Chapter 3
Affected Environment

CHAPTER 3 AFFECTED ENVIRONMENT 1

3.0 AFFECTED ENVIRONMENT 1
3.1 Geographically Based Management in the Project Area 2
3.1.1 Designated Areas 4
3.1.1.1 Olympic Coast National Marine Sanctuary 4
3.1.1.1.1 Introduction 4
3.1.1.1.2 Designation and Regulatory Overview 4
3.1.1.1.3 Current Issues 7
3.1.1.2 Washington Islands National Wildlife Refuges 8
3.1.1.3 Coast Guard Regulated Navigation Area 10
3.1.1.4 Olympic National Park 11
3.1.1.5 World Heritage Site 12
3.1.1.6 Olympic Biosphere Reserve 13
3.1.1.7 Other Designated Areas 13
3.1.2 Makah Management of Reservation and U&A Areas 14
3.1.2.1 Makah Tribal Departments and Agencies 15
3.1.2.2 Makah Tribal Programs and Management Plans 19
3.1.2.2.1 Makah Public Safety Program 19
3.1.2.2.2 Makah Fisheries Management Programs 20
3.1.2.2.3 Makah Comprehensive Economic Development Strategies 22
3.1.2.2.4 Makah Forest Management Plan 23
3.2 Water Quality 24
3.2.1 Introduction 24
3.2.2 Regulatory Overview 24
3.2.3 Existing Conditions 25
3.2.3.1 Drinking Water Sources 26
3.2.3.2 Shellfish 26
3.2.3.3 Spill Prevention 28
3.2.3.4 Solid Waste Disposal 29
3.3 Marine Habitat and Species 30
3.3.1 Introduction 30
3.3.2 Regulatory Overview 30
3.3.3 Existing Conditions 32
3.3.3.1 Pelagic Environment 32
3.3.3.1.1 Physical Features and Processes 32
3.3.3.1.2 Biological Resources 38
3.3.3.2 Benthic Environment 45

Table of Contents (continued)

3.3.3.2.1 Physical Features and Processes 45
3.3.3.2.2 Biological Resources 47
3.4 Eastern North Pacific Gray Whale..... 50
3.4.1 Introduction..... 50
3.4.2 Regulatory Overview 50
3.4.2.1 Marine Mammal Protection Act Management.....51
3.4.2.1.1 Defining Marine Mammal Population Parameters 51
3.4.2.1.2 Calculating Marine Mammal Population Parameters 52
3.4.2.1.3 Linking Marine Mammal Population Parameters to Removals 53
3.4.2.1.4 Defining and Calculating PBR.....53
3.4.2.1.5 Implementation of PBR Approach.....54
3.4.2.1.6 Take Permits 55
3.4.2.2 Whaling Convention Act.....56
3.4.2.2.1 Whaling License 56
3.4.2.2.2 Equipment, Crew, Supplies, and Training 56
3.4.2.2.3 Wasteful Manner Restrictions.....56
3.4.2.2.4 Recording and Reporting 57
3.4.3 Existing Conditions..... 57
3.4.3.1 General Life History and Biology.....57
3.4.3.1.1 Identifying Physical Characteristics.....57
3.4.3.1.2 Global Distribution and Population Structure and Status 57
3.4.3.1.3 Feeding Ecology and Role in the Marine Ecosystem 61
3.4.3.1.4 Seasonal Migrations.....63
3.4.3.1.5 Reproductive Physiology and Calf Birth, Growth, and Development.....68
3.4.3.1.6 Natural Mortality 70
3.4.3.2 Historic Status of the Gray Whale Population 70
3.4.3.2.1 Estimates of Historic Abundance.....70
3.4.3.2.2 Protection and Recovery after Commercial Exploitation 71
3.4.3.3 Distribution and Habitat Use.....73
3.4.3.3.1 Summer Range Distribution and Habitat Use.....74
3.4.3.3.2 Winter Range Distribution and Habitat Use 93
3.4.3.4 Current Status of the Gray Whale Population.....96
3.4.3.4.1 Abundance Data.....96
3.4.3.4.2 Stranding Data 99
3.4.3.4.3 Calf Production Data.....104
3.4.3.4.4 Population Dynamics and Trends 107
3.4.3.4.5 Estimates of Carrying Capacity (K), OSP, and PBR 108
3.4.3.5 Welfare of Individual Whales 111
3.4.3.5.1 Review of Hunting Methods.....112
3.4.3.5.2 Whale Response to Being Pursued 114
3.4.3.5.3 Whale Response to Being Struck.....114
3.4.3.5.4 Method of Killing and Time to Death.....116
3.4.3.5.5 Proportion of Whales Struck and Lost.....119
3.4.3.5.6 Training and Weapons Improvement.....119
3.4.3.5.7 Weather and Sea Conditions.....119
3.4.3.5.8 Behavior of People Associated with the Hunt 120
3.4.3.6 Known and Potential Anthropogenic Impacts 120

Table of Contents (continued)

3.4.3.6.1 Aboriginal Subsistence Whaling....120
3.4.3.6.2 Environmental Contaminants....122
3.4.3.6.3 Harmful Algal Blooms....124
3.4.3.6.4 Oil Spills and Discharges....125
3.4.3.6.5 Offshore Activities and Underwater Noise....128
3.4.3.6.6 Vessel Interactions....129
3.4.3.6.7 Activities Occurring in the Winter Range....131
3.4.3.6.8 Ship Strikes....133
3.4.3.6.9 Incidental Catch in Commercial Fisheries....134
3.4.3.6.10 Marine Energy Projects....134
3.5 Other Wildlife Species....136
3.5.1 Introduction....136
3.5.2 Regulatory Overview....136
3.5.3 Existing Conditions....138
3.5.3.1 Marine Mammals....138
3.5.3.1.1 ESA-Listed Marine Mammal Species....140
3.5.3.1.2 Common Species off Washington Coast....147
3.5.3.1.3 Uncommon Marine Mammal Species off Washington Coast....155
3.5.3.2 Other Marine Wildlife....156
3.5.3.2.1 ESA-Listed Species....156
3.5.3.2.2 Non-Listed Birds and Their Associated Habitats....158
3.5.3.3 Sensitivity of Wildlife to Noise and Other Disturbance....166
3.5.3.3.1 Aircraft Overflights....167
3.5.3.3.2 Boat Traffic....170
3.5.3.3.3 Gunfire and Explosives....172
3.5.3.3.4 Marine Mammals and Underwater Noise....173
3.6 Economics....176
3.6.1 Introduction....176
3.6.2 Regulatory Overview....176
3.6.3 Existing Conditions....176
3.6.3.1 Countywide Conditions (Clallam County)....176
3.6.3.1.1 Employment, Unemployment, and Labor Force....176
3.6.3.1.2 Personal Income....178
3.6.3.1.3 Tourism....179
3.6.3.1.4 Commercial Shipping....182
3.6.3.2 Local Conditions on the Makah Reservation, including Neah Bay....183
3.6.3.2.1 General Description of the Local Economy....183
3.6.3.2.2 Employment....184
3.6.3.2.3 Personal Income....187
3.6.3.2.4 Contribution of Tourism to the Local Economy....187
3.6.3.2.5 Contribution of Ocean Sport Fishing to the Local Economy....189
3.6.3.2.6 Contribution of Ocean Commercial Fishing to the Local Economy....191
3.6.3.3 Gray Whale Economic Values....196
3.6.3.3.1 Summary of Economic Effects of the Makah Gray Whale Hunts....196
3.6.3.3.2 Commercial Value of Whales....197
3.7 Environmental Justice....201
3.7.1 Introduction....201

Table of Contents (continued)

3.7.2 Regulatory Overview 201
3.7.3 Existing Conditions 202
3.7.3.1 Minority Populations 202
3.7.3.1.1 Clallam County 202
3.7.3.1.2 County Tribal Demographics 203
3.7.3.1.3 Makah Tribe 204
3.7.3.2 Minority Employment 205
3.7.3.2.1 Clallam County 205
3.7.3.2.2 County Tribal Employment 206
3.7.3.2.3 Makah Tribe 206
3.7.3.3 Personal Income and Poverty Levels 208
3.7.3.3.1 Clallam County 208
3.7.3.3.2 County Tribal Income 210
3.7.3.3.3 Makah Tribe 211
3.7.3.4 Outreach to Minority and Low-Income Populations 212
3.8 Social Environment 213
3.8.1 Introduction 213
3.8.2 Regulatory Overview 213
3.8.3 Existing Conditions 213
3.8.3.1 Makah Tribal Members 213
3.8.3.2 Other Tribes 215
3.8.3.3 Other Individuals and Organizations 215
3.9 Cultural Resources 220
3.9.1 Introduction 220
3.9.2 Regulatory Overview 220
3.9.3 Existing Conditions 221
3.9.3.1 National Historical Register Sites 221
3.9.3.2 Archaeological Sites 221
3.9.3.3 Other Culturally Important Sites 221
3.10 Ceremonial and Subsistence Resources 222
3.10.1 Introduction 222
3.10.2 Regulatory Overview 222
3.10.3 Existing Conditions 223
3.10.3.1 Makah Archaeological Resources Connected with Whaling 223
3.10.3.2 Makah Cultural Environment 225
3.10.3.3 Historic Makah Community 225
3.10.3.4 Makah Historic Whaling 226
3.10.3.4.1 Cessation of the Hunt 232
3.10.3.4.2 Factors Responsible for Discontinuation of the Hunt 233
3.10.3.5 Contemporary Makah Society 237
3.10.3.5.1 Makah Whaling 240
3.10.3.5.2 Makah Subsistence Consumption 247
3.10.3.5.3 Symbolic Expression of Whaling 250
3.11 Noise 251
3.11.1 Introduction 251
3.11.2 Regulatory Overview 252
3.11.3 Existing Conditions 253
3.11.3.1 Sensitive Noise Receptors in the Human Environment 253

Table of Contents (continued)

3.11.3.1.1 Olympic Coast National Marine Sanctuary 253
3.11.3.1.2 Makah Reservation 254
3.11.3.1.3 Olympic National Park.....254
3.11.3.2 Existing Noise Levels 254
3.11.3.2.1 Atmospheric Noise.....254
3.11.3.2.2 Marine Noise.....256
3.12 Aesthetics..... 258
3.12.1 Introduction..... 258
3.12.2 Regulatory Overview 259
3.12.3 Existing Conditions..... 260
3.12.3.1 Visual Resources in the Project Area.....260
3.12.3.2 Vantage Points and Viewing Opportunities.....261
3.12.3.3 Media Coverage of Previous Authorized Hunts 263
3.13 Transportation..... 266
3.13.1 Introduction..... 266
3.13.2 Regulatory Overview 266
3.13.3 Existing Conditions..... 267
3.13.3.1 Highway Vehicle Traffic.....267
3.13.3.1.1 Typical Vehicle Traffic Volume Patterns 267
3.13.3.1.2 Vehicle Traffic Patterns During the 1999 Hunt 268
3.13.3.2 Marine Vessel Traffic 271
3.13.3.2.1 Fishing Vessel Traffic.....271
3.13.3.2.2 Offshore Vessel Transits.....272
3.13.3.2.3 Marine Traffic During the Previous Hunt.....273
3.13.3.3 Air Traffic 274
3.14 Public Services..... 274
3.14.1 Introduction..... 274
3.14.2 Regulatory Overview 275
3.14.3 Existing Conditions..... 275
3.14.3.1 Coast Guard.....275
3.14.3.2 Police.....276
3.14.3.3 Local Medical Facilities.....278
3.15 Public Safety 279
3.15.1 Introduction..... 279
3.15.2 Regulatory Overview 279
3.15.2.1 Vessel Safety Regulations and Authorities 279
3.15.2.2 Weapon Safety Regulations and Authorities 281
3.15.2.3 Other Safety Regulations and Authorities.....282
3.15.3 Existing Conditions..... 282
3.15.3.1 Location of the Hunt 282
3.15.3.2 Weather and Sea Conditions 283
3.15.3.2.1 Relevance of Weather and Sea Conditions 283
3.15.3.2.2 Description of Weather and Sea Conditions in the Project Area.....284
3.15.3.3 Behavior of the Gray Whale 287
3.15.3.4 Behavior of People Associated with the Hunt 287
3.15.3.5 Hunting Methods.....291
3.15.3.5.1 Vessels Associated with the Hunt.....291
3.15.3.5.2 Weapons Associated with the Hunt 291
3.16 Human Health 296
3.16.1 Introduction..... 296

Table of Contents (continued)

3.16.2 Regulatory Overview 296
3.16.3 Existing Conditions 296
3.16.3.1 Nutritional and Health Benefits from Consuming Whale Food Products and Other Traditional Subsistence Foods 296
3.16.3.2 Environmental Contaminants in Gray Whales.....301
3.16.3.3 Exposure to Food-Borne Pathogens.....306
3.17 National and International Regulatory Environment 308
3.17.1 Introduction 308
3.17.2 Regulatory Overview 309
3.17.2.1 Marine Mammal Protection Act.....309
3.17.2.2 Whaling Convention Act.....309
3.17.2.3 International Convention for the Regulation of Whaling.....309
3.17.2.4 Pelly Amendment.....309
3.17.2.5 Packwood-Magnuson Amendment 310
3.17.2.6 International Law Regarding Indigenous People 310
3.17.3 Existing Conditions 311
3.17.3.1 Waivers of the MMPA Take Moratorium.....311
3.17.3.2 Worldwide Whaling 313
3.17.3.2.2 Commercial and Scientific Whaling 325
3.17.3.2.3 Aboriginal Subsistence Whaling.....328
3.17.3.3 Ceremonial and Subsistence Practices of Indigenous People 332

List of Tables

Table 3-1. Associations and Times of Occurrence for Pelagic and Benthic Species Potentially Present in the Project Area. 42

Table 3-2. Classification of whales seen within the PCFA (Northern California to Northern British Columbia). 89

Table 3-3. Classification of whales seen within the ORSVI (Oregon to Southern Vancouver Island). 89

Table 3-4. Classification of whales seen within the Makah U&A (Northern Washington Coast & Strait of Juan de Fuca). 90

Table 3-5. Uniquely Identified Whale Sightings in the PCFA 96

Table 3-6. Gray Whale Population Estimates from 1967 to 2002..... 98

Table 3-7. Summary of ENP Gray Whale Stranding Data from Alaska to Mexico, 1995 to 200699

