>Tribal Chairman<br>Confederated Tribes of Siletz Indians | Met with BOEM and other tribal representatives in January 2012. No additional information provided |
| Jessie Plueard<br>Cultural Resources Archaeologist,<br>Cow Creek Band of Umpqua Indians | No reply |
| Karen Quigley<br>Oregon Commission on Indian Services | No reply |
| Eirik Thorsgard<br>Cultural Protection Coordinator/<br>Tribal Historic Preservation Officer,<br>Confederated Tribes of the Grand Ronde Community of Oregon | Met with BOEM and other tribal representatives in January 2012. No additional information provided. |

Table A-4
Washington Tribes and Tribal Representatives Contacted

| **Name/Tribal Affiliation** | **Results** |
|---|---|
| Alexis Barry<br>Hoh Indian Tribe | No reply |
| Richard Bellon<br>Cultural Resources, Chehalis Confederated Tribes | No reply |
| Craig A. Bill<br>Executive Director,<br>Washington State Governor’s Office of Indian Affairs | No reply |
| Janine Bowechop<br>Tribal Historic Preservation Officer, Makah Tribe | Met with BOEM and other tribal representatives in November 2012. No additional information provided. |
| Dave Burlingame<br>Cowlitz Indian Tribe | No reply |
| Gideon U. Cauffman<br>Jamestown S’Klallam Tribe | Phone conversation with BOEM about project details. No additional information provided. |
| Earl Davis<br>Shoalwater Bay Tribe | No reply |
| Ray Gardner<br>Chinook Indian Nation | No reply |
| Mystique Hurtado<br>Executive Assistant, Washington State Governor’s Office of Indian Affairs | No reply |
| Justine James<br>Quinault Nation | Met with BOEM and other tribal representatives in November 2012. No additional information provided. |
| Dennis Lewarch<br>Tribal Historic Preservation Officer, Suquamish Tribe | No reply |
| Chris Morganroth<br>Quileute Tribe | No reply. |
| Joe Schumacker<br>Marine Resources Scientist, Quinault Nation | Met with BOEM and other tribal representatives in November 2012. No additional information provided. |
| Bill White<br>Archaeologist/Cultural Resources,<br>Lower Elwha Klallam Tribe | No reply |
| Eric Wilkins<br>Coastal Habitat Biologist,<br>Northwest Indian Fisheries Commission | No reply |
| Josh Wisniewki<br>Tribal Historic Preservation Officer,<br>Port Gamble S’Kallam Tribe | Stated there are multiple landscape features and places in the Study Area that qualify as cultural landscapes for the Tribal Register of Cultural Resources but did not provide specific information. Requested updates. |

Table A-5
Historical Interest Groups Contacted

| Name | Results |
|---|---|
| **California** | |
| California Heritage Council | Recommended contacting regional historic interest groups for input. |
| California Preservation Foundation | Recommended contacting regional historic interest groups for input. |
| National Trust for Historic Preservation—Western Office | Left message. No response. |
| California Historical Society | Left message. No response. |
| Coronado Historical Association | Association historian provided a list of the built dates for all residences in Coronado to assist with future surveys. |
| Save Our Heritage Organization (SOHO) | Left message. No response. |
| San Diego Historical Society | Left message. No response. |
| La Jolla Historical Society | Left message. No response. |
| Del Mar Village Association | Left message. No response. |
| Solana Beach Civic & Historical Society, Inc. | Spoke with Jim Nelson. Stated all of the houses in Solana beach date between the 1920s and 1960s. None are listed but would need to be evaluated. Stated that all would be adversely affected by any alteration of the view. |
| Encinitas Historical Society | Left message. No response. |
| Carlsbad Historical Society | Suggested the McGee house, which is not on the NRHP because of restoration after a fire, should be considered |
| Ponto Historic Society | Suggested contacting the local library for their list. |
| Oceanside Historical Society | Left message. No response. |
| San Clemente Historical Society | Suggested considering bridle trails as historic properties potentially affected. |
| San Juan Capistrano Historical Society | Don Tryon was reasonably sure that all historic view properties in the area have been previously listed. Offered any help in the future. |

Table A-5. Historical Interest Groups Contacted (continued)

| Name | Results |
|---|---|
| Dana Point Historical Society | Requested a letter explaining the query. |
| Laguna Beach Historical Society | The city's heritage committee is currently updating the local list, originally done in the 1980s. The "Hangover House" 31172 Ceanothus, South Laguna Beach was recommended as a historically significant property potentially affected. |
| Huntington Beach Historical Society | Left message. No response. |
| Historical Society of Long Beach | Left message. No response |
| San Pedro Bay Historical Society | They had nothing to add to the property list. Stated that when San Pedro was built, the concern was not ocean views. |
| Los Angeles Conservancy | Director of Advocacy, Adrien, requested an email. He also suggested contacting Survey LA. Survey LA was contacted. No response. |
| California Garden & Landscape History Society | Emailed. No response. |
| Hermosa Beach Historical Society | Left message. No response |
| Redondo Beach Historical Society | Unable to contact. |
| Manhattan Beach Historical Society | President Steve Meisenholder suggested contacting Jan Dennis. Left message. No response. |
| Venice Heritage Foundation | Left message. No response |
| Santa Monica Conservancy | Left message. No response |
| Oxnard Heritage Foundation | Unable to contact. |
| Ventura County Historical Society | Librarian Charles Johnson had no properties to add. |
| Santa Barbara Trust for Historic Preservation | Left message. No response. |
| Santa Barbara Historical Society | Michael Redman, director of research, requested email. No response. |
| San Luis Obispo County Historical Society | Left message. No response. |
| Heritage Society of Pacific Grove | Claudia Sawyer stated Pacific Grove is starting a major effort to update and expand the documentation of local built resources. Should take 2–3 years. Update needs to be included in future BOEM surveys. |
| Monterey County Historical Society | Left message. No response |