Table 3-8. Summary of ENP Gray Whale Calf Counts in California, 1994 to 2005 107

Table 3-10. Federal, State, and Local Regulations for Protected Wildlife..... 137

Table 3-11. Marine Mammals that Occur Along the Washington Coast and Their Federal/State Status 138

Table 3-12. Marine Bird Species Present in the Makah U&A 159

Table 3-13. Marine Bird Species Richness in Marine Habitats Based on Habitat Association .. 163

Table 3-14. Breeding Seabird Species and Abundance in the Vicinity of Cape Flattery..... 164

Table 3-15. Population and Personal Income in Clallam County in 1990 and 2004..... 178

Table of Contents (continued)

Table 3-16. Percentage of Visitors to Clallam County Participating in Specific Activities During Their Visits 180

Table 3-17. Travel Spending in Clallam County in 2003 180

Table 3-18. Travel Spending in Clallam County and Washington State, 1991 to 2003 181

Table 3-19. Estimated Travel-related Economic Impacts by Sector in Clallam County in 2003 182

Table 3-20. Businesses on the Makah Reservation 185

Table 3-21. Employment by Occupation of Makah Reservation Residents in 2000 186

Table 3-22. Employment by Industry of Makah Reservation Residents in 2000 186

Table 3-23. Sport Fishing Angler Trips by Species, 1995 to 2004 192

Table 3-24. Value of Commercial Fishing Landings by Species, 2000 to 2004 (In Millions of Nominal Dollars) 195

Table 3-25. Racial Distribution of Clallam County Population in 2000 202

Table 3-26. Population of American Indian Reservations and Trust Lands in Clallam County in 2000 203

Table 3-27. Selected Demographics of Native Americans Residing on Reservation and Trust Lands in Clallam County in 2000 204

Table 3-28. Labor Force, Employment, and Unemployment for Clallam County Minority and Native American Populations in 2000 205

Table 3-29. Employment by Industry of Native American Residents at Clallam County in 2000 207

Table 3-30. Income and Poverty Status of Minority Populations in Clallam County in 1999 210

Table 3-31. Income and Poverty Status of Native American Residents on Reservations in Clallam County in 1999 211

Table 3-32. Makah Attitudes Toward Whale Hunting 241

Table 3-33. Makah Reasons For Support Of Whale Hunting 242

Table 3-34. Numbers and Percentage of Participants in the 1999 Makah Whale Hunt 244

Table 3-35. Percentage of Households Using Local Resources During 1997 to 1998 248

Table 3-36. Percentage of Harvesters of Each Resource Who Gave Away Some Portion, 1997-1998 249

Table 3-37. Average Weekday Traffic Counts on Highway 101 near State Route 113, 1995 to 2004 269

Table 3-38. Daily Traffic Counts on Highway 101 near State Route 113, May 1999 270

Table 3-39. Recreational Fishing Boat Trips and Commercial Fishing Vessel Landings at Neah Bay, 1997 to 2004 272

Table 3-40. Vessel Transits Using the Strait of Juan de Fuca, 2002 to 2004 273

Table 3-41. Neah Bay Area Traffic Stops and Collisions, 1997 to 2004 278

Table 3-42. Climatological Data from Tatoosh Island, WA (48°23'N, 124°44'W, 115 feet elevation) 286

Table of Contents (continued)

Table 3-43. USDA Nutritional Values For Selected Food Types 299

Table 3-44. Concentrations of Organic Compounds Measured in Freshly Harvested and Stranded Gray Whale Tissues..... 304

Table 3-45. Concentrations of Metal/Metalloid(s) Measured in Freshly harvested and Stranded Gray Whale Tissues..... 305

Table 3-46. Characteristics of Food-Borne Pathogens[1] 307

Table 3-47. Commercial Whaling Catches since 1985 (taken under Objection to the Moratorium) 313

Table 3-48. Scientific Whaling Catches since 1985 (Taken under Special Permit)..... 314

Table 3-49. Aboriginal Subsistence Whaling Catches since 1985 318

List of Figures

Figure 3-1. Designated and Managed Areas 3

Figure 3-2. Topographic Features of Interest 27

Figure 3-3. Approximate Rangewide Distribution of the ENP Gray Whale Population..... 60

Figure 3-4. Spatial Scales in the Project Area – PCFA and ORSVI Survey Areas..... 85

Figure 3-5. Individual Survey Areas Within the Makah U&A, ORSVI, and PCFA Survey Areas 86

Figure 3-6. Cumulative number (i.e., "Discovery curve") of unique gray whales photo-identified in PCFA, ORSVI, and Makah U&A during 1998-2005..... 90

Figure 3-7. Cumulative number (i.e., "Discovery curve") of unique gray whales photo-identified in PCFA, ORSVI, and Makah U&A during 1998-2004 and resighted in a subsequent year..... 91

Figure 3-8. ENP Gray Whale Strandings Reported from Alaska to Mexico, 1995-2005 100

Figure 3-9. ENP Gray Whale Calf Counts in California, 1994-2005..... 106

Figure 3-10. Trajectory of ENP Gray Whale Population Size 110

Figure 3-11. Average Weekday Traffic Counts on Highway 101 Near State Route 113, 1996 to 2004 270

Figure 3-12. Average Monthly Levels of Marine Vessel Traffic at Neah Bay, 1997 to 2004 272

Figure 3-13. Sea Temperatures at Cape Elizabeth Buoy from June 1987 through December 2001 285

Figure 3-14. Significant Wave Height at Cape Elizabeth Buoy from June 1987 through December 2001 285

Figure 3-15. Commercial Whaling Catches by Species Since 1985 314

Figure 3-16. Scientific Whaling Catches by Species since 1985 318

Figure 3-17. Aboriginal Subsistence Whaling Catches by species since 1985 325

3.0 AFFECTED ENVIRONMENT

This chapter describes the affected environment (environmental conditions in the project area) to provide background information for the assessment of the environmental effects of the alternatives in Chapter 4 (Environmental Consequences) and Chapter 5 (Cumulative Impacts). The affected environment sections describe the pertinent aspects of resources and the current conditions within the project area, which will be used to evaluate the anticipated environmental effects of the alternatives described in Chapter 2 (Alternatives). The first section describes geographically based management in the project area (including federal and international designated areas and tribal management of reservations and usual and accustomed grounds) to provide context for the description of the other sections. The remaining sections present the physical environment first, followed by the biological environment, then the social environment, in the project area. The specific order of the sections is as follows:

- Geographically Based Management in the Project Area (Section 3.1)
- Water Quality (Section 3.2)
- Marine Habitat and Species (Section 3.3)
- Eastern North Pacific Gray Whale (Section 3.4)
- Other Wildlife Species (Section 3.5)
- Economics (Section 3.6)
- Environmental Justice (Section 3.7)
- Social Environment (Section 3.8)
- Cultural Resources (Section 3.9)
- Ceremonial and Subsistence Resources (Section 3.10)
- Noise (Section 3.11)
- Aesthetics (Section 3.12)
- Transportation (Section 3.13)
- Public Services (Section 3.14)
- Public Safety (Section 3.15)
- Human Health (Section 3.16)
- National and International Regulatory Environment (Section 3.17)

The resources considered for environmental review in Chapters 3 to 5 of this environmental impact statement (EIS) are those that the National Marine Fisheries Service (NMFS) has identified as having the potential to be affected by the project alternatives. To determine the correct resources to analyze, NMFS first compiled a complete list of physical, biological, and social resources during internal agency project scoping. NMFS then reduced the list to those that might have any potential to be affected by the project and published notices of intent in the Federal Register requesting public comments on various components of the EIS, including resources to be analyzed. After considering public comments, some resources were identified as not having the potential to be affected by the action alternatives, and are, therefore, not analyzed in this EIS. These resources include utilities, air quality, geology and soils, groundwater, hazardous waste, energy, housing, light and glare, and National Historic Preservation Act cultural properties.

3.1 Geographically Based Management in the Project Area

The project area is confined primarily to the marine waters, islands, and land areas near the Makah Tribe's usual and accustomed fishing grounds (U&A) in the Pacific Ocean and Strait of Juan de Fuca that may be directly or indirectly affected by the proposed whale hunt (Figure 1-1) (Section 1.1.2, Project Location). The project area encompasses several federally designated and managed areas, including the Olympic Coast National Marine Sanctuary (OCNMS or Sanctuary), the Washington Islands National Wildlife Refuges, the United States Coast Guard (Coast Guard) regulated navigation area (RNA), Olympic National Park, and internationally designated areas, including a United Nations World Heritage Site and the Olympic Biosphere Reserve. The project area also includes the Makah and Ozette Reservations. These designated and managed areas have objectives and policies that are directly or indirectly related to the proposed action as described below.

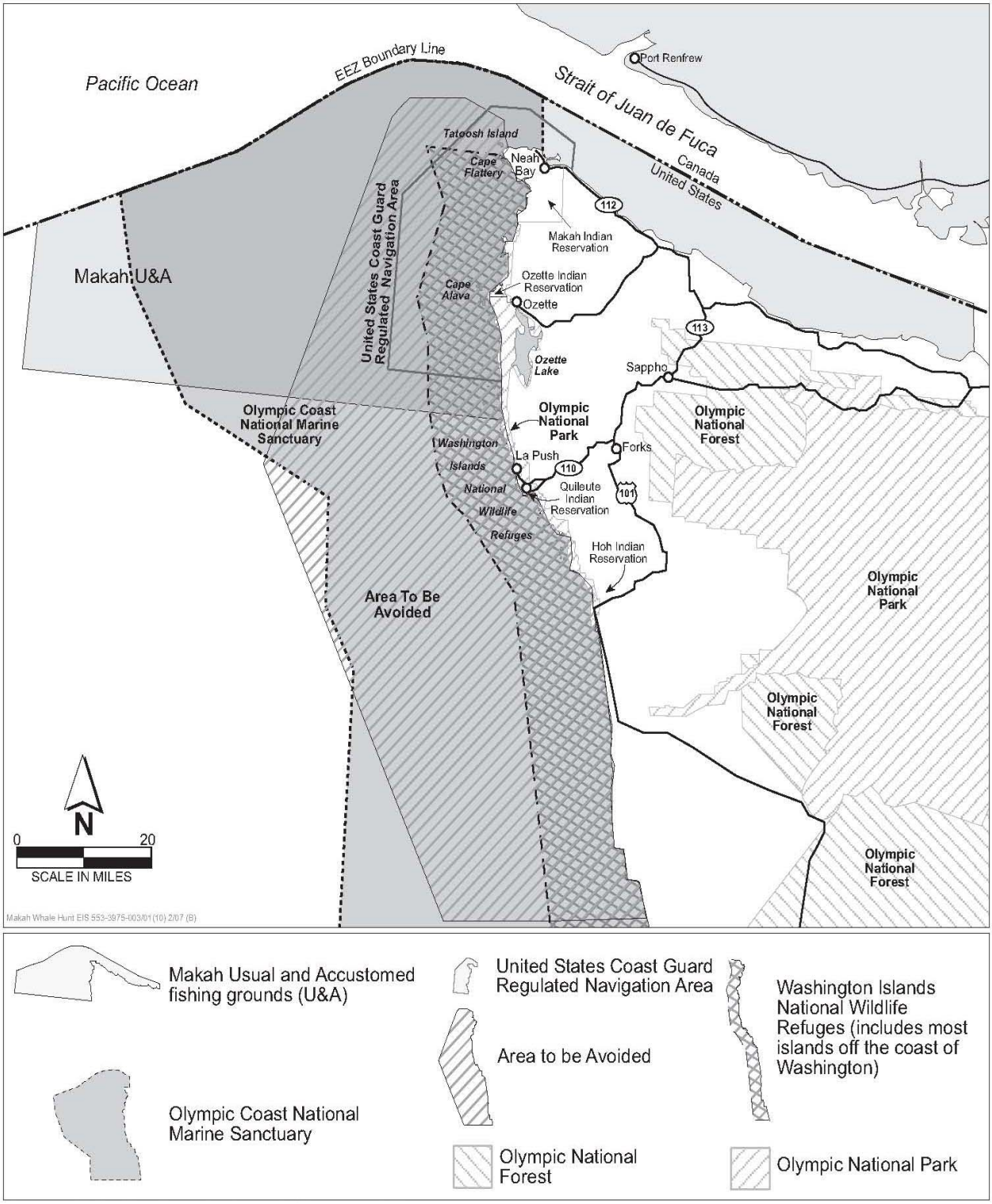


Figure 3-1. Designated and Managed Areas

3.1.1 Designated Areas

3.1.1.1 Olympic Coast National Marine Sanctuary

3.1.1.1.1 Introduction

The OCNMS is one of 13 national marine sanctuaries in United States waters, located off the northwest coast of Washington State and encompassing a 2,500-square-nautical-mile area of coastal and ocean waters and submerged lands along the Olympic Peninsula and the western portion of the Strait of Juan de Fuca. Figure 3-1 identifies the portion of the OCNMS in the project area.

3.1.1.1.2 Designation and Regulatory Overview

The Secretary of Commerce designated the OCNMS in 1994 as an area of special national significance under the authority of the National Marine Sanctuaries Act (16 United States Code [USC] 1431 et seq.) due to its unique and nationally significant collection of flora and fauna, and adjacency to the Olympic National Park. In the OCNMS Designation Document (published in 59 FR 24586, May 11, 1994) and 1993 Final EIS and Management Plan (National Oceanic and Atmospheric Administration [NOAA] 1993), NOAA noted that the Sanctuary is a highly productive, nearly pristine ocean and coastal environment that is important to the continued survival of several ecologically and commercially important species of fish, seabirds, and marine mammals. In the Designation Document and the Final EIS and Management Plan, NOAA enumerated biological and historical resources that give the Sanctuary particular value (NOAA 1993). Some of the biological resources NOAA identified that give the Sanctuary particular value include high biological productivity, diversity of habitats, a wide variety of marine mammals and birds living in or migrating through the area, and the presence of endangered and threatened species and essential habitats.

In particular, NOAA noted that the unusually large and diverse range of habitats comprising the Sanctuary includes the following:

- Offshore islands and rocks (most are within the Flattery Rocks, Quillayute Needles, and Copalis National Wildlife Refuges)
- Large and diverse kelp beds
- Intertidal pools
- Erosional features (such as rocky headlands, seastacks, and arches)
- Interspersed exposed beaches and protected bays
- Submarine canyons and ridges

- The continental shelf (including a broad shallow plateau extending from the mouth of the Juan de Fuca canyon)
- Continental slope environments

The numerous sea stacks and rocky outcrops along the Sanctuary shoreline, coupled with a large tidal range and wave splash zone, support some of the most diverse and complex intertidal zones in the United States (59 FR 24586, May 11, 1994). NOAA also identified several historical resources that give the Sanctuary particular value, including Indian village sites, ancient canoe runs, petroglyphs, Indian artifacts, and numerous shipwrecks (NOAA 1993; 59 FR 24586, 24604, [May 11, 1994]). Extensive archeological work oriented toward late prehistoric culture had been completed along the Washington coastline at the time of designation, including a major archeological dig conducted at Ozette, near Cape Alava, which uncovered an ancient village thought to be 2,000 years old and considered to be one of the most significant excavations in North America (NOAA 1993). NOAA also found that an important feature of the Sanctuary is its proximity to four Native American reservations and the U&As of the Makah and Ozette, Quileute, Hoh, and Quinault Indian Tribes. Tribal members use the Sanctuary area for subsistence and commercial harvesting and for religious ceremonies; the presence of Indian tribes along the coast adds special cultural character and historical significance to the Sanctuary (NOAA 1993).

NOAA's National Ocean Service, Sanctuaries and Reserves Division, National Marine Sanctuaries Program, administers the OCNMS, managed on location by Sanctuary staff in Port Angeles. The mission statement of the OCNMS program is to protect the Olympic Coast's natural and cultural resources through responsible stewardship, to conduct and apply research to preserve the area's ecological integrity and maritime heritage, and to promote understanding through public outreach and education. These multiple-use management objectives are achieved through both cooperative management and regulation. NOAA finds that one of the major benefits of establishing the OCNMS is the integration of important nearshore and oceanic marine resource zones and corresponding human activities, including federal, state, and tribal management of those activities, under one coordinated management regime (NOAA 1993). To this end, Sanctuary staff coordinates management with the Washington State Departments of Ecology (Ecology), Natural Resources, Fish and Wildlife, and Agriculture; the United States and Canadian Coast Guards; the United States Fish and Wildlife Service (FWS); the National Park Service; the four coastal tribes (Makah, Quileute, Hoh, and Quinault Indian Tribes); local businesses, towns, counties, timber and fishing representatives; and research and education institutions. To better understand certain stakeholder interests, the Sanctuary staff listens to a Sanctuary Advisory

Council, comprising representatives of Indian tribes, state and local governments, other federal agencies, industry, conservation organizations, and citizens. The Sanctuary Advisory Council operates under a charter and serves strictly in a voluntary, advice-giving role. The Sanctuary program staff also reviews ocean management in the OCNMS with the four coastal tribes, including the Makah Tribe, the Northwest Indian Fisheries Commission, and the state of Washington, through the Intergovernmental Policy Council (NOAA 2007). The Intergovernmental Policy Council was created by a memorandum of agreement in 2006 (NOAA 2007).

Regulations governing the OCNMS are located at 15 Code of Federal Regulations (CFR) Part 922, Subpart O. The regulations describe Sanctuary boundaries, prohibit certain kinds of activities, and set up a permitting system to allow some activities that are otherwise prohibited. Activities generally prohibited in the OCNMS include offshore oil, gas, and mineral exploration, development, or production; pollution discharge; seabed disturbance; and possessing, moving, removing, or injuring any historical resource. Prohibited activities that are particularly relevant to the proposed action include flight level restrictions and marine mammal take restrictions. Flying motorized aircraft at less than 2,000 feet both above the Sanctuary and within 1 nautical mile of the shoreline or National Wildlife Refuge islands is prohibited under 15 CFR 922.152(6), unless the Sanctuary staff issues a permit (with certain exceptions, e.g., valid law enforcement and national defense activities). This prohibition is consistent with the 2,000-foot flight advisory over the adjacent Olympic National Park and National Wildlife Refuges and is designed to limit the potential effects of noise, particularly as it might affect hauled-out seals and sea lions, sea otters, and nesting birds along the shoreline and offshore rocks and islands of the Sanctuary (NOAA 1993; 59 FR 24586, 24608 [May 11, 1994]).

Regulations also prohibit taking any marine mammal, sea turtle, or seabird in or above the Sanctuary, except as authorized by the Marine Mammal Protection Act (MMPA), the Endangered Species Act (ESA), and the Migratory Bird Treaty Act, or pursuant to any treaty with an Indian tribe to which the United States is a party (15 CFR 922.152(5)). If the taking is conducted pursuant to an Indian treaty, the taking is to be exercised in accordance with the MMPA, ESA, and the Migratory Bird Treaty Act, to the extent that they apply (15 CFR 922.150(5)). For applicability of these federal laws to the Makah Tribe's treaty right of taking fish and of whaling or sealing at usual and accustomed grounds and stations, refer to Chapter 1, Purpose and Need, and Chapter 2, Alternatives, of this EIS.

3.1.1.1.3 Current Issues

OCNMS Management Plan Review. The 1994 OCNMS Management Plan outlines objectives for resource protection, research, and education programs. Section 304(e) of the National Marine Sanctuaries Act requires five-year periodic reviews of management plans; a review of the OCNMS Management Plan will begin in 2007. These reviews include the effectiveness of site-specific management techniques and strategies implemented at the Sanctuary, along with a review of management objective priorities.

Area to be Avoided. In 1995, Sanctuary staff worked with the Coast Guard and the International Maritime Organization to establish an area to be avoided for the primary purpose of preventing a catastrophic oil spill. The area to be avoided is a voluntary ship traffic management program that advises operators of ships greater than 1,600 gross tons, which carry large amounts of bunker fuel and hazardous materials, to maintain a 25-mile buffer from the coastline in its southern portion, narrowing to approximately 8 nautical miles west of Cape Flattery and 1 nautical mile (1.2 miles) north of Neah Bay. This area to be avoided corresponds largely with the nearshore portion of the Makah Tribe's U&A (Figure 3-1). The restrictions do not apply to vessels that are engaged in an otherwise permitted activity that occurs predominantly within the Sanctuary, such as fishing or research. Of 6,938 vessel transits through the Sanctuary in 2004, all but 260 remained outside of the area to be avoided, equating to an estimated compliance rate of 96 percent (Ecology 2005a). More information on vessel traffic can be found in Section 3.13.3.2, Marine Vessel Traffic. See also Section 3.2.3.3, Spill Prevention.

Sanctuary Research. The Sanctuary staff conducts and sponsors ongoing research as a component of its management program. The Sanctuary's current research program includes studies on water quality, groundfish, seafloor mapping, intertidal ecology, marine mammals, and seabirds (NOAA 2001a; NOAA 2006). The marine mammal research at the Sanctuary includes sea otter *(Enhyrda lutris)* population and distribution, radio telemetry, and food habit studies; pinniped aerial surveys for population and distribution information; gray whale *(Eschrichtius robustus)*, killer whale *(Orcinus orca)*, and humpback whale *(Megaptera novaeangliae)* photo-identification; and surveys on the offshore distribution of cetaceans and pinnipeds (NOAA 2001b). The water quality studies have focused on harmful algal blooms and why these blooms may occur on the Washington coast. The seafloor mapping studies have included surveys of deep-water coral and sponge assemblages, as well as the effects of bottom-trawling activities for fish harvesting on these benthic communities.

Tribal Journeys. During summer 2005, the Sanctuary provided logistical and documentary support for Tribal Journeys, a multi-tribe celebration of Northwest Coast Native American and First Nation canoe culture. Tribes from Vancouver Island, mainland British Columbia, and the Puget Sound region traveled by canoe to the village of Taholah, where they were hosted by the Quinault Indian Nation. Canoe crews, their families, and supporters camped at villages of the Makah, Quileute, and Hoh Tribes. The Sanctuary outfitted a research vessel to provide safety and support for the participants and documented the journey on video (NOAA 2003).

Sanctuary Cooperation with the Makah Tribe. The Makah Tribe is a key partner in Sanctuary public relations, education, and outreach. The Makah Cultural and Research Center has fostered a strong relationship with the Sanctuary through development and implementation of a cooperative interpretive program centered on the Makah Reservation. Since 2000, the Sanctuary has provided annual funding to the Makah Cultural and Research Center to hire Makah interpreters and guides for a 17-week summer program (Bowechop 2006). Makah interpreters hosted more than 15,000 Sanctuary visitors who learned about coastal issues, Makah culture, and natural history within the area. Sanctuary staff also supported the creation of the Makah Office of Marine Safety to provide technical assistance in developing and planning pollution prevention strategies and to represent the Tribe's interest in guarding treaty-protected resources from oil spills (NOAA 2006). For more information on spill prevention, see Section 3.2.3.3, Spill Prevention. Since 2006, the Makah Tribe has also been member of the Sanctuary's Intergovernmental Policy Council.

3.1.1.2 Washington Islands National Wildlife Refuges

More than 870 islands, rocks, and reefs extending for more than 100 miles along the coast of Washington State are included in three national wildlife refuges: Quillayute Needles, Flattery Rocks, and Copalis (collectively called the Washington Islands National Wildlife Refuges). The islands range from less than 1 acre to about 36 acres, and most drop abruptly into the sea. The islands are protected from human disturbance and predators and are close to abundant ocean food sources. The islands provide refuge for more than 20 species of birds as they nest and raise their young; the total population of seabirds, waterfowl, and shorebirds may exceed one million birds (Section 3.5.3.2, Existing Conditions, Other Marine Wildlife, for more information on birds nesting on islands off the coast of Washington). In addition, sea lions, harbor seals, sea otters, porpoises, and whales are commonly found around the islands (Section 3.5.3.1, Existing Conditions, Marine Mammals, for more information on marine mammals that occur near these islands). All three refuges were originally established as migratory bird sanctuaries through Executive Orders 703, 704, and 705 issued by President Theodore Roosevelt in 1907, and later

redesignated as refuges in 1940 (Presidential Proclamation, July 30, 1940) and wilderness areas in 1970 (under the Wilderness Act of 1964, 16 USC 1131 et seq.), except for Destruction Island, which was excluded due to the presence of an operational Coast Guard lighthouse on the island. The Flattery Rocks and Quillayute Needles National Wildlife Refuges are within the Makah Tribe's U&A and the OCNMS. The Flattery Rocks and Quillayute Needles National Wildlife Refuges encompass 125 acres and are located along the northwestern portion of Washington State, beginning about 1 mile south of Tatoosh Island and extending approximately 3 miles south of Destruction Island.

The refuges are maintained as a sanctuary for nesting seabirds and marine mammals and are managed by the FWS. The FWS coordinates with NOAA's Olympic Coast National Marine Sanctuary staff to prohibit motorized aircraft less than 2,000 feet above certain portions of the refuges. The FWS also manages the refuges cooperatively with the National Park Service through a memorandum of understanding, because the refuges are within the exterior boundaries of Olympic National Park (National Park Service and FWS 1993). The objective of the Washington Islands National Wildlife Refuges is to enhance protection and interpretation of the wildlife, natural, and scenic resources of the refuges by taking the following measures:

- Minimizing human impacts
- Maintaining the wilderness character of the area
- Helping the public understand and appreciate the value of the refuges
- Conducting research to understand the refuge resources

The FWS has also issued advisories prohibiting public access to the islands and is recommending a voluntary 200-yard exclusion area around each island to avoid the flushing of nesting seabirds by boat and other vessel traffic (FWS 2007).

The FWS prepared a Washington Islands National Wildlife Refuges Comprehensive Conservation Plan/Environmental Assessment (EA) (FWS 2007) to guide its management of the Flattery Rocks National Wildlife Refuges, as well as the Quillayute Needles and Copalis National Wildlife Refuges. Management activities include monitoring the refuge wildlife and protecting and maintaining the natural functioning ecosystem. The plan directs the FWS to coordinate with other agencies and tribes to ensure continuation of the long-term health and viability of native seabird and marine wildlife populations. The Washington Islands National Wildlife Refuges Comprehensive Conservation Plan/EA includes the Treaty of Neah Bay as a law or executive order potentially applicable to its Comprehensive Conservation Plan/EA (FWS 2007)

(specifically the Tribe's fishing, whaling, and sealing rights within its U&A, as well as hunting and gathering rights on open and unclaimed lands). The Washington Islands National Refuge System adheres to laws, regulations, and policies applicable to all National Refuge Systems (50 CFR Subchapter C, Parts 25 to 32). Goals, objectives, and strategies applicable to the Washington Islands National Wildlife Refuge Comprehensive Conservation Plan/EA are listed below:

- Protect migratory birds and other native wildlife and their associated habitats, with special emphasis on seabirds.
- Protect and support the recovery of federally threatened and endangered species and Washington State special status species and their associated habitats.
- Promote and manage the Washington Islands Wilderness Area to maintain its wilderness character and values.
- Promote effective coordination and cooperation with others for conservation of refuge resources with special emphasis on government agencies and tribes with adjoining ownership and/or jurisdiction.
- Continue to enhance long-term monitoring and sustained applied research.
- Increase public interpretation and awareness programs to enhance appreciation, understanding, and enjoyment of refuge resources.

3.1.1.3 Coast Guard Regulated Navigation Area

The United States Coast Guard has established an RNA (Figure 3-1) in the Strait of Juan de Fuca and adjacent coastal waters of northwest Washington (33 CFR 165.1310) under its Ports and Waterways Safety Act authority (33 USC 1221 et seq.), allowing the Coast Guard to enforce vessel activities near any Makah whale hunt and reduce the danger of loss of life and property from any hunt. When finalizing the RNA after the 1999 hunt, the Coast Guard specifically found that "the uncertain reactions of a pursued or wounded whale and the inherent dangers in firing a [.50 caliber] hunting rifle from a pitching and rolling small boat are likely to be present in all future hunts, and present a significant danger to life and property if persons or vessels are not excluded from the immediate vicinity of a hunt" (64 FR 61212, November 10, 1999).