Table A-5. Historical Interest Groups Contacted (continued)

| Name | Results |
|---|---|
| Spanishtown Historical Society | Left message. No response |
| Western Neighborhoods Project—Preserving & Sharing the History of W. San Francisco Neighborhoods | Woody LaBounty suggested including Sea Cliff neighborhood. |
| San Francisco Architectural Heritage | Left message. No response. |
| Fort Bragg Mendocino Coast Historical Society | No answer. |
| Eureka Heritage Society | Left message. No response. |
| Historical Society of Arcata | No answer. |
| Humboldt County Historical Society | Referred query to the Eureka Heritage Society. |
| Del Norte County Historical Society | Stated the De Martin Ranch on SR 101, now the Wilson Creek Road Hostel, is historically significant. |
| Oregon | |
| Historic Preservation League of Oregon | Brandon Spencer-Hartle suggested calling MJ Koreiva from Umpqua River Lighthouse. |
| Oregon Cultural Trust | Left message with Richard Engemann, former public historian with historical society. No response. |
| Oregon Historical Society | Left message. No response. |
| Chetco Valley Historical Society | Left message. No response. |
| Curry County Historical Society | Left message. No response. |
| Lane County Historical Society | Left message. No response |
| Lincoln County Historical Society | Requested the list of resources already included. |
| Seaside Museum & Historical Society | Stated that there was nothing there that offshore development would impact. |
| Cannon Beach Historical Society | Left message. No response |
| Clatsop County Historical Society | John Goodenberger suggested including Norman Yeon house, now part of NPS Lewis and Clark National Historic Park. Oysterville (on the NRHP), Cannon Beach, Warrenton. Hammond. |
| **Washington** | |
| Washington Trust For Historic Preservation | Spoke with research librarian—nothing to add. |
| Pacific County Historical Society | Left message. No response. |
| Jefferson County Historical Society | Left message. No response. |
| Clallam County Historical Society | Left message. No response. |

# Appendix B

# BOEM Pacific Coastal Cultural Resources Database User Guide

## INTRODUCTION

The BOEM Pacific Coastal Cultural Resources Database was compiled to create a database system of identified cultural resources along the west coast of the United States that could possibly be impacted by the construction of offshore wind and wave energy facilities. This user guide summarizes the database system and provides helpful information on its design and use.

ICF developed the database system as a relational database in Microsoft Access format linked to GIS data. The Microsoft Access database contains a user-friendly interface and was populated with information obtained from existing cultural resources inventories, state databases, and archival records of California, Oregon, and Washington. This information was then used to plot the geographic location of identified resources in the study area and create an interconnected GIS dataset. The combined GIS/database system allows for the geographic mapping of the data and the modeling of potential visual impacts from offshore facilities.

The following chapters outline the Microsoft Access database, including its design and use.

## DATABASE DESIGN AND STRUCTURE

ICF compiled tabular data into a relational database from electronic and hard copy information sources found while conducting research for the project. Although Microsoft Access version 2007 was used to design the database, the database file itself is in version 2002–2003 format, which offers superior functionality in a multi-user network setup.

The database consists of multiple components, including a user-friendly interface (or the "frontend") and a series of tabular data tables (or the "backend"). The setup of these components is based on the built-in framework of Microsoft Access, and their functionality is built around the display or manipulation of data in each of the database's individual records.

There is one record in the database for each cultural resource identified during the present study. Each record possesses a unique identifier field, or OBJECTID, which is intended to help keep together information about each resource, regardless of where it appears in the database. The OBJECTID is an arbitrary number used to create relationships between the various data tables within the database (making it relational). It also provides the means to create a linkage between the database and GIS. Where possible, the unique identifiers assigned to each record were based on agency-provided site/trinomial numbers for individual cultural resources. When an existing agency identifier was not available for a resource, a unique alphanumeric number was assigned and entered into the database record.

The database features 14 data tables, including 1 master table and 13 sub-tables. A summarized list of these tables is provided below. The master table contains records for all the resources recorded in the database, primarily consisting of basic location information. Each sub-table contains additional information that falls into a specific category or contains data related to a certain type of cultural resource (i.e., archaeological, built environment, or traditional cultural properties). The sub-tables relate to the master table in a "one-to-one" or "one-to-many" relationship, depending on the information they contain, and are linked together by each record's OBJECTID. A one-to-one relationship exists when both the master table and sub-table each contain one recorded entry per resource. A one-to-many relationship exists when the record in the master table is linked to multiple record entries in the sub-table. This situation occurs, for example, when there are multiple architectural styles or resource types associated with a single record. The defining of these relationships is what creates a relational database. Figure B-1 illustrates the database's relationships between the master table and sub-tables, and their individual data fields.

- tblData01a_Location—The "location" table functions as the master table in the database, to which all the other tables are linked. It primarily contains basic location data, such as latitude/longitude, UTM, street address, and Assessor's Parcel Number (APN).
- tblData02a_Intake-QAQC—The "intake-QA/QC" table is linked to the location table by a one-to-one relationship. It primarily contains data pertaining to the creation and initial entry of data into the database, including who completed the work and when.
- tblData03a_References—The "references" table is linked to the location table by a one-to-one relationship. It contains records of the primary and secondary sources of information from which the data was obtained.
- tblData04a_Research—The "research" table is linked to the location table by a one-to-one relationship. It contains data related to the prior documentation of resources recorded in the database. This information includes inventories, designations, and listings on the local, state, and national levels.
- tblData05a_Buildings—The "buildings" table is linked to the location table by a one-to-one relationship. It contains information specific to built environment resources.
- tblData05b_Buildings_Type—The "buildings type" table is linked to the location table by a one-to-many relationship. It contains one or more resource types that define the built environment resources recorded in the database.
- tblData05c_Buildings_Style—The "buildings style" table is linked to the location table by a one-to-many relationship. It contains one or more architectural styles that define the built environment resources recorded in the database.
- tblData07a_Photos—The "photos" table is linked to the location table by a one-to-one relationship. Data related to the photographs of resources is recorded in this table.
- tblData08a_Archaeo—The "archaeological" table is linked to the location table by a one-to-one relationship. It contains information specific to archaeological resources.
- tblData08b_Archaeo_type—The "archaeological type" table is linked to the location table by a one-to-many relationship. It contains one or more resource types that define the archaeological resources recorded in the database.
- tblData09a_TCP—The "TCP" table is linked to the location table by a one-to-one relationship. It contains information specific to Traditional Cultural Properties and other culturally significant resources.

- tlbData09b_TCP_Type—The “TCP type” table is linked to the location table by a one-to-many relationship. It contains the one or more resource types that define the traditional cultural properties and other culturally significant resources recorded in the database.
- tbldData09c_TCP_CultAffil—The “TCP cultural affiliation” table is linked to the location table by a one-to-many relationship. It contains information on select cultural group(s) that maintain affiliations with the traditional cultural properties and other culturally significant resources recorded in the database.
- tblData10a_Groups—The “groups” table is linked to the location table by a one-to-many relationship. It contains information on select groups and organizations that would have an interest in undertakings affecting resources recorded in the database.

In addition to these 14 data tables, the database also contains 13 “look-up” tables. These provide standardized lists of information related to the resources recorded in the database, and which were functionally used by the database’s frontend during data entry. For example, they include tabular lists of commonly entered cities and counties, resource types, and the names and contact information for commonly entered groups and organizations. The use of these look-up tables helped standardize information recorded in the database and reduced data entry errors.

All information entered in the database was verified for accuracy through a quality assurance/quality control process. This process primarily consisted of a review of all database records to ensure that information was complete and entered correctly. The logical integrity of the database was checked through Standardized Query Language (SQL) queries. Tests were run on the data tables to ensure their data and structures are normalized and logical, and SQL queries were executed to confirm that each resource has necessary spatial representation data. In combination with the enforced relationships inherent in the Microsoft Access database format, these queries helped ensure the integrity of the database and its data. Documentation of this verification was recorded for each record in the database’s intake-QA/QC table for future reference.

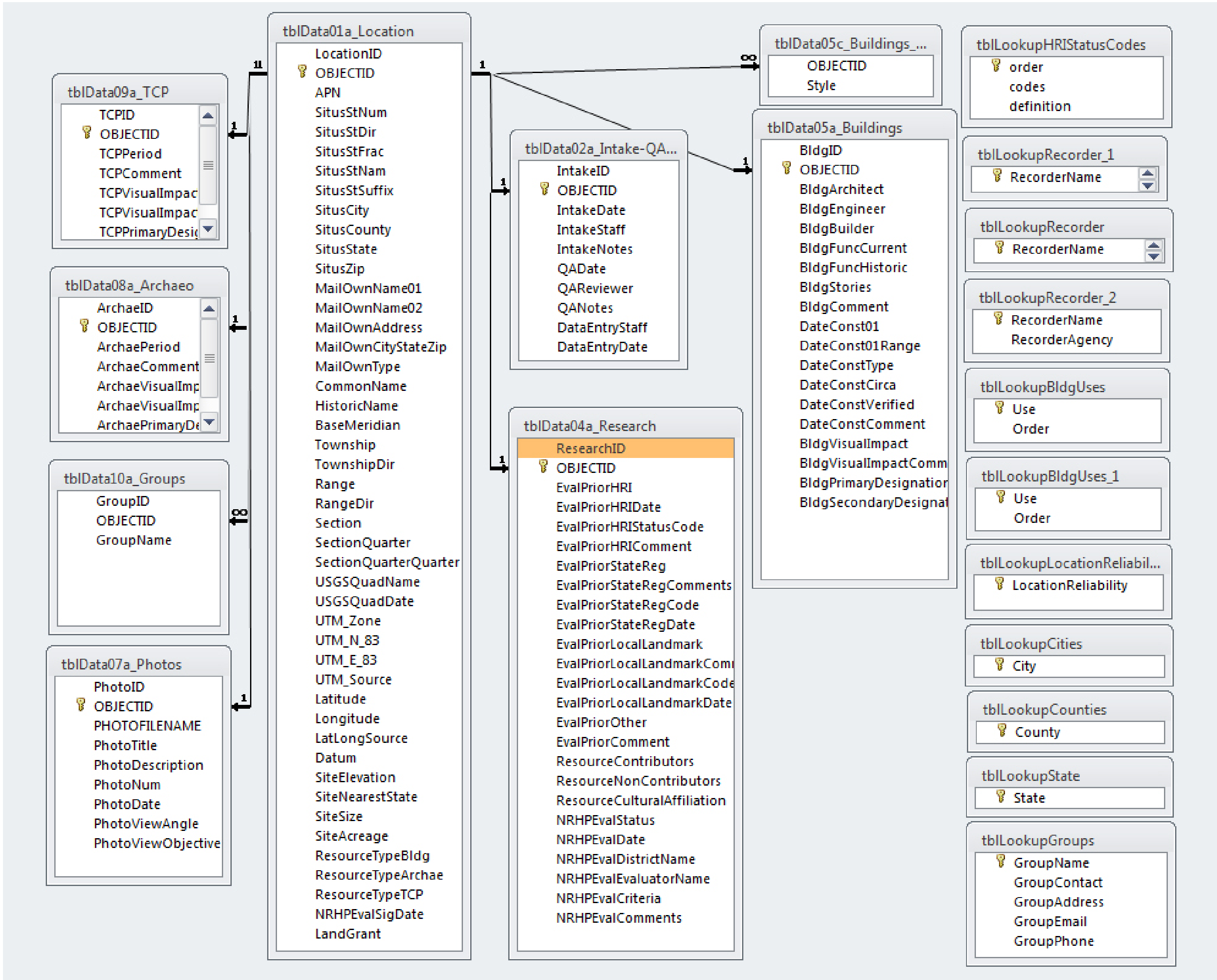



Figure B-1. Backend Table Structure/Relationships

## Frontend User Interface

A series of data entry forms structured as a user-friendly interface facilitated the entry of resource data into the database. These forms also allow the information to be viewed in an easily comprehendible format and facilitate making additions and corrections to the data.

The database contains three forms:

- Switchboard
- Resources Intake/Create New Record
- Resource Data

Upon opening the database, the user is presented with the Switchboard (Figure B-2), which provides navigation to the other two forms, several database setup options, and a basic property search function. Each form contains a series of gray buttons, which perform specified actions or enable navigation through the database.