The RNA rests entirely within the Makah U&A (Figure 3-1); its boundaries enclose waters off Neah Bay and the Strait of Juan de Fuca in the north, wrap around Cape Flattery and Tatoosh Island, and then parallel the shore at a 10-nautical-mile (11.5-mile) distance until the southern boundary is formed by connecting to the shore at the southern extent of the U&A. The Coast Guard extended the southern boundary of the RNA to match the southern boundary of the U&A when the final rule was promulgated in 1999 (64 FR 61212, November 10, 1999). When the

interim rule (63 FR 52609, October. 1, 1998) was in force during the 1999 Makah whale hunt, most of the Makah whale hunting and associated protesting activities occurred farther south than the borders of the RNA (though the whale hunting activities and the protesting incidents still occurred within the Makah U&A) (Section 1.4.2, Summary of Recent Makah Whaling – 1998 through 2007, for more information about these whale hunting and protest activities).

Within the RNA during any Makah whale hunt, a moving exclusionary zone (MEZ), for "the column of water from the surface to the seabed within a radius of 500 yards centered on the Makah whale hunt vessel" is activated when one Makah whale hunt vessel (i.e., the canoe or the chase boat with the rifleman) displays an international numeral pennant 5 between sunset and sunset when surface visibility exceeds 1 nautical mile (33 CFR 165.1310(b)). No person or vessel may enter the MEZ when it is activated, except for the authorized Makah whale hunt vessel, an authorized media pool vessel preauthorized by the Coast Guard, or another vessel or person authorized by the Coast Guard (33 CFR 165.1310(c)), such as the observer vessel. The authorized media pool vessel must maneuver to avoid positioning itself between whales and hunt vessels, out of the line of fire, at a prudent distance and location relative to the whale hunt operations, and in a manner that avoids hindering the hunt or path of the whale in any way (33 CFR 165.1310(f)(3)). The media pool vessel operates at its own risk, but must adhere to safety and law enforcement instructions from Coast Guard personnel (33 CFR 1310(f)). The regulation does not affect normal transit or navigation in the RNA. Refer to Section 1.4.2, Summary of Recent Makah Whaling – 1998 through 2007, Section 3.15.2.1, Vessel Safety Regulations and Authorities, and Section 3.15.3.4 Behavior of People Associated with the Hunt, for more information about the operation of the RNA and the MEZ during Makah whale hunting from 1998 to 2000.

3.1.1.4 Olympic National Park

The Olympic National Park comprises 922,651 acres located primarily in the center of the Olympic Peninsula and includes lands along the upper northern coast of Washington State (Figure 3-1). President Theodore Roosevelt originally created the Olympic National Monument in 1909; Congress later redesignated and authorized the monument as a National Park in 1938 (Chapter 812, 52 Stat. 1241). In 1988, Congress designated about 95 percent of the park (876,669 acres) as wilderness through the Washington Park Wilderness Act (16 USC 90 note, Public Law 100-668); it is now one of the largest wilderness areas in the contiguous United States. Combined with the OCNMS, the two designations protect almost 5,000 square miles of intertidal, island, and ocean habitats. The National Park Service is the federal agency that manages the park to preserve and protect, unimpaired, the park's diverse natural and cultural

resources and provide for the enjoyment, education, and inspiration of present and future generations. More than 650 archeological sites documenting 10,000 years of human occupation are protected within the Olympic National Park lands (National Park Service 2008). Ten Peninsula tribes retain their ongoing connection between community and traditional lands, including the Makah Tribe, Hoh Tribe, Jamestown S'Klallam Tribe, Quileute Tribe, Quinault Nation, Skokomish Tribe, Squaxin Tribe, Suquamish Tribe, Elwha Klallam Tribe, and Port Gamble S'Klallam Tribe. The park also protects cultural resources that reveal and document the 200-year history of discovery, exploration, homesteading, and community development in the region (National Park Service 2008).

The National Park Service recently prepared a general management plan/EIS for the park that describes a vision for its future (National Park Service 2008). The plan is intended to guide park decision-making for the next 15 to 20 years. Management emphasis for the National Park Service's preferred alternative is protecting resources and improving visitor experiences. This goal would be accomplished by accommodating diverse visitor use, providing sustainable access on existing roads, improving mass transit opportunities, and concentrating improved educational and recreational opportunities on the developed park edges. The National Park Service plans to provide more park information to visitors so that they can better plan their visits. Under the preferred alternative, visitation and wilderness use would be managed for resource protection and to improve visitor experiences. Comprehensive maintenance, protection, and preservation measures, in accordance with the Secretary of the Interior's Standards, would be used for those structures listed or eligible for listing on the National Register of Historic Places.

3.1.1.5 World Heritage Site

The Olympic National Park was designated as a United Nations Educational, Scientific, and Cultural Organization World Heritage Site in 1981, and it is one of 20 World Heritage Sites in the United States (UNESCO 1981). The Word Heritage Site list was established under the terms of the Convention Concerning the Protection of World Culture and Natural Heritage that was adopted in 1972 at the 17th General Conference of the United Nations Educational, Scientific, and Cultural Organization. World Heritage Site objectives are to encourage the identification, protection, and preservation of cultural and natural heritage sites that are considered to be of outstanding value to humanity. These sites are listed to be protected for future generations to appreciate and enjoy. The Convention states that a World Heritage Committee will establish, keep up to date, and publish a World Heritage List of cultural and natural properties submitted by the states and considered to be of outstanding value UNESCO.

3.1.1.6 Olympic Biosphere Reserve

The Olympic Peninsula, including the Olympic National Park, was designated as a biosphere reserve in 1976 (UNESCO 1976). Biosphere reserves are areas of terrestrial and coastal ecosystems promoting solutions to reconcile the conservation of biodiversity with sustainable use. The reserves are internationally recognized, nominated by national governments, and remain under sovereign jurisdiction of the states where located. Each biosphere reserve is intended to fulfill three basic functions:

- Conservation function that contributes to the conservation of landscapes, ecosystems, species and genetic variation
- Development function that fosters economical and human development that is socio-culturally and ecologically sustainable
- Logistic function that provides support for research, monitoring, education, and information exchange related to local, national, and global issues of conservation and environment

The objective of this designation is to set aside areas with representative ecosystems to achieve the fullest possible biogeographical cover over the world and ensure systematic conservation of biodiversity.

The Olympic Biosphere Reserve is one of 51 designated biosphere reserves in the United States. This reserve is considered one of the best examples of intact and protected temperate rainforests in the Pacific Northwest. Other outstanding characteristics include rivers supporting some of the best habitat for anadromous fish species, the longest undeveloped wilderness coast in the United States, and rich native and endemic animal and plant species (UNESCO 1981).

3.1.1.7 Other Designated Areas

NMFS and the Pacific Fishery Management Council have identified essential fish habitat within the project area under Magnuson-Stevens Act authority. More information about the establishment and identification of essential fish habitat and habitat areas of particular concern is presented in Section 3.3, Marine Habitat and Species. NMFS has also identified critical habitat for certain threatened and endangered species under its ESA authority occurring within the project area. More information on critical habitat of fish species occurring within the project area is in Section 3.3, Marine Habitat and Species. More information on critical habitat for other marine wildlife, including recently designated critical habitat for southern resident killer whales

(71 FR 69057, Nov. 29, 2006), is in Section 3.5.3.1.1, ESA-Listed Marine Mammal Species, and Section 3.5.3.2.1, ESA-Listed Species (Other Marine Wildlife).

3.1.2 Makah Management of Reservation and U&A Areas

The Makah Reservation is located on the northwesternmost tip of the Olympic Peninsula (Figure 3-1) and encompasses 44 square miles of land (30,142 acres) bounded by the Pacific Ocean to the west and the Strait of Juan de Fuca to the north. The approximately 1-square-mile Ozette Reservation, 10 miles south of Neah Bay, is also part of the Makah Reservation, with the Olympic National Park managing the contiguous shoreline between the two areas of the reservation.

The relationship between the United States and Makah Tribe was formalized upon ratification of the Treaty of Neah Bay in 1855. Following the 1975 Indian Self-Determination and Education Assistance Act (Public Law [PL] 93-638), the Tribe entered into self-determination contracts with the Bureau of Indian Affairs (BIA). Later, the Tribe entered into tribal self-governance compacts in accordance with the Tribal Self-Governance Act of 1994 (PL 103-413). The tribal self-governance compact incorporates virtually all BIA programs on the reservation. The Tribe has also entered into a self-governance compact with the Department of Health and Human Services (under the Tribal Self-Governance Amendments of 2000, PL 106-260), addressing the delivery of health services to tribal members. In addition, following a series of court decisions establishing the right of the Makah and other Washington state treaty tribes to half the harvestable surplus of salmon (*United States v Washington* 1974 ['Boldt decision']) and shellfish (*United States v Washington* 1994 ['Rafeedie decision']), the federal government formally recognized that the four Washington coastal tribes (Makah, Quileute, Quinault, and Hoh) have treaty rights to groundfish in their respective U&As (Pacific Fishery Management Council and NMFS 2006). In accord with these decisions and recognition, the Makah Tribe participates in a variety of fisheries management forums such as the North of Falcon process, the Pacific Fisheries Management Council, and the Pacific Salmon Treaty.

The Makah Tribe is governed by an elected tribal council. The Constitution and Bylaws of the Makah Indian Tribe, adopted in 1936, describe the organization and authority of the Makah Tribal Council. The council consists of five members elected for staggered three-year terms. The Makah Tribal Council selects officers from its membership, including, but not limited to chairman, vice-chairman, and treasurer. Currently the secretary is appointed from outside the Makah Tribal Council. The secretary is a tribal employee fulfilling the requirements of the office

on behalf of the Makah Tribal Council. Any tribal member who is 21 years of age or older and has lived on the reservation for one year immediately preceding an election is eligible to vote, and any legal voter is eligible to be elected to serve on the Council.

As stated in the Constitution and Bylaws of the Makah Indian Tribe, the powers of the Tribal Council include the power to perform the following actions:

> To promulgate and enforce ordinances, which shall be subject to review by the Secretary of the Interior, governing the conduct of members of the Makah Indian Tribe, and providing for the maintenance of law and order, and the administration of justice by establishing a reservation Indian court and defining its duties, powers, and limitations . . . . To safeguard and promote the peace, safety, morals and general welfare of the Makah Indian Tribe by regulating the conduct of trade and the use and disposition of property upon the reservation . . . . To adopt resolutions regulating the procedure of the council itself and other tribal agencies and tribal officials of the reservation (Article IV, Sections 1(i), (j), and (n)).

The constitution and bylaws may be amended by a majority vote of the qualified tribal voters. A referendum on any proposed or enacted ordinance or resolution of the Tribal Council may be called if at least one-third of the qualified tribal voters petition for one. The majority vote of such a referendum is conclusive and binding on the Makah Tribal Council.

Laws and regulations are enforced under the provisions of the Makah Law and Order Code. The Makah Law and Order Code establishes a tribal court, defines its jurisdiction, provides for tribal police, details the selection and procedures for judges and juries, and includes a criminal code and procedures for criminal and civil actions. If NMFS authorized a gray whale hunt, the Tribe proposes to adopt laws and regulations to enforce NMFS' regulations governing the hunt.

3.1.2.1 Makah Tribal Departments and Agencies

The Makah Tribal Council oversees the operations and management of some 14 governmental departments and six tribally chartered organizations. The Council identifies priorities and aids Departments in planning through a strategic planning process. A five-year strategic plan was developed in 2005, and both the Council and Departments revisit goals and objectives annually (Makah Tribe 2005b). The 2006 annual update of the five-year strategic plan is referred to as the 2006 Update to the 2005 Comprehensive Economic Development Strategy (Makah Tribe 2006b). The five-year plan (Makah Tribe 2005b; Makah Tribe 2006b) describes the Makah Departments:

Makah Social Services comprises six programs: Domestic Violence Program, Low Income Home Energy Assistance Program, General and Employment Assistance Program, Family

Services Program, Senior Citizens Program, and United States Department of Agriculture Food Distribution Program.

Makah Education provides services to tribal/community members for higher education and the Workforce Investment Act program, i.e., funding, work placements, and clothing vouchers.

Makah Realty protects and promotes the trust assets (realty and physical property) of the Makah Tribe and the tribal membership.

Makah Operations addresses essential and basic health, legal, transportation, community beautification, and employment and training needs of tribal community.

Makah Justice Team provides a forum for resolving disputes that is consistent with applicable governing laws and in keeping with the traditional and cultural values of the Makah Tribe. This includes the tribal court system.

Makah Health Services (Sophie Trettevick Health Center) provides primary medical care and dental services. There are three permanent providers at the clinic, two medical doctors and one nurse practitioner. The clinic is open Monday through Friday, from 8:00 a.m. to 5:00 p.m., with emergency service available via 911, 24 hours a day, 7 days a week. Emergency medical situations are addressed by providing stabilization and transport to the nearest appropriate facility. Airlift Northwest (Seattle) can be called in, based on emergency medical technician and/or provider determination. If Airlift Northwest is not available, the Coast Guard may provide transport. The Coast Guard responds to open-water-related emergencies. Although the health clinic provides day-to-day care service to tribal members, it will treat anyone with life- or limb-threatening injuries. Such injured non-Indians are treated to stabilize their injuries and transport them to an appropriate facility. The facility has a memorandum of agreement with Clallam Bay Fire District 5 to provide mutual assistance in emergency situations.

Makah Forestry establishes and develops policies to guide management of the forested lands of the Makah Indian Reservation and serve as a basis for decision-making by Makah Natural Resources Departments and the Makah Tribal Council.

Makah Environmental Division includes Treaty Reserved Rights Protection, Environmental Planning, Environmental Health, Air Quality, Water Quality/Resources, and Environmental Education.

Makah Public Safety is responsible for tribal law and ordinance enforcement, emergency medical care, and fire department services. Makah Public Safety includes the Police

Department, Corrections, Communications, Adult Probation, Natural Resources Enforcement, Emergency Medical Services (providing emergency medical care 24 hours per day to residents [tribal and non-tribal individuals] and visitors to the reservation), Volunteer Fire Department, and Animal Control. There are eight uniformed police officers. In addition, four natural resources enforcement officers are responsible for enforcing hunting, fishing, and forest products permits/regulations. They are trained law enforcement officers who can supplement the Police Department officers, as needed. The Fire Department consists of two full-time employees and 10 volunteers, with two engines and one aid car. Emergency response is provided by two full-time staff and eight volunteers, with two ambulances (a third ambulance will be obtained in 2007).

Makah Planning (Community Planning and Economic Development) provides integrated, comprehensive, and traditional planning support to the Makah Tribal Council in decision-making concerning economic and community development.

Makah Fisheries Management is responsible for protecting, sustaining, and enhancing the relationship between the Makah Tribe and the many aquatic species that play a vital part in both the Tribe's cultural and economic well being. The Department manages more than 20 different fisheries within the Tribe's U&A. The fisheries target a wide variety of fish species, use diverse gear types, and span seasonal time periods throughout the entire year.

Makah Whaling Commission is housed in the Fisheries Department, although it is directly responsible to the Makah Tribal Council. The Council first adopted the Charter of the Makah Whaling Commission in 1996 with Resolution 10-97, and amended it in 2001 with Resolution 100-01. The Makah Whaling Commission conducts educational programs, in particular to train whaling crews in compliance with the tribal whaling regulations and Whaling Convention Act (WCA) regulations. The Makah Whaling Commission also initiates and conducts research on methods to improve whaling methods. The Makah Whaling Commission is organized around the traditional heads of Makah families, for the purpose of advising and making recommendations to the Makah Tribal Council regarding "rules and regulations to govern the conduct of treaty ceremonial and subsistence whaling," and "the administration and enforcement of such regulations, and [the] conduct[ing of] educational programs and research relating to ceremonial and subsistence whaling" (Makah Whaling Commission Charter 2001). The Makah Tribal Council considers the Whaling Commission's recommendations regarding tribal regulations and tribal permits authorizing the conduct of treaty ceremonial and subsistence whaling.

The Whaling Commission confirms that the whaling captain and crew have met the training guidelines and other applicable requirements for a permit. Upon concurrence of the Makah Whaling Commission, the executive director (or manager) and president sign the permit and present it to the Makah Tribal Council for approval. A whaling permit is valid upon an affirmative vote of the Makah Tribal Council and is finally approved by the tribal chair. The tribal whaling permit is issued to the whaling captain. It identifies the whaling captain, date issued, vessels involved, names of crew members, and area where the hunt is authorized. The permit also identifies conditions that will result in its termination: landing of a gray whale, striking and losing a gray whale, and expiration of the permit after 10 days (without a strike or landing) or due to voluntary termination by the Makah Whaling Commission or Makah Tribal Council.

Administrative Services Department provides administrative financial services to the Tribe, including complying with applicable federal, state, and local policies; ensuring effective financial, personnel, procurement, and property management; promoting the highest standards of integrity, impartiality, and professionalism (in conduct of administrative programs); and promoting effective coordination and improved management practices among tribal programs, the Makah Tribal Council, enterprises, and outside agencies.

Tribal Enterprises. There are several separately chartered enterprises: Makah Business Enterprises, Makah Forestry Enterprise, Makah Cultural and Research Center, Makah Housing Authority, and Port of Neah Bay/Makah Marina. Makah Business Enterprises "operates within the structure of the Tribe." The other entities operate under independent boards (appointed by Makah Tribal Council).

- **Makah Business Enterprises** is responsible for creating and enhancing a for-profit sector for the betterment of the Makah tribal community. The businesses operating under Makah Business Enterprises are intended to generate profits, develop self-sufficiency, and create employment. Five businesses operate under Makah Business Enterprises: Makah Mini-Mart/Fuel Station, Hobuck Beach RV and Cabin Resort, Makah Earth Resources Company, Warmhouse Restaurant, and Bingo.
- **Makah Forestry Enterprise** focuses on sustainable timber harvests while marketing logs and other forest-related products.
- **Makah Cultural and Research Center** is a nonprofit organization dedicated to revitalizing and preserving Makah culture. Its operations include an archive and research library, a museum, an education department, a language program, and a Tribal Historical

Preservation Department that manages cultural properties on the Reservation. Makah Cultural and Research Center receives approximately 14,000 visitors and researchers annually.

- **Makah Housing Authority** builds, rehabilitates, and weatherizes homes; acquires land for neighborhood revitalization development; and develops local capacity to provide these services.
- **Port of Neah Bay/Makah Marina** was chartered in 1996 and assumed management of the Makah Marina and Big Salmon Fishing Resort. The Marina provides year-round moorage for tribal and non-tribal fishing fleets. The Port's mission is to develop, construct, regulate, and operate facilities and infrastructure for the transportation and industrial needs of the Makah Reservation to create profitable opportunities for tribal and individual businesses through project revenues, bonds, grants, and other sources. The Port also provides administration and regulation over reservation waters and leads negotiations for recreational fishing quotas and seasons. The Port manages contracts with the Marine Spill Response Corporation and National Response Corporation and keeps a list of responders for spill responses and protection around the Olympic Peninsula (Makah Tribe 2006b).

3.1.2.2 Makah Tribal Programs and Management Plans

Through the Makah Tribal Council and tribal departments, the Makah Tribe operates numerous governmental programs under a variety of management plans. Those most relevant to this EIS are described below.

3.1.2.2.1 <u>Makah Public Safety Program</u>

In addition to weapons training, police officer training includes advanced narcotics training, forensics, and critical incident management. In 2005, the Makah Tribal Council adopted the National Management Incident System for response to emergencies that may affect the tribal community. Most emergency situations are handled locally, but major incidents may require assistance from state or federal authorities. The National Management Incident System was developed to better coordinate responders from different jurisdictions and disciplines in the event of natural disasters and emergencies, including acts of terrorism. Benefits include a unified approach to incident management; standard command and management structures; and emphasis on preparedness, mutual aid, and resource management. The website is http://www.fema.gov/emergency/nims/index.shtm.

Using the National Management Incident System template, the Makah Tribal Council adopted an integrated comprehensive emergency plan in 2005. The plan provides for coordinated response and unified command structure under the Makah Director of Public Safety (Police Chief). The handling of any emergency, including civil disturbance, falls under the plan. An example of the plan's implementation occurred in December 2005, when there was a water shortage emergency on the reservation due to a combination of unusual drought and storm damage. In response to the emergency, the Police Chief sought a Makah Tribal Council declaration of emergency, which placed the comprehensive emergency plan in effect.

3.1.2.2.2 Makah Fisheries Management Programs

Fisheries in Puget Sound, the Strait of Juan de Fuca, and nearshore coastal waters are co-managed by the Indian treaty tribes and the Washington Department of Fish and Wildlife (WDFW). Ocean fisheries in United States waters are regulated by the Pacific Fishery Management Council with NMFS oversight and approval under the Magnuson-Stevens Act. State and tribal biologists participate in developing the scientific information that guides the decision-making and deliberative processes of the Pacific Fishery Management Council and NMFS. Harvest of salmon is also governed internationally under the 1985 Pacific Salmon Treaty, developed through cooperation by tribes, state governments, United States and Canadian federal governments, and sport and commercial fishing groups. The treaty is implemented by the eight-member bilateral Pacific Salmon Commission, which includes representatives of federal, state, and tribal governments. The Pacific Salmon Commission does not regulate salmon fisheries, but provides regulatory advice and recommendations, and is a forum for the two countries to reach agreement on mutual fisheries issues.

The Makah Tribe regulates and coordinates its own fishery management program within its U&A. The Tribe manages fisheries for salmon, halibut and other bottom fish, rockfish, Pacific whiting, black cod/sablefish, shellfish, and other marine species off the Washington coast, in coastal rivers and bays, and in the Strait of Juan de Fuca.

According to the Makah Fisheries Management 2005 Annual Report (Makah Fisheries Management 2005), the following programs are under Makah Fisheries Management:

Groundfish Management Program. The groundfish management programs below cover Pacific halibut, blackcod (sablefish), Pacific whiting, yellowtail (rock fish), and bottom fish (groundfish):

- **Observer Program.** Since 2003, this program places an observer on fishing vessels to monitor mid-water and bottom trawl fisheries for bycatch of overfished species.
- **Marine Fish Port Sampler.** Also since 2003, this program is co-managed with WDFW (Bryant 2007). The data collected are critical for yearly stock assessments and coast-wide management of groundfish by the Pacific Fishery Management Council.
- **Yelloweye Rock Fish Bycatch Studies.** Studies are conducted on the potential to reduce the incidence of yelloweye rock fish bycatch when fishing for halibut by using three different bait types (started in 2005, under a Pacific States Marine Fisheries Commission grant) (Makah Fisheries Management 2005; Bryant 2007).
- **Shellfish Management.** This includes three dive fisheries targeting sea cucumbers and red and green sea urchins, as well as a Dungeness crab fishery in the Strait of Juan de Fuca that was implemented in 2005 (Bryant 2007).
- **Other Fisheries.** Other fisheries being explored include sardines and previously non-targeted species of flatfish (arrowtooth flounder).

Salmon Management Program. In 2005, Makah fisheries management program staff participated in the pre-season planning process for salmon management with the Pacific Fishery Management Council. In July, the Makah salmon management program staff initiated an evaluation of the all-species portion of the treaty ocean troll fishery. Salmonid fisheries include Chinook, sockeye, coho, pink, chum, and steelhead. The program includes research and monitoring, primarily of the status and progress toward recovery of local salmon stocks. Results of research and monitoring are provided to technical and policy staff for improved management. The program also provides information for use in restoration projects.

Marine Mammal Management Program. The Makah fisheries management staff are responsible for the management of marine mammals, important biological and cultural resources within the Makah U&A. Activities include participation with the International Whaling Commission (IWC) Scientific Committee and three subcommittees: Aboriginal Whaling Management Procedure; Bowhead, Right, and Gray Whale; and Environmental Concerns. The tribal staff marine mammal biologist also participated in the Pacific Scientific Review Group, which provides advice to NMFS and FWS on marine mammal stock assessments and review of sources of mortality. Other activities include conducting photographic-identification research of gray and humpback whales in the U&A, collecting biopsies from gray and humpback whales, and participating in a scientific exchange with the Chukotkan Region of the Russian Federation in 2006 to evaluate the logistics of conducting an intensive 'stinky whale' research program.

Scientific Research and Collaboration Program. Under this program, the Tribe and WDFW conduct a joint research project on Puget Sound herring stocks. The Tribe has completed a series of other research projects with federal, state, and tribal governmental agencies. Additional projects are focused on developing new fisheries (such as Pacific cod and sardine) and groundfish stocks in the Makah U&A and geoduck aquaculture in Makah Bay area.

Hatchery Operations Program. The hatchery operations program raises and rears six salmonid stocks, including two stocks of steelhead, two stocks of Chinook, coho, and sockeye.

Sustainable Resource Management Program. Activities include OCNMS Advisory Committee; Pacific Fishery Management Council; Marine Protected Areas Federal Advisory Committee; essential fish habitat, low impact development; Environmental and Marine Sciences Youth Development Program; United States Environmental Protection Agency (EPA) Data Management Network; Makah Environmental Policy Act development; Coastal Zone Management Plan development; Derelict fishing gear removal; and cooperation with Coast Guard environmental assessment of breakwater development.

Water Quality. This program samples various water systems to collect a range of data including dissolved oxygen, salinity, pH, conductivity, and turbidity.

Freshwater Habitat Enhancement Program. Principal activities of this program include participating with other tribal departments regarding on-reservation planning, development, and resource extraction projects that affect freshwater resources; participating in habitat enhancement with WDFW under the state of Washington Forest Practices Act; identifying, prioritizing, and implementing habitat rehabilitation projects benefiting aquatic habitat on the Makah Reservation and in the U&A; participating in recovery efforts of Lake Ozette Sockeye; and developing watershed planning and protection efforts with adjacent communities to protect aquatic resources on the Makah Reservation and U&A.

3.1.2.2.3 Makah Comprehensive Economic Development Strategies

The Makah Tribe's Comprehensive Economic Development Strategy (Makah Tribe 2005c; Makah Tribe 2006b) identifies the Makah Tribal Council as the approving body for economic development within the reservation. The Makah Tribe obtains most of its tribal income through marina and harbor development, Makah Forest Enterprise, and the Makah Business Enterprises.

Goals identified within the plan include the following:

- Determine the feasibility of and priority ranking for eight projects associated with marine and harbor development (marine expansion, haul-out facility, upgraded marine fuel float, aquaculture, graving dock, log dump expansion, Neah Bay harbor deep-water entry, and cruise ship facility).
- Develop a small business program for ancillary businesses that support, enhance, and fulfill needs associated with a new marina.
- Expand the forested land base for the Tribe.
- Study the feasibility of a marine fish hatchery.
- Provide academic and business training and education.
- Diversify the Makah fishing industry, specifically the whiting fishery.
- Identify new projects consistent with the Makah Tribal Land Use Committee, including a visitor center (that may be associated with an ocean-front cabin resort, motel, and new restaurant), road improvements, and a new development area that would provide a wellness/medical center, senior citizen apartments, clinic staff housing, baseball fields, and new Makah Tribal Council offices.

Other priorities included in the plan are a new clean water source for tribal use, projects that provide for downtown revitalization, Shi Shi Trail expansion, tribal communications network upgrades, a potential wave energy project, a potential wind generation development, and opportunities to provide value-added seafood processing.

3.1.2.2.4 Makah Forest Management Plan

The Makah Forest Management Plan (Makah Tribe 1999) was prepared to identify goals and objectives for maintaining a desired future condition for the Tribe's forest resources. The intent of the forest plan is to guide harvest of mostly second-growth timber while allowing for harvest of only small, scattered pockets of older timber (exceeding 100 years of age) in an attempt to keep the remaining, large, contiguous blocks of older timber intact. Annual harvests of 8.5 million board feet are expected to achieve this goal, while providing for a long-term sustainable timber harvest level. Approximately 25,735 acres (85 percent of the reservation) are managed for timber harvest, and timber sale revenues represent approximately 50 percent of non-grant (monies not received through federal grants administered by the BIA) tribal income.

3.2 Water Quality

3.2.1 Introduction

The following section describes the management and existing condition of water resources in the project area. Topics addressed include drinking water sources, shellfish harvest areas, and existing practices for the prevention of and response to spills of fuel and other contaminants. This section also addresses solid waste disposal as it relates to options for disposal of a whale carcass. Ocean currents and nearshore mixing are discussed in Section 3.3 (Marine Habitat and Species).