Figure B-2. Switchboard

NOTE: Microsoft Access disables macros for security purposes by default. If the navigation buttons on the Switchboard are missing, or the user receives an error message when opening the database, it is possible that macros are not enabled. Macros can be enabled either through the option bar at the top of the screen or in the "Trust Center Settings" in the Access program options. Enabled macros are necessary for proper operation of the database.

allow several of the database's look-up tables to be edited. These tables can also be edited from dropdown lists in the frontend interface. A default Access button will appear at the bottom of the dropdown lists (i.e., combo boxes) for these fields.

The Property Search button initiates a search function that provides quick access to desired records, based on a resources identification number, name, location, or other criteria. A successful search will result in a list of records that meet the entered search criteria. To view a specific record from the search results, the user must double-click the vertical gray bar at the left of the entry (Figure B-3). Clicking this bar will bring a user to the Resource Data form for that entry.

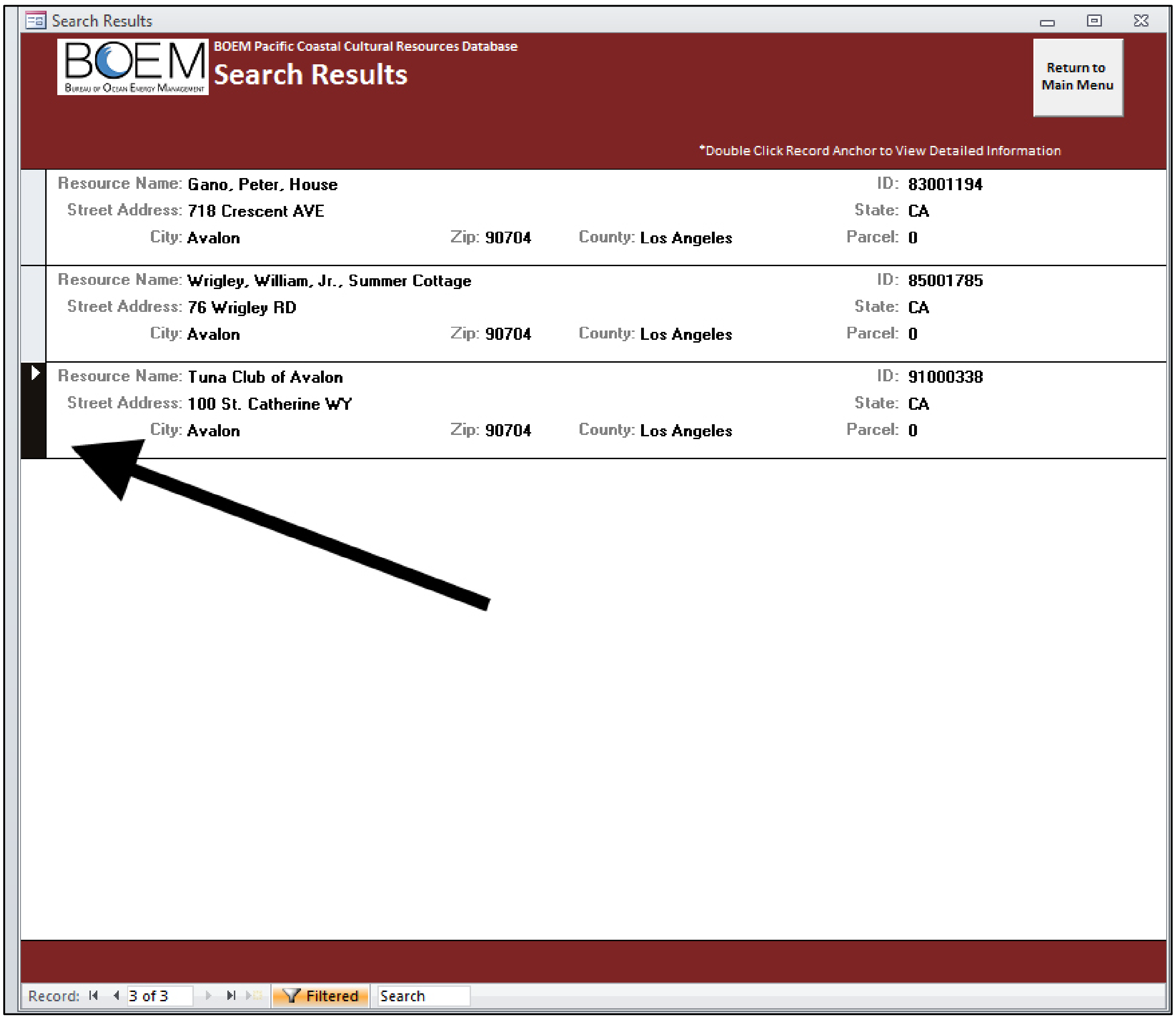



Figure B-3. Search Results

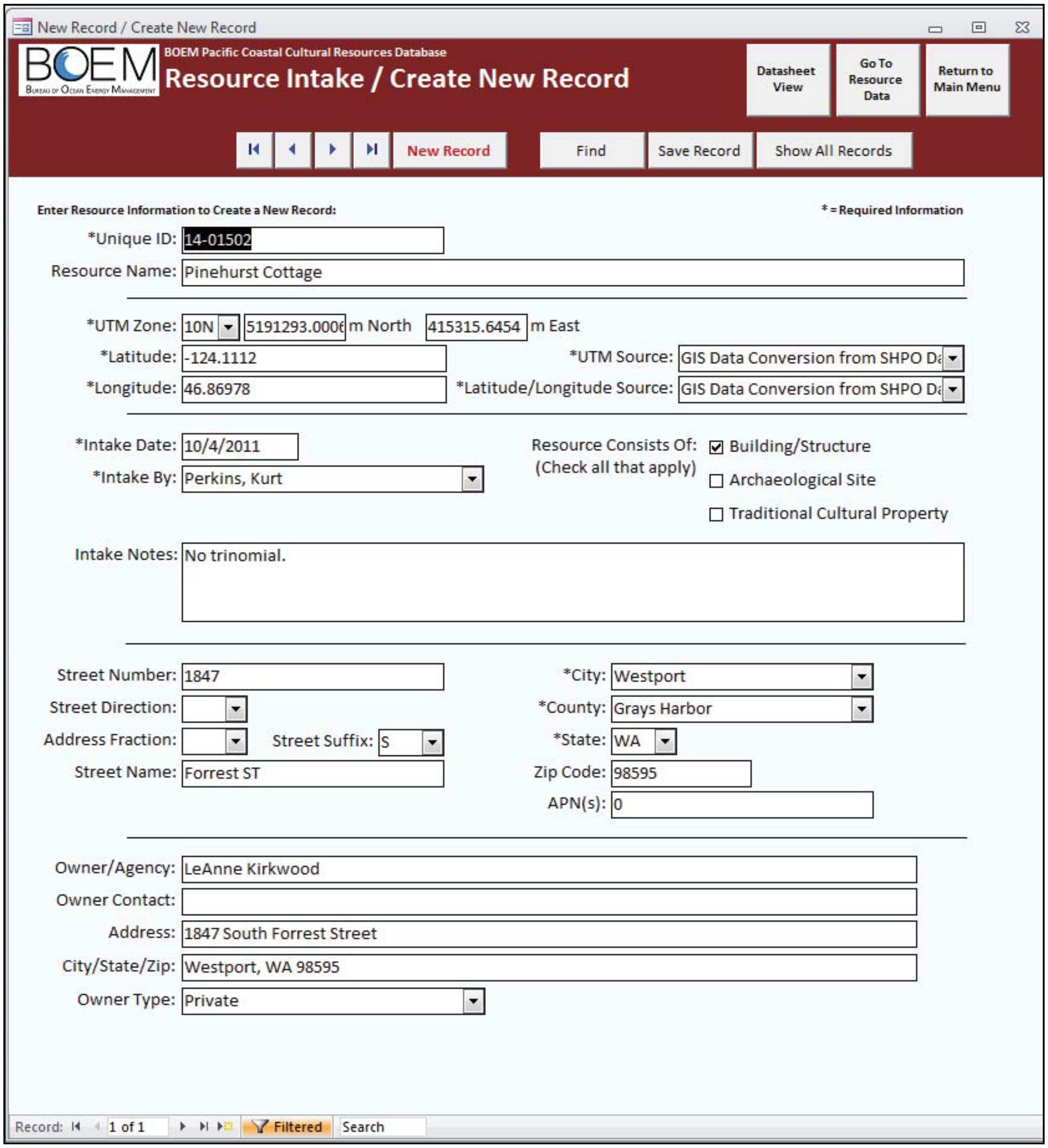
NOTE: The search function is set up based on simple background queries, and the selection of search criteria must match a record exactly. Consequently, the selection of multiple search criteria may result in the return of no values, depending on whether the search criteria selected all match a given record.

The following selection buttons are located on both the Resources Intake/Create New Record and Resource Data forms (Figures B-4 and B-5, respectively):

- "Forward" and "Backward"—Located at the top and bottom of the screen, these buttons enable scrolling through the database records.
- "New Record"—Creates a new record in the database (Resources Intake form only).
- "Find"—This is the default find function found in all Microsoft programs. Clicking "find" after placing the cursor in a single data field will open the default Access find/replace menu and enable a user to search for records with specific keywords/text in that field.