3.2.2 Regulatory Overview

The federal Clean Water Act (33 USC 1251 et seq.) establishes standards and regulations for protecting the quality and beneficial uses of the nation's waterways and regulates navigable waters of the United States. Federal agencies responsible for enforcing the Clean Water Act include EPA and the Army Corps of Engineers. On the Makah Reservation, EPA has delegated authority under Sections 303(c) and 401 (both water quality standards and implementation plans and dredge and fill permits), of the Clean Water Act to the Makah Tribe. On the Makah Reservation, Makah Health Code Title III states that "it shall be a violation [of the Health Code] to conduct activities in the watershed which may degrade the physical, chemical, microbiological, viral, or radiological quality of the source of supply." All proposed activities require a written permit from the Tribal Council. EPA has retained some authority over Clean Water Act management on the Makah Reservation and administers programs such as the national pollutant discharge elimination system under Section 402.

Off the Makah Reservation, EPA has delegated authority over state waters (including Sections 401 and 402) to Ecology, which is responsible for the implementation of the Washington State Water Pollution Control Act (Revised Code of Washington [RCW] 90.48). This law is intended to maintain the highest possible standards for all waters of the state consistent with public health and enjoyment; the propagation and protection of wildlife, birds, game, fish and other aquatic life; and prevention and control of pollution within waters of the state of Washington. Ecology has set water quality standards to protect the beneficial uses of surface waters. Ecology has established fresh and marine water quality standards for fecal coliform bacteria (an indicator of fecal contamination); dissolved oxygen; total dissolved gas; temperature; pH; turbidity; aesthetics; and toxic, radioactive, and deleterious materials (WAC 173-210A).

Ecology routinely collects marine water quality data as part of the long-term Marine Waters Monitoring Program, initiated in 1967. Ecology uses these long-term data to assess marine water quality in Washington State, including coastal estuarine areas represented by Willapa Bay and Grays Harbor (Ecology 2002). The agency uses these data to differentiate inter-annual and seasonal variations from those due to human activities at specific locations. Ecology uses the data primarily to maintain the federal Clean Water Act 303(d) list of impaired waterbodies throughout the state and 305(b), the report describing the overall status of the waters of the state.

3.2.3 Existing Conditions

The primary saltwater resources in the project area include the Pacific Ocean from the mouth of the Strait of Juan de Fuca to the exclusive economic zone (EEZ) boundary and the western portion of the Strait of Juan de Fuca that includes the Makah Tribe's U&A (Figure 3-1). The EEZ extends up to 200 miles offshore, and coastal states have the right to explore, exploit, and manage within its limits. Freshwater resources in the project area occur in portions of Water Resource Inventory Areas 20 (Soleduck-Hoh) and 19 (Lyre-Hoko), and portions of the Makah Reservation fall within both. Major rivers include the Wa'atch and Sooes Rivers, the two main tributaries that drain into Makah Bay from the Makah Reservation, as well as the Ozette River, which runs from Ozette Lake to the nearshore area of the Olympic National Park (Figure 3-2). These rivers all occur in Water Resource Inventory Area 20. Numerous additional smaller streams in the project area drain to the Pacific Ocean, the Strait of Juan de Fuca, and Neah Bay. Based on information Ecology provided, these waterbodies have extraordinary water quality, and none of the designated uses (shellfish harvesting, primary contact recreation, wildlife habitat, harvesting, commercial navigation, boating, and aesthetics) is restricted (WAC 173-210A).

Ecology implements marine water quality management activities in Puget Sound and the outer coastal estuaries based, in part, on periodic quantitative water quality monitoring data. The data are also used for interdisciplinary efforts aimed at assessing the health of marine ecosystem components, ranging from eelgrass to salmon, because these organisms live in and are affected by marine water and its quality.

Ecology has not listed the Pacific Ocean, the Strait of Juan de Fuca, Neah Bay, or any of the rivers and streams within the project area as impaired for water or sediment quality parameters. These parameters generally include temperature, dissolved oxygen, pH, nutrients, bacteria, metals, and toxic substances (WAC 173-210A). In addition, Ecology and the Washington Department of Health have monitored for fecal coliform bacteria at beaches along Neah Bay and

Hobuck and Sooes Beaches (Figure 3-2). Very low levels of fecal coliform bacteria were recorded on these beaches, indicating little or no contamination (Ecology 2005a).

3.2.3.1 Drinking Water Sources

Drinking water sources for the Makah Reservation (with three primary settlement areas) are local rivers and the Educket Reservoir (United States Bureau of Reclamation 2006). The difficulties in collecting and distributing water suitable for drinking led to a moratorium on residential and commercial building on the reservation in 2000. The Bureau of Reclamation is considering the following options for increasing the availability of drinking water for current use and planned growth:

- Reclamation of Educket Reservoir
- Development of an additional collection system from three creeks along Cape Flattery
- Construction and operation of a reverse osmosis desalinization plant, which would collect water from the Wa'atch River intertidal zone south of the existing tribal center through an underground collection system near the outlet of the Wa'atch River

3.2.3.2 Shellfish

The Washington Department of Health regularly monitors shellfish areas because shellfish tend to accumulate pollutants and generally reflect long-term (chronic) water quality concerns (Ecology 2002). This information supplements the periodic samples Ecology takes at discrete water quality monitoring stations. The state Surface Water Quality Standards also contain criteria to reduce the chance of people becoming ill from eating shellfish or from swimming or wading in waters of the state. Makah Fisheries and the Makah Port Authority also monitor shellfish for contamination. Managers can close shellfish beds to human harvest for two reasons: the presence of human fecal coliforms (typically from failing septic systems) and toxic algal blooms. Fecal coliforms are used as indicators of contamination. Although generally not harmful themselves, they indicate the possible presence of pathogenic (disease-causing) bacteria, viruses, and protozoans that live in the digestive systems of humans and other animals (EPA 1997). Toxins associated with algal blooms include domoic acid, saxitoxin, and gonyautoxin derivatives. These naturally occurring neurotoxins may be harmful if consumed in significant concentrations, which can occur when people eat crabs or shellfish that have accumulated toxins by feeding on toxic algae.

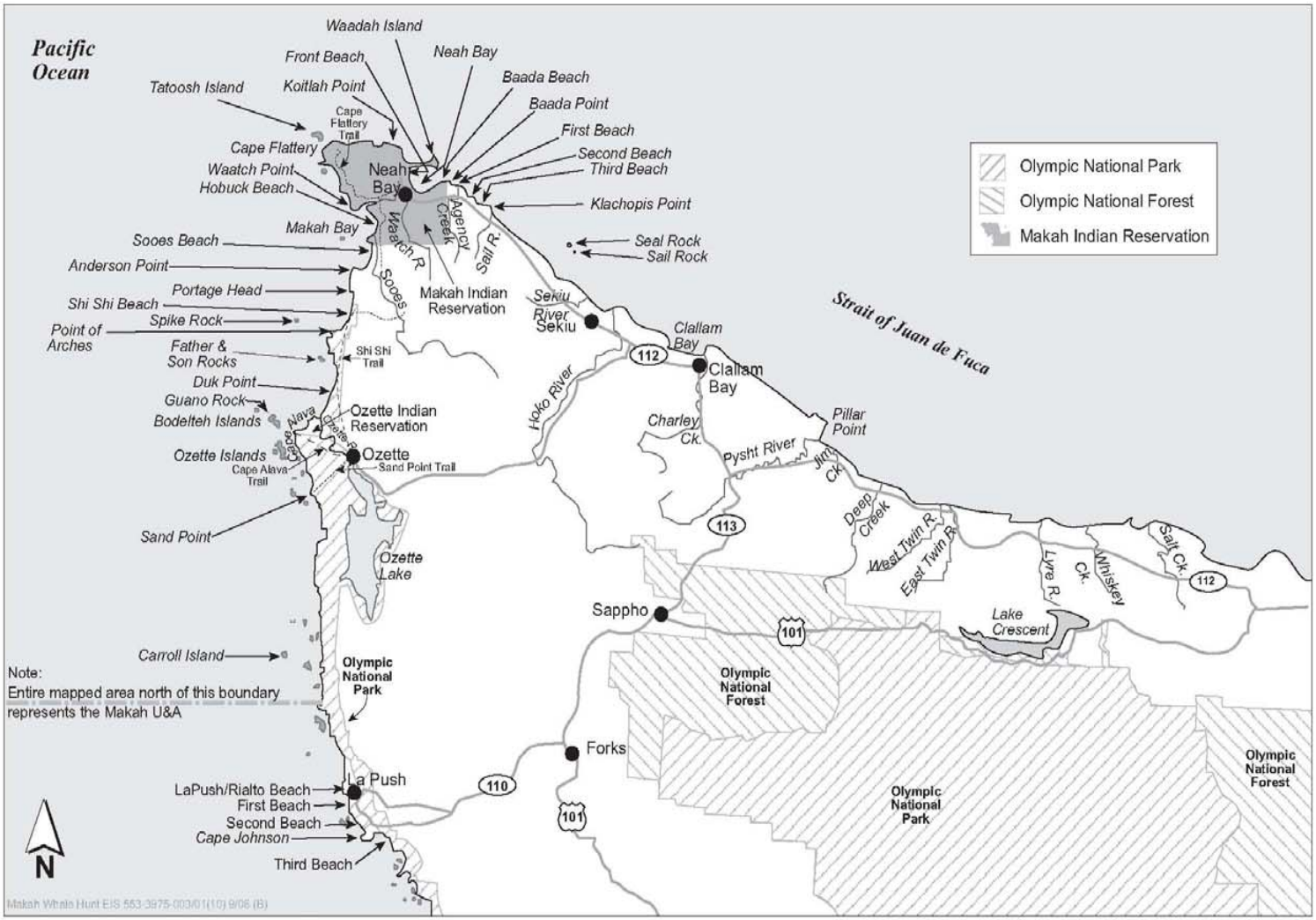


Figure 3-2. Topographic Features of Interest

Neither WDFW nor the Washington Department of Health has identified or mapped any recreational or commercial shellfish beds within the project area along the Pacific Ocean (WDFW 2005a). Subsistence shellfish gathering takes place at Neah Bay, Makah Bay, and other relatively rocky areas on the reservation. Butter clams, steamer clams, and cockles are gathered on the west and east ends of Neah Bay. A horseclam bed occurs on Front Beach, near where the gray whale was landed in 1999. A pilot project by Makah Fisheries Management with geoduck aquaculture is also underway on Front Beach. Additional species, such as mussels, are gathered in intertidal rock areas throughout the reservation. The only commercial activity associated with this gathering is limited local selling.

The Washington Department of Health previously closed shellfish harvesting in the southern portions of Neah Bay due to potential pollution (primarily fecal coliform) associated with a sewer outfall and marina located in this area (Washington Department of Health 2005). By summer 2006, however, most shellfish harvest was open (WDFW 2006a). The Department of Health also recently closed waters along the Pacific Ocean within the project area due to the results of biotoxin tests (Washington Department of Health 2005). In general, the beaches located within the project area are hotspots for algal blooms, at least partially because of the nutrient-rich waters and mixing that occur at the mouth of the Strait of Juan de Fuca (WDFW 2004). Algal blooms are triggered by a complex interaction of environmental conditions, and the duration and timing of closures are difficult to predict.

3.2.3.3 Spill Prevention

The project area includes national and international shipping lanes and is open to recreational boating and commercial and recreational fishing. Wherever marine vessels are present, there is a risk that pollutants from boat emissions and/or spills will enter the water. As discussed above, however, Ecology has not listed any of the waters of the project area as impaired for water or sediment quality parameters; some impairment of marine waters has, however, occurred during major spill events.

Currently several organizations are prepared to respond to emergency spills in Puget Sound, the Strait of Juan de Fuca, and off the Washington coast (Ecology 2003a). These organizations include National Response Corporation Environmental and Marine Spill Response and Clean Sound Cooperative. As part of Ecology's Spill Prevention, Preparedness, and Response Program, it stations a rescue tug in Neah Bay seasonally to assist tankers and cargo ships that are drifting or

need support during bad weather (Ecology 2005b). In general, pollutants (such as hydrocarbons) are associated with gasoline and diesel engines, as well as vessel traffic, and they enter the environment from spills and/or exhaust. Smaller oil spills could occur during fueling and maintenance operations at docks.

The nearshore portion of the Makah U&A corresponds largely with the designated area to be avoided for the OCNMS. This designation is meant to reduce the potential for catastrophic oil spills by encouraging big ships (carrying large amounts of bunker fuel) to avoid the nearshore areas of the coast. While this designated area does not encompass the entire OCNMS, its boundaries protect sanctuary resources most at risk from vessel casualties, while being compatible with existing vessel traffic lanes (Galasso 2000). See Section 3.1.1.1.3, Olympic Coast National Marine Sanctuary, Current Issues, Area to be Avoided, and Section 3.13.2, Transportation, Regulatory Overview.

3.2.3.4 Solid Waste Disposal

There is a landfill at Neah Bay that is used solely by residents and businesses on the Makah Reservation. The facility, which is under the jurisdiction of the Makah Tribal Council, is currently the only landfill in Clallam County that accepts municipal solid waste (Parametrix 2007). In the 1980s, a solid waste management plan for the Makah Reservation recommended closure of the Neah Bay landfill and construction of a transfer station to haul waste to the closest permitted disposal facility (Paul S. Running and Associates 1983). A comprehensive solid waste management plan update prepared for Clallam County indicated that siting a new municipal solid waste landfill in Clallam County is not feasible due to various factors including climate, geography, land use, and the availability of a lower-cost option to export waste (Parametrix 2007). The Makah Tribe has recently obtained funding to design a new transfer station at the site of the Neah Bay landfill and is proceeding with plans to close the landfill (Parametrix 2007).

The two primary generators of animal carcasses in Clallam County are the Humane Society (in Port Angeles) and Battelle Marine Sciences Laboratory (near Sequim). Both organizations use Petland Crematorium in Aberdeen for cremation of animals. Battelle sends hazardous carcasses to Pacific Marine Lab for disposal. The Clallam County Road Department buries roadkill carcasses at remote locations on public lands scattered throughout the county (Parametrix 2007).

3.3 Marine Habitat and Species

3.3.1 Introduction

The marine environment off the coast of Washington is highly energetic, productive, and dynamic, supporting a wide range of invertebrates, fish, and marine wildlife. The ecological importance of the habitat was acknowledged in the OCNMS designation (NOAA 1993). High biological productivity, diversity of habitats, the wide variety of marine mammals and birds living in or migrating through the area, and the presence of endangered and threatened species and essential habitats were identified as some of the biological resources giving the Sanctuary particular value (Section 3.1.1.1, Olympic Coast National Marine Sanctuary, for more detail). The dynamic physical processes and high levels of disturbance experienced along the Washington coast, including the project area, affect ecosystem structure, ecological interactions, and species' recruitment dynamics. Understanding the physical processes in the project area will inform the analysis of potential direct and indirect effects to the ecosystem from activities associated with the proposed hunt.

The description of the marine ecosystem that follows is organized by pelagic environment (open water column) and benthic environment (bottom substrata), identifying physical features and processes and biological resources associated with each environment. ENP gray whales and other marine wildlife in the project area are described in more detail in other sections (Section 3.4, Eastern North Pacific Gray Whale, and Section 3.5, Other Wildlife Species).

3.3.2 Regulatory Overview

The conservation, preservation, and management of marine habitat and biological resources in the project area occur under several statutory and regulatory authorities, the most pertinent of which are detailed below.

Under federally granted Coastal Zone Management Act authority, Ecology administers Washington State's coastal zone management program on the state's shoreline (under the Shoreline Management Act) and waters (under the Aquatic Management Act), except for excluded federal lands (i.e., lands that the federal government owns, leases, holds in trust, or otherwise has sole discretion to determine their use, such as the Olympic National Park coastal strip and the Makah and Ozette Reservations).

Under the National Marine Sanctuaries Act and regulations, marine plants and algae, invertebrates, plankton, and fish are protected and conserved as Sanctuary resources within the

boundaries of the OCNMS. Federal designation and management of the OCNMS and protection of Sanctuary resources by NOAA's National Marine Sanctuaries Program under the National Marine Sanctuaries Act, including protection and management of habitat such as bottom formations and substratum, is described above in Section 3.1.1.1, Olympic Coast National Marine Sanctuary. Federal designation and management of the rocks and islands comprising the Washington Islands National Wildlife Refuges are also described above in Section 3.1.1.2, Washington Islands National Wildlife Refuges.

The Pacific Fishery Management Council and NMFS are the primary federal management authorities for managing and conserving living marine resources, including marine fish and plants, out to 200 miles from shore under the Magnuson-Stevens Act and the North of Falcon planning process. Northwest Indian tribes and WDFW also participate in fisheries management. Under the Magnuson-Stevens Act, NMFS and the Pacific Fishery Management Council also protect habitat identified as essential for commercially important fish species. Essential fish habitat is defined under the Magnuson-Stevens Act as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 USC 1802 Section 3(10)). Regulatory guidelines elaborate that the words 'essential' and 'necessary' mean that essential fish habitat should be sufficient to "support a population adequate to maintain a sustainable fishery and the managed species' contributions to a healthy ecosystem." The Pacific Fishery Management Council describes essential fish habitat in their fishery management plans, minimizes impacts to essential fish habitat resulting from fishing activities, and consults with NMFS about activities that might affect essential fish habitat. The council may use fishing gear restrictions, time and area closures, harvest limits, and other measures to lessen adverse impacts on essential fish habitat. The Magnuson-Stevens Act also encourages NMFS to designate habitat areas of particular concern. These are specific habitat areas, a subset of the much larger area identified as essential fish habitat, that play a particularly important ecological role in the fish life cycle or that are especially sensitive, rare, or vulnerable. Designating habitat areas of particular concern allows the Pacific Fishery Management Council and NMFS to focus their attention on conservation priorities during review of proposals, affords those habitats extra management protection, and gives the fish species within these areas an extra buffer against adverse impacts.

Under the ESA, NMFS and FWS are responsible for the conservation of threatened and endangered species, including fish, wildlife, and plants under their jurisdiction. The agencies are

required to identify and designate critical habitat for threatened and endangered fish and wildlife species under their jurisdictions. 'Critical habitat' is (1) specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and those features may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation. Under Section 7 of the ESA, all federal agencies must ensure that any actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species, or destroy or adversely modify its designated critical habitat. These complementary requirements apply only to federal agency actions, and the latter apply only to habitat that has been designated. A critical habitat designation does not set up a preserve or refuge; it applies only when federal funding, permits, or projects are involved.

3.3.3 Existing Conditions

3.3.3.1 Pelagic Environment

The term 'pelagic' is commonly used in reference to the upper water column of the open ocean that is not in association with the ocean bottom or bathymetric features. The oceanographic processes in the action area are generally large in scale, with ocean circulation driven by a major eastern boundary current system, the California Current System. Local conditions are energetic, dynamic, and affected by oceanographic processes operating across a spectrum of temporal and spatial scales. These physical processes and their pronounced effects on the area's biota are described in the following sections.

3.3.3.1.1 <u>Physical Features and Processes</u>

Large-Scale Ocean Currents

The project area on the Washington coast is situated in an eastern boundary current system where the North Pacific Current divides into the northward flowing Alaska Current and the California Current System to the south (Hickey 1998; Gramling 2000). The California Current System is composed of the California Current, the California Undercurrent, the wintertime Davidson Current, and possibly a subsurface Washington Undercurrent. The relative strength of these currents and their influence on the temperature, salinity, flow, and productivity of the project area varies considerably over seasonal and interannual time scales (Hickey 1998; Hickey and Banas 2003; MacCall et al. 2005). The components of the California Current System are described

below, along with discussion of how they contribute to the dynamic physical environment of the project area.

The California Current extends up to 600 miles offshore and ranges from the Pacific Northwest south to Baja California (Hickey 1979; Miller 1996; Hickey 1998; Burtenshaw et al. 2004). The California Current is a major force in shaping local ecosystems by affecting upwelling, downwelling, and biological production along the Pacific coast (Airamé et al. 2003). Despite being one of the most studied oceanographic systems in the Pacific Ocean, the mechanisms underlying the variability of this meandering current are still obscurely understood and inadequately sampled (Miller 1996). Flow of the California Current is strongest in the summer and early fall and weakest in the winter (Hickey 1998; Gramling 2000; Hickey and Banas 2003). The California Current is strongly affected by seasonal wind forcing (Thomas et al. 2003), and shifts in regional climate can have dramatic effects on its flow (e.g., during El Niño events, the flow of the California Current is unusually weak; Hickey 1979; Gramling 2000). For further description of El Niño events, see El Niño Southern Oscillation Cycle below in this section.

The California Undercurrent is a permanent, relatively narrow (6- to 25-mile), deep subsurface feature that flows northward over the continental slope from Baja California to Vancouver Island (Reed and Halpern 1976; Hickey 1998; Neander 2001). The California Undercurrent transports warm, saline, low-oxygen, equatorial water to the northern Pacific, with strongest northward flows in the summer or early fall and minimum flows in the spring (Hickey 1998; Neander 2001; Hickey and Banas 2003). During El Niño years, when flow of the California Current is weakened, the California Undercurrent is unusually enhanced (Hickey 1979; Gramling 2000).

The Davidson Current is an inshore, seasonal, northward flowing feature that develops when the southward flowing California Current is weaker and situated further offshore. The Davidson Current is approximately 60 miles wide, extends seaward of the continental slope, and transports warm, saline, low-oxygen, high-phosphate, equatorial water to the north (Gramling 2000; Hickey and Banas 2003). The Davidson Current develops along the Washington coast in September, is well established in January, and dissipates by May (Purdy 1990; Hickey and Banas 2003). The strongest flow of the current occurs during the winter months (Hickey and Banas 2003). There is speculation that the Davidson Current is a surface expression of the California Undercurrent (Hickey 1979).

There is some indication that a southward undercurrent, the Washington Undercurrent, occurs over the continental slope of Washington and Oregon in the winter (Werner and Hickey 1983; Purdy 1990). This undercurrent is located 1,000 to 1,600 feet deep, deeper than the northward-flowing California Undercurrent (Hickey 1998; Hickey and Banas 2003).

Dynamic Processes and Variability

Seasonal Variability, Upwelling, and Down-welling

Seasonal variations in the oceanography of the project area occur in response to various forcing events, including solar heating and cooling, wind mixing, freshwater runoff, and coastal upwelling (Brueggeman et al. 1992). The seasonal pattern of the physical environment is typified by periods of intense coastal upwelling (April through September) and periods of relaxed winds (October through March) punctuated by strong winter storms (November to March).

Upwelling is a wind-driven, dynamic process that brings nutrient-rich deep water to the surface and transports nutrient-poor surface waters offshore (Mann and Lazier 1991). During spring and summer, northwesterly winds and the earth's rotation combine to push the surface waters offshore. This, in turn, results in the movement of deeper cold water upward into surface waters, introducing nitrate, phosphate, and silicate nutrients essential for phytoplankton production. Periods of wind relaxation lasting two to six days may alternate with upwelling-favorable conditions during the spring, contributing to dynamic and patchily distributed nutrient availability and productivity. The strongest upwelling in the project area occurs during July and August (Brueggeman et al. 1992; Airamé et al. 2003). Prolonged periods of wind relaxation may occur from late summer to early fall. The timing and intensity of regional upwelling varies from year to year (Huyer et al. 1979; Strub and James 1988) and with changes in long-term climatic phenomena (El Niño Southern Oscillation Cycle and Pacific Decadal Oscillation in this section, below) (Huyer and Smith 1985; Barth and Smith 1997).

In October or November, there is a shift in wind direction that results in predominant winds that flow from the east/southeast (Norman et al. 2004), resulting in the onshore transport of surface waters and the conditions typical of fall and winter that favor downwelling (Hickey 1998). During periods of diminished upwelling or downwelling, the survivorship and reproductive success of planktivorous invertebrates and fishes decrease in response to reduced plankton abundance and productivity (Airamé et al. 2003). Between late November and mid-March, low pressure systems from the Gulf of Alaska generate strong winter storms, southerly winds, and

large waves in the Pacific Northwest (Strub and Batchelder 2002; Airamé et al. 2003). These winter storms create intense vertical mixing, usually persist for only a few days, are important sources of localized oceanographic disturbance.

Eddies and Fronts

During the spring, the large counterclockwise Juan de Fuca Eddy (or Tully Eddy; Tully 1942) develops offshore of northern Washington at the mouth of the Strait of Juan de Fuca (Burger 2003; Hickey and Banas 2003). The eddy forms as a result of the interaction between effluent from the Strait of Juan de Fuca, southward wind-driven currents along the continental slope, and the bathymetry of the region (Hickey and Banas 2003). At its maximum, the eddy has a diameter of approximately 30 miles, and it is the dominant circulation pattern off northern Washington until its decline in the fall (Freeland and Denman 1982; Hickey and Banas 2003). The eddy upwells deep, cold, nutrient-rich water into surface waters, resulting in locally enhanced biological productivity (Freeland and Denman 1982; Thomson et al. 1989; Freeland 1992).

Ephemeral eddies and offshore filaments of variable duration (days, weeks, months, years) are also generated by meanders of the California Current, bathymetric features, and coastal upwelling events. Such ephemeral features are most common during summer and fall in the California Current System (Huyer et al. 1998; Barth et al. 2000; Strub and James 1988; Ressler et al. 2005). As with the Juan de Fuca Eddy, ephemeral counterclockwise eddies stimulate enhanced productivity by drawing cooler, nutrient-rich waters to the surface, while clockwise eddies are associated warmer, nutrient-poor, and less productive conditions. Ephemeral eddy-like features are also generated by the Columbia River plume (Columbia River Plume below in this section) (Yankovsky et al. 2001; Berdeal et al. 2002). Subsurface eddies are generally observed within and overlying submarine canyons off the Pacific coast (Hickey and Banas 2003), providing an effective mechanism for locally increased productivity and the suspension of sediment and organic detritus over these features (Hickey 1995).

Oceanic 'fronts' are zones of high water property gradients (e.g., gradients in temperature, salinity, and nutrients). Ephemeral fronts often exist at the interface between upwelled water and ambient coastal water, and the onset and relaxation of upwelling may result in the cross-shelf transport of planktonic organisms associated with these gradients. Persistent fronts tend to occur regularly at certain locations along the coast (e.g., capes and points) and may extend 60 miles

offshore (Short 1992). Ephemeral fronts generated off of Vancouver Island may extend southward off of the Washington coast near the project area (Freeland and Denman 1982).

Columbia River Plume

The Columbia River plume, through its influence on sea surface salinity, has a major effect on the coastal oceanography of the Pacific Northwest, including the project area. In general, salinity increases southward along the Pacific coast (Hickey and Banas 2003). However, the low-salinity plume of freshwater discharge from the Columbia River constantly changes direction, depth, and width in response to variation in discharge and fluctuations in local wind strength and direction (Hickey et al. 1998; Berdeal et al. 2002; Hickey and Banas 2003). In spring and summer, the plume moves southward, well offshore of the Oregon shelf (Hickey and Banas 2003) and has no influence on the coastal oceanography of the project area. During the winter, however, the plume flows northward and can generate local currents with magnitudes on the order of wind-driven currents in the near-surface layer (Hickey et al. 1998). In addition to seasonal variability, the structure and magnitude of the Columbia River plume has significant interannual and long-term variability (Hickey and Banas 2003). For example, in years of high snowmelt in the Pacific Northwest, freshwater generated from the plume can influence coastal oceanography for prolonged periods.

El Niño Southern Oscillation Cycle

El Niño Southern Oscillation events (including both El Niño and La Niña events) produce extreme interannual anomalies in global climate, atmospheric circulation, and oceanographic processes (Jacobs et al. 1994; Schwing et al. 1996). El Niño Southern Oscillation conditions typically last 6 to 18 months, although they can persist for longer periods (Barber and Chavez 1983; Lynn et al. 1998; Durazo et al. 2001; Schwing et al. 2002a; Schwing et al. 2002b). El Niño conditions occur when unusually high atmospheric pressure develops over the western tropical Pacific and Indian Oceans, and low sea level pressures develop in the southeastern Pacific (Trenberth 1997; Conlan and Service 2000). The trade winds consequently weaken in the central and west Pacific, reducing the normal east to west surface water transport. Upwelling along South America decreases, resulting in shoaling of the thermocline, increased sea surface temperatures, and diminished productivity across the mid to eastern Pacific (Donguy et al. 1982). Rainfall patterns also shift eastward across the Pacific, resulting in increased (sometimes extreme) rainfall across the southern United States and Peru (Conlan and Service 2000). La Niña is the opposite

phase of El Niño in the El Niño Southern Oscillation Cycle. La Niña is characterized by strong trade winds that push the warm surface waters back across to the western Pacific (Schwing et al. 2000). Under these conditions there is increased upwelling along the eastern Pacific coastline, the thermocline in the eastern Pacific becomes shallower, and there is increased upwelling and productivity.