- "Save Record"—Saves changes to the current record. The same effect is achieved by scrolling to the next record.
- "Show All Records"—Removes any filters and shows all records in the database. Filters and/or the number of records shown are indicated in the Access menu at the bottom of the screen. The user is moved to the first record in the database when this button is clicked.
- "Return to Main Menu"—Returns the user to the Switchboard.

The following buttons are unique to the two forms:

- "Datasheet View"—Changes the view of the current form to the Access default datasheet view. Only the data fields on the current form are shown. The user must close the datasheet and return to the Switchboard to restore the original view (Resources Intake form only).
- "Go To Resource Data"—Opens the Resource Data form for the current record. The database is filtered as a result of this action (Resources Intake form only).
- "Go To Intake"—Opens the Resources Intake form for the current record. The database is filtered as a result of this action (Resource Data form only).


New Record / Create New Record

BOEM Pacific Coastal Cultural Resources Database

Resource Intake / Create New Record

Datasheet View | Go To Resource Data | Return to Main Menu

New Record | Find | Save Record | Show All Records

Enter Resource Information to Create a New Record:

* = Required Information

*Unique ID: 14-01502

Resource Name: Pinehurst Cottage

*UTM Zone: 10N 5191293.0006 m North 415315.6454 m East

*Latitude: -124.1112

*UTM Source: GIS Data Conversion from SHPO Da

*Longitude: 46.86978

*Latitude/Longitude Source: GIS Data Conversion from SHPO Da

*Intake Date: 10/4/2011

*Intake By: Perkins, Kurt

Resource Consists Of: (Check all that apply)

☑ Building/Structure

☐ Archaeological Site

☐ Traditional Cultural Property

Intake Notes: No trinomial.

Street Number: 1847

Street Direction:

Address Fraction:

Street Suffix: S

Street Name: Forrest ST

*City: Westport

*County: Grays Harbor

*State: WA

Zip Code: 98595

APN(s): 0

Owner/Agency: LeAnne Kirkwood

Owner Contact:

Address: 1847 South Forrest Street

City/State/Zip: Westport, WA 98595

Owner Type: Private

Record: 1 of 1 Filtered Search

Figure B-4. Resources Intake/Create New Record

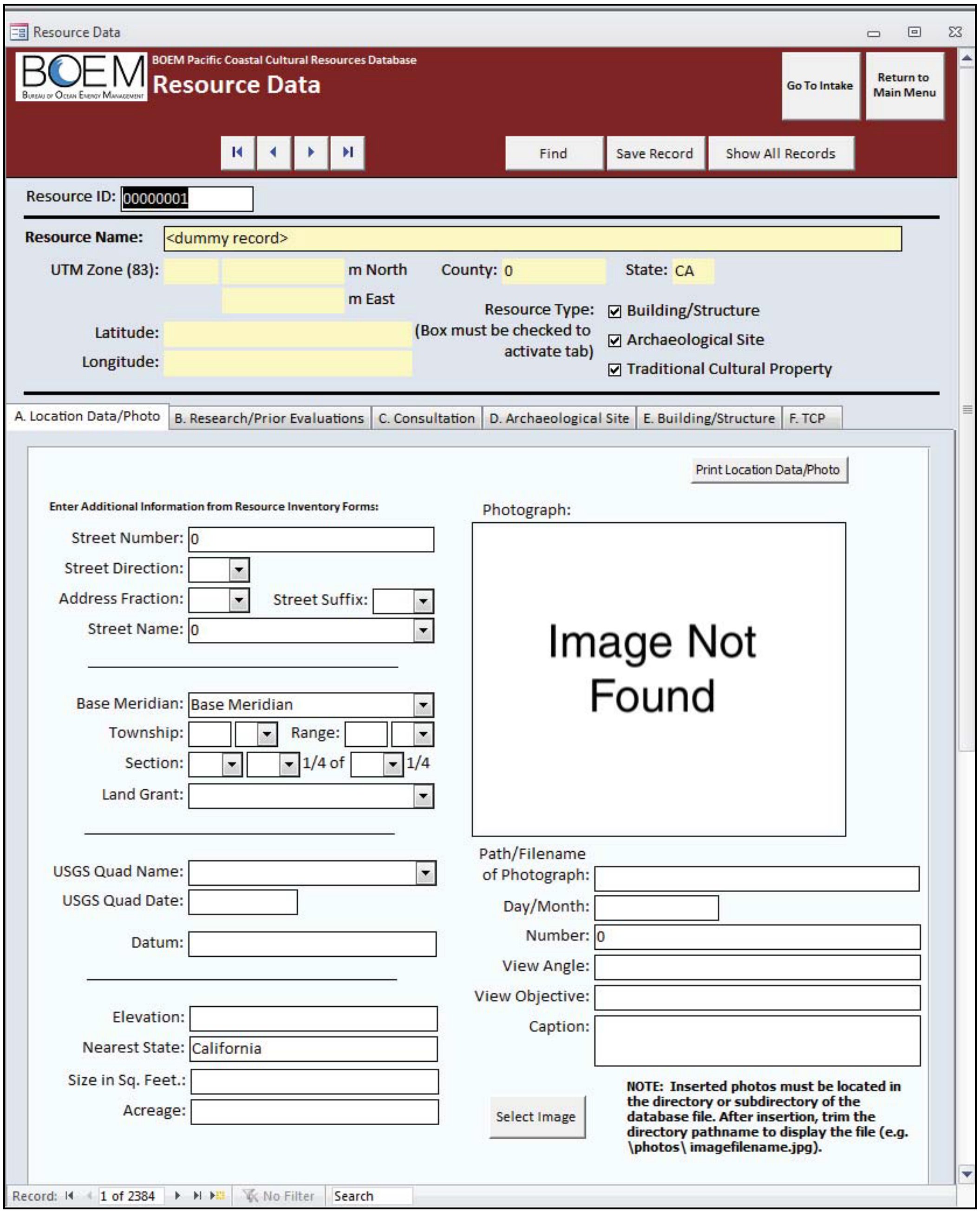



Figure B-5. Resources Data

In addition, the Resource Data form contains a "Select Image" button and a "Print" button on each tab. The "Print" button allows the user to print the information on the individual tabs for the current record. The "Select Image" button provides a standard Microsoft Windows interface for selecting images to be added to the database. The images must be in JPEG format and must be located in the directory or subdirectory of the database file. After insertion, to display correctly, the pathname of the image file must be trimmed to read only the subdirectory and image filename (e.g., \photos\imagefilename.jpg).

## DATA ENTRY FORMS

A total of 2,383 cultural resources were identified through the course of the Pacific coastal survey that have the potential to be impacted by the construction of an offshore facility. Of these, a total of 683 archaeological resources, 1,719 built environment resources, and 78 culturally significant properties were identified. Many of the identified cultural resources consist of multicomponent sites that contain two or more resources in each of these categories.

The database contains two forms that contain data about recorded resources, and these forms can be used to add to or edit this information.

### Resources Intake/Create New Record Form

New records may be added to the database using the “New Record” button at the top of the Resources Intake/Create New Record form (Figure B-4). This form contains basic information about each resource, primarily location and ownership. New records cannot be added from elsewhere in the database, due to the connected relationships of the underlying table structure.

> NOTE: Many of the data fields on the Resources Intake/Create New Record form are used in the operation of the aforementioned property search function. The presence of “0” in these fields is indicative of this feature. The “0” indicates that a particular data field is blank/empty and is required for the search function to work. Microsoft Access will not allow the function to run correctly if there are empty (i.e., null) fields. Several of these data fields are repeated on the Resource Data form. In all other cases, a data field with a null or blank entry indicates that no information exists or was found for the particular data field, and therefore no information was entered.

The database is designed to integrate with a corresponding GIS dataset based in ArcMap 9.2 or later. The spatial information contained in the database for each record was obtained using a variety of methods. The “UTM Source” and “Latitude/Longitude Source” fields indicate the source of this information, whether from paper records or through conversion in GIS. For example, if UTM coordinates or full site addresses were known, this information was entered into the database on a Resources Intake/Create New Record form and was used to automatically generate latitude and longitude coordinates in GIS through the importation of tabular x, y data (UTM coordinates) and address geocoding. If UTM coordinates or address information were not available, then ICF referred to the SHPO databases to obtain their location information. If the SHPO databases contained inadequate information to locate the resources (most in California, with some isolated resources in Oregon and Washington), staff plotted the resource locations using location maps and/or narrative information provided in site forms obtained during the records search.

### Resources Data Form

Most of the information about resources recorded in the database is contained in the Resources Data form (Figure B-5). The information is separated into up to six different tabs, depending on the characteristics of the resource and whether it is a multicomponent resource. The different tabs are described below. The “Location Data/Photo,” “Research/Prior Evaluations,” and “Consultation” tabs are visible for all records in the database. The “Archaeological Site,” “Building/Structure,” and “TCP” tabs are only enabled for those records that contain resources in those categories. Multicomponent resources will have one or more of these tabs displayed, while single component resources will have only one. The checkboxes at the top of the form (and on the Resources Intake/Create New Record form) determine whether a resource has components in one or more of these categories.

The underlying data tables are separate for each of the tabs on the Resources Data form. However, some of the data fields on each tab contain similar information or have similar labels. This similarity does not mean the data fields are the same, or are somehow linked.

- *A. Location Data/Photo*—Location/coordinate data for each resource. Many of the fields on this tab are the same as those that appear on the Resources Intake/Create New Record form, which was entered at the time of the record's creation. In addition, data fields for a photograph of the resource and associated metadata are provided on this tab. Photographs are linked to the database by entering the image path/filename. This information can be keyed in manually or by using the aforementioned "Select Image" button.
- *B. Research/Prior Evaluations*—Information on each resource obtained from previously completed inventories, surveys, and/or historical registry entries made on the local, state, or national levels. The data fields were meant to capture specific information from the NRHP, HRI, and state historical registers in California, Washington, and Oregon. However, they were also designed to be flexible enough to accommodate information from other sources (i.e., other state and local registers/inventories). Users can enter bibliographic citations for the different sources of information at the bottom of this tab.
- *C. Consultation*—Name and contact information for Native American tribes and other interested parties that may be associated with or have an interest in a resource.
- *D. Archaeological Site*—Information about recorded archaeological site(s), if a resource includes an archaeological component. The information was derived from archaeological site forms for each resource and includes the type of resource, its period of significance, and primary/secondary designations. The latter consists of the inventory or survey numbers assigned to a resource. For archaeological sites these are typically the recorded Smithsonian trinomial system numbers for the resource.
- *E. Building/Structure*—Information about recorded buildings and structures, if a resource includes a built environment component. The information was derived primarily from the historical resources inventory systems in California, Washington, and Oregon. Washington and Oregon state inventory data was entered manually. Data from the California HRI was imported electronically into the database and largely remains unchanged. Fields for resource type(s), primary/secondary designations, build dates (beginning and ending), style, current/historic function, and original architect/engineer/builder are provided.

- *F. TCP*—Information about recorded traditional cultural properties or known sites of cultural significance. The data fields are similar to the "Archaeological Site" tab, but include a place to record cultural affiliations.

### Evaluating Visual Impacts

A "Potential for Visual Impacts" field occurs on the "Archaeological Site," "Building/Structure," and "TCP" tabs of the Resources Data form. The determinations recorded in these fields were made using a rating scale of "high," "medium," or "low" and included consideration of the sensitivity of each resource's individual property type. A rating of "high" was assigned to those resources whose historical significance derives (in full or in part) from its ocean views, or would likely be considered sensitive to visual impacts by interested parties. A rating of "medium" was given to those resources that are close to the ocean and would likely be considered sensitive to visual impacts by interested parties, but ocean views are not a defining characteristic of their historical significance. And a rating of "low" was provided for those resources whose historical significance is not defined by ocean views and that would likely not be considered sensitive to visual impacts by interested parties.

The application of these ratings varied depending on the type of resource considered and whether it was categorized as an archaeological resource, a built environment resource, or a culturally significant property. For example, archaeological sites containing burials or village components were assigned a "high" or "medium" rating, due to their expected importance to Native American tribes. Meanwhile, historical archaeological sites were given a "low" rating because their historical significance typically does not include consideration of ocean views. Among built environment resources, lighthouses were provided a "high" rating because of their close associations with the ocean and their ability to see and be seen from the water. In contrast, most other buildings and structures were provided a "low" rating because their historical significance derives from their style or type, or associations with people and places, and not from viewsheds of the sea. Buildings and structures purposely designed to capture a specific ocean view were the noted exceptions. All of the identified culturally significant properties were evaluated with a "high" rating, due to their expected importance to Native American tribes and other interested parties.

# Appendix C

# Outreach Efforts Completed for the Underwater Cultural Heritage Inventory

Table C-1
Museums, State Historic Preservation Offices, Libraries, Archives, and Other Institutions Contacted

| Location | Repository Contacted | Response |
|---|---|---|
| **California** | California State Archives | Data collected by ICF International |
| | California State Lands Commission | California Shipwreck Database |
| | National Register of Historic Places (NARA) San Bruno | Consulted during 1990 outer continental shelf (OCS) study |
| | NARA Riverside | Records reviewed for the present study |
| | National Maritime Museum | Consulted during 1990 OCS study |
| | Maritime Museum of San Diego | No substantial collection reported |
| | Santa Barbara Maritime Museum | No substantial collection reported |
| | San Francisco Maritime National Park | No substantial collection reported |
| | Seabee Museum Archives | Reported no centralized collection |
| | U.S. Army Corps of Engineers (USACE) Los Angeles District | Reported no information to share |
| | USACE San Francisco District | Reported no information to share |
| | Ventura Museum Library | No substantial collection reported |
| | Ventura County Maritime Museum | Library temporarily closed due to move |
| **Oregon** | Oregon State Archives | Reported no substantial collection |
| | USACE Portland District | Reported no information to share |
| **Washington** | USACE Seattle District | Reported no information to share |
| | USACE Walla Walla District | Reported no information to share |
| | Washington State Archives | Reported no substantial collection |
| **Nationwide** | Department of the Interior Library (DC) | Reported no substantial collection |
| | NARA College Park (Archives II—Still Pictures) | Reported no centralized collection |
| | NARA Washington, DC | Records reviewed for the present study |
| | Naval History and Heritage Command (Underwater Archeology Branch) | West coast database transmitted to SEARCH for inclusion |
| | USACE Northwestern Division | No information reported |
| | Vancouver Maritime Museum | No information reported |

Table C-2
West Coast Maritime Archaeologists, Historians, Shipwreck Researchers, and Interested Individuals Contacted

| **Name and Affiliation** | **Response** |
|---|---|
| Dr. Jim Allan, William Self and Associates and St. Mary's College | No information reported |
| Dr. Matthew Russell, William Self and Associates (former National Park Service [NPS]) | Recommended reviewing his PhD dissertation from University of California, Berkeley |
| Peter Pelkofer, California State Lands Commission | No information reported |
| Lora Holland, Atkins | No information reported |
| Heather Macfarlane, Macfarlane Archaeological Consultants | Provided the Macfarlane Shipwreck database for the west coast |
| Jack Hunter, California Department of Transportation (retired) | No information reported |
| Dr. Marco Meniketti, San Jose State University | No information reported |
| Dominique Rissolo, The Waitt Institute | No information reported |
| Dr. Georgia Fox, California State University Chico | No information reported |
| Dr. Jerome Lynn Hall, University of San Diego | No information reported |
| Tricia Dodds, California State Parks | No information reported |
| John Foster, California State Parks (retired) | No information reported |
| Larry Pierson, Brian F. Smith and Associates, Inc. | No information reported |
| Dr. Brian Marks, ESA Associates, Inc. | No information reported |
| Dr. Mitch Marken, ESA Associates, Inc. | No information reported |
| Dr. Sheli Smith, PAST Foundation | No information reported |
| Dr. Ray Ashley, Maritime Museum of San Diego | No information reported |
| Trisha Drennan, SAIC | No information reported |
| David Grant, Naval Facilities Engineering Command Northwest | Provided *US Navy Shipwrecks and Submerged Naval Aircraft in Washington: An Overview* |
| Dr. Robyn Woodward, Simon Fraser University | No information reported |
| David Harder, Plateau Archaeological Investigations, LLC | No information reported |
| Michelle Hannum, Plateau Archaeological Investigations, LLC | No information reported |
| Dr. James Delgado, National Oceanic and Atmospheric Administration (NOAA) Maritime Heritage | Provided Oregon Wreck database |
| Robert Schwemmer, NOAA Channel Islands National Marine Sanctuary | No information reported |

Table C-2. West Coast Maritime Archaeologists, Historians, Shipwreck Researchers, and Interested Individuals Contacted (continued)

| **Name and Affiliation** | **Response** |
|---|---|
| Dr. Valerie Grussing, NOAA Marine Protected Area Program | Online Marine Protected Areas (MPA) Inventory: http://www.mpa.gov/dataanalysis/mpainventory/ |
| Dr. David Conlin, NPS | No information reported |
| Bert Ho, NPS | Provided copies of west coast NPS reports |
| Robert Church, C&C Technology | No information reported |
| Ted Hampton, FUGRO | No information reported |
| Mark Melancon, FUGRO | No information reported |

# Appendix D

# BOEM POCS Shipwreck Database User Guide

## DATA VIEWING

- Opening message
  - Microsoft Access disables macros for security purposes. Either enable the content through the options button provided or add the database to the “Trust Center Settings” in Access options. Enabled macros are necessary for the proper operation of the database.
  - Close the dialog box to continue.
- Opening Switchboard
  - Vessel information and vessel images have separate data viewing and data entry forms; select the desired form using the Switchboard buttons.
- Vessel Form
  - The Vessel form is separated into five tabs of related data; select the tab that provides the desired information.
  - In the “Documentation” tab any imagery associated with the record is viewable using the “View/Edit Existing Imagery Record” button. Click “OK” through the messages, which are for data entry (described below).
- Imagery Form
  - The Imagery form can be accessed from the Switchboard or the “Documentation” tab of the Vessel form.
  - The Imagery form is separated into six tabs of imagery categories; select the tab that provides the desired imagery (note: not all records have images associated with each category).
  - Return to the Vessel form by using the “Return to Vessel Record” button.

## DATA ENTRY

- Vessel Form
  - A new record can be created by using the “New Vessel Record” button on the Vessel form.
  - Tab to or highlight the desired field to enter data. Many fields provide drop-down menus, and selections must be made from these menus (i.e., no data outside of these menus is permitted).
  - If a “Vessel Name” is entered that already exists in the database a prompt will alert the user to determine if this is actually a new vessel with an identical name. If not, do not create a new record but rather find and edit the existing record.

- — Take note of the text describing the difference between Verified and Unverified positions in the "Spatial Information" tab.
- — Complete all the fields even if data is unknown or does not apply. For text fields use "Unknown" (drop-down menus have "Unknown" as an option), and for numeric fields use "9999."

- Imagery Form
  - — If images are added to a record, toggle the appropriate fields in the "Documentation" tab (e.g., "Side-Scan Sonar," "Photograph," etc.).
  - — A new imagery record can be added from the Switchboard or the "Documentation" tab. If created from the "Documentation" tab, the "Vessel Name" and "Record Number" will be auto-populated.
  - — Images must be in bitmap format and less than 300 KB. Access exponentially inflates imagery when it is imported into a database; therefore, 300 KB is the best compromise between resolution and file size.
  - — If a new imagery record is created but no imagery is added, Access will still create the new record. To avoid empty records inflating the size of the database, delete such records using the "Delete Record" button.
  - — Images can be added by right-clicking the image box, and selecting "Insert Object," and "Create from File."

## GENERATING REPORTS

- Reports for viewing and printing can be generating using the "Report Wizard."
- Select the fields required for inclusion in the report, keeping in mind that categories of data are stored in unique tables.
  - — Data are stored in the following tables:
    - ▪ tblGeneral
    - ▪ tblSpatial
    - ▪ tblDescription
    - ▪ tblWreckSite
    - ▪ tblDocumentation
  - — Additional tables that begin with "ltbl" share a relationship with drop-down menus and should not be altered in any way.
- Select the desired formatting and finish the wizard to generate the report.

**Note: Changes to the design or structure of the database will adversely affect the operation and data.**

- Add the database table “Spatial” to ArcMap utilizing the “Add XY Data” tool.
  - Add both verified and reported positions.
- Create relates between the “Spatial” table and the remaining database tables (“General,” “Description,” “WreckSite,” and “Documentation”) utilizing the “Joins and Relates” tool.
  - Base each relate on the field “RecordNumber.”
- The “Identify” tool will include data from each relate.

**The Department of the Interior Mission**

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

**The Bureau of Ocean Energy Management**

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

**The BOEM Environmental Studies Program**

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