Although the direct effects of El Niño Southern Oscillation events are observed in the equatorial latitudes, significant correlations exist between the climate of the Pacific Northwest and El Niño/La Niña events (e.g., Pulwarty and Redmond 1997; Cayan et al. 1999). In the Pacific Northwest, El Niño events are characterized by increases in ocean temperature and elevated sea level (4 to 12 inches), enhanced onshore and northward flow, and reduced coastal upwelling (Crawford et al. 1999; Smith et al. 1999; Freeland 2000; Airamé et al. 2003). Historically, the region was impacted by strong El Niño events in 1940, 1958, 1983, 1992, 1997 to 1998, and 2004 to early 2005 (Hayward 2000; Lyon and Barnston 2005). The 1997 to 1998 El Niño was one of the largest ocean perturbations in the historical record, inducing a 4-degree to 5-degree Fahrenheit (F) warming of sea surface temperatures over the historical average and profoundly affecting the productivity and marine ecology of the region (Castro et al. 2002; Airamé et al. 2003; Childers et al. 2005; Zamon and Welch 2005). This El Niño was immediately followed by an equally strong, cold La Niña event in 1999. For the ENP gray whale, Section 3.4.3.3, Distribution and Habitat Use, discusses the effect of oceanic climatic cycles, including El Niño/La Niña events, on gray whale distribution and habitat use; Section 3.4.3.4.2, Stranding Data, discusses the potential relationship between the 1997 and 1998 El Niño events and the ENP gray whale unusual mortality event.

Pacific Decadal Oscillation

The Pacific Decadal Oscillation is a long-term (approximately every 20 to 30 years) climatic pattern correlated with alternate regimes of sea surface temperature, surface winds, and sea level atmospheric pressure (Mantua 2002; Mantua and Hare 2002). The Pacific Decadal Oscillation is often described as a long-lived, El-Niño-like pattern of Pacific climate variability with both warm and cool phases (Mantua 2002; Mantua and Hare 2002; Airamé et al. 2003; Minobe et al. 2004). There are, however, noteworthy distinctions between the Pacific Decadal Oscillation and El Niño Southern Oscillation-induced events: (1) Pacific Decadal Oscillation regimes can persist for 20 to 30 years, in contrast to the comparatively shorter duration of El Niño Southern Oscillation events

(typically up to 18 months) (Minobe 1997; Minobe 1999; Hare and Mantua 2000; Mantua and Hare 2002); (2) the ecosystem effects of the Pacific Decadal Oscillation are more pronounced in temperate latitudes (Hare and Mantua 2000); and (3) the mechanisms controlling the Pacific Decadal Oscillation are unknown, while those underlying El Niño Southern Oscillation variability have been well resolved (Mantua and Hare 2002). During warm Pacific Decadal Oscillation regimes, the western and central North Pacific Ocean typically exhibit cold sea surface temperature anomalies, while the eastern Pacific (including the project area) exhibits above-average temperatures and reduced productivity. The opposite conditions exist during cool Pacific Decadal Oscillation regimes. The Pacific Decadal Oscillation has been correlated with markedly different regimes of Columbia River discharge (Mantua et al. 1997), ocean productivity, zooplankton species composition, and forage fish and salmonid recruitment in the Pacific Northwest (e.g., Hare et al. 1999; Tanasichuk 1999; Botsford 2001; Mueter et al. 2002; Gustafson et al. 2006). The Pacific Decadal Oscillation regime shifts are abrupt, with observed shifts occurring in 1925, 1947, and 1977 (Hare 1996; Minobe 1997). The most recent shift, from a warm to a cool phase, occurred in 1998 (Airamé et al. 2003; Peterson and Schwing 2003; Childers et al. 2005; Gómez-Gutiérrez et al. 2005). For the ENP gray whale, Section 3.4.3.3, Distribution and Habitat Use, discusses the effect of oceanic climatic cycles, including the Pacific Decadal Oscillation, on gray whale distribution and habitat.

3.3.3.1.2 Biological Resources

Phytoplankton

The biological productivity and composition of the project area is best characterized as diverse, variable, and patchily distributed owing to the dynamic physical processes described above which vary across a spectrum of temporal and spatial scales. Phytoplankton (freely floating photosynthetic organisms) are responsible for the bulk of the primary production in the ocean (the conversion of inorganic carbon to organic matter) and form the basis of the pelagic ecosystem. The distribution and concentration of phytoplankton are affected by ocean currents, vertical mixing, and the rate of photosynthesis. The intensity and quality of light, the availability of nutrients, and seawater temperature all influence rates of photosynthesis (Valiela 1995). The Pacific Northwest coast supports high phytoplankton production, stimulated by the upwelling of nutrient-rich waters and retention of phytoplankton by local oceanographic currents and bathymetric features (Sutor et al. 2005). In general, the Washington coast experiences two seasonal peaks in phytoplankton production; the first occurs from February to April, and the

second occurs in October. There is, however, considerable spatial and temporal variability in the production and distribution of phytoplankton caused by the physical oceanographic processes described above. For example, during an El Niño event, less upwelling occurs along the Pacific Northwest, fewer nutrients are available for phytoplankton growth, and phytoplankton concentration may decrease by as much as 70 percent compared to an average year (Wheeler and Hill 1999; Thomas and Strub 2001).

In addition to controlling the distribution and concentration of phytoplankton, physical oceanographic processes also affect the species and size composition of phytoplankton in the water column. For example, the onset and relaxation of upwelling events result in dramatic shifts in the phytoplankton community within the California Current System. Newly upwelled water along the shelf is composed chiefly of high concentrations of large, chain-forming diatoms. Following upwelling events, the phytoplankton community is predominantly composed of reduced concentrations of small phytoplankton species (less than 5 microns in size) (Sherr et al. 2005) better adapted to survival in low-nutrient conditions. Similarly, during low productivity conditions induced by El Niño events, 80 to 90 percent of the phytoplankton community along Pacific Northwest shelf waters consists of these smaller phytoplankton species (Corwith and Wheeler 2002; Sherr et al. 2005).

Zooplankton

Zooplankton are a taxonomically diverse group of organisms that consume phytoplankton (as well as other zooplankton). Juvenile crabs (megalopae), copepods, amphipods, euphausiids, and chaetognaths tend to dominate the near-surface zooplankton community (Peterson 1997; Reese et al. 2005; Swartzman et al. 2005). The distribution of zooplankton along the coastline can be described as spatially and temporally patchy, reflecting the variable concentration and distribution of phytoplankton prey, as well as the underlying dynamic physical environment (Reese et al. 2005; Ressler et al. 2005). The highest zooplankton concentrations typically are found within 90 miles of the coastline (Swartzman and Hickey 2003; Ressler et al. 2005; Swartzman et al. 2005) in the upper 66 feet of the water column over the inner and mid shelf (Peterson and Miller 1975; Peterson and Miller 1977). Zooplankton densities along the Pacific Northwest are highly seasonal, with summer densities ten times greater than those observed during the winter months (Burger 2003; Reese et al. 2005). Copepods form the largest fraction of the zooplankton biomass. Although smaller copepods are numerically dominant (e.g., *Acartia* spp.), larger copepods

comprise most of the zooplankton biomass (e.g., *Calanus* spp.) (Strickland 1983) and tend to feed on the diatoms that dominate under upwelling conditions. Euphausiids, amphipods, and mysids are also important components of the zooplankton assemblage (Strickland 1983). Ephemeral, seasonal, interannual, and interdecadal physical oceanographic processes (described above) largely control the abundance, distribution, and species composition of zooplankton in the region (e.g., Batchelder et al. 2002; Botsford 2001; Peterson 1999; Peterson and Miller 1977; Peterson and Keister 2003; Tanasichuk 1999).

Fish and Invertebrates

The productivity of the project area is strongly affected by the California Current System and the dynamic physical oceanographic processes inducing variability within the California Current System, as noted in previous discussions. The high productivity of the region produces a diverse plankton community that, in turn, supports a large assemblage of pelagic marine fish and invertebrates dependent upon this spatially and temporally patchy planktonic food supply (e.g., diatoms, dinoflagellates, copepods, euphausiids, and other organisms). Marine fish and invertebrate species associated with the pelagic environment include coastal pelagics, salmonids, and highly migratory species (Table 3-1). Various physical features within the project area such as ocean currents, upwelling, the Columbia River plume, fronts, and eddy features influence the distribution and abundance of pelagic prey species, as well as that of their fish and invertebrate predators (Doyle 1992; Dower and Perry 2001; Nasby-Lucas et al. 2002; Williams and Ralston 2002; Bosley et al. 2004; Emmett et al. 2004; Emmett et al. 2006). The distribution and abundance of pelagic fish and invertebrate species also are profoundly affected by inter-annual and inter-decadal climatic variations such as El Niño/La Niña or Pacific Decadal Oscillation (Hickey 1993). For example, dramatic changes in species assemblages were observed during extreme El Niño/La Niña years (1998 to 2002) off northern Washington State to central Oregon. The pelagic community shifted from one dominated by southern species (mackerels and hake) to one dominated by northern species (squid, smelts, and salmon), with the small pelagic species (sardines, herring, and anchovy) showing no consistent trends in abundance over this time (Brodeur et al. 2005).

Coastal Pelagic Species

The coastal pelagic species in the project area include four finfish species (Pacific sardine, *Sardinops sagax*; Pacific [chub] mackerel, *Scomber japonicus*; northern anchovy, *Engraulis*

mordax mordax; and jack mackerel, *Trachurus symmetricus*) and market squid (*Loligo opalescens*) (NOAA 1993; Pacific Fishery Management Council 2003a; Table 3-1). The distribution of coastal pelagic species typically depends on water temperature, but can vary both annually and seasonally (Pacific Fishery Management Council 2005a). For many of these species, occupancy zones may vary by life-history stage.

TABLE 3-1. ASSOCIATIONS AND TIMES OF OCCURRENCE FOR PELAGIC AND BENTHIC SPECIES POTENTIALLY PRESENT IN THE PROJECT AREA.

FISH	TYPICAL HABITAT	TIME OF OCCURRENCE
Coastal Pelagic Species		
Sardine/anchovy/herring	Pelagic (open water) schooling fish	Winter-summer
Mackerel	Pelagic, schooling fish	Spring-summer
Squid	Pelagic, shelf zone	Spring-summer
Salmon		
Pacific salmon and steelhead	Pelagic, nearshore, upwelling areas	Year-round
Sea-run bull and cutthroat trout	Pelagic, nearshore, upwelling areas	Fall through winter (returning adults); spring (juvenile outmigrants)
Highly Migratory Species		
Tuna	Pelagic, shelf and slope	Year-round
Shark	Pelagic, nearshore, upwelling areas	Year-round
Groundfish		
Rockfish	Demersal (on or near the bottom), nearshore, shelf, and slope rocky areas	Year-round
Thornyhead	Demersal, shelf or slope, soft-bottom areas	Year-round
Flatfish	Demersal, nearshore/shelf, and slope sandy, muddy, or gravelly bottoms	Year-round
Gadid	Pelagic/semipelagic, nearshore, and shelf in large inlets	Year-round
Shark	Pelagic, nearshore and shelf	Year-round
Skate	Demersal, shelf, mud or sand substrate	Year-round
Lingcod and cabezon	Demersal, nearshore, rocky, or steep slopes	Year-round
Sablefish	Demersal, shelf slope, sand, mud, or clay substrate	Year-round
Green sturgeon	Demersal, shelf slope, sand, mud, or clay substrate	Summer
Other Demersal Species		
Halibut	Demersal, shelf, sand, and gravel substrate	Year-round
Crustaceans: myssids, euphaussids, amphipods	Nearshore, sand/mud substrate	Year-round
Crab	Nearshore, sand/mud substrate	Year-round

The Pacific Fishery Management Council and NMFS identified essential fish habitat for coastal pelagic species based on the temperature range where the fish occur and on the geographic area where they are present at any particular life stage. This range varies widely according to ocean temperature. Identifying essential fish habitat for coastal pelagic species is also based on where these species have been observed in the past and where they may occur in the future.

The east-west boundary of essential fish habitat for coastal pelagic species includes all marine and estuary waters from the coasts of California, Oregon, and Washington to the limits of the EEZ and above the thermocline (Pacific Fishery Management Council 2006). A thermocline is the depth where water temperature changes relatively rapidly and separates less dense, warmer waters from denser, colder waters. Surface temperatures above the thermocline exhibit considerable variability, ranging from 50 to 79 degrees F. The northern essential fish habitat boundary is defined as the position of the 50-degree F isotherm, which varies seasonally and annually. The 50-degree F isotherm is a rough estimate of the lowest temperature where finfish are found; thus, it represents their northern boundary. In years with cold winter sea surface temperatures, the 50-degree F isotherm during February is around 43 degrees north latitude in the offshore zone and slightly farther south along the coast. In August, this northern boundary moves up to Canada or Alaska (Pacific Fishery Management Council 2006). Therefore, the northern extent of essential fish habitat for coastal pelagic species likely occurs south of the project area in winter. During spring and summer months, with the northward migration of the 50-degree F isotherm, essential fish habitat likely occurs within the project area.

Salmonid Species

All Pacific salmonid species exhibit varying forms of anadromy (they spend their early life stages in freshwater, migrate to the ocean to grow and mature, and return to freshwater as adults to reproduce). For further information on the life history and behavioral ecology of Pacific salmonid species, see Groot and Margolis (1991) and Emmett et al. (1991). Twenty-six population groups of West Coast salmon and steelhead (*Oncorhynchus* spp.) are currently listed as threatened (21) or endangered (5) under the ESA. Steelhead in Puget Sound were also recently proposed for listing as threatened (71 FR 15666, March 29, 2006). Threatened bull trout populations occur in major coastal rivers of Washington (64 FR 58913, November 1, 1999); although limited data exist regarding the distribution of bull trout in marine waters, they are known to migrate between

these rivers and are expected to occur occasionally in the project area (U.S. Fish and Wildlife Service 2004). Although some of the ESA-listed species noted above might occur in the project area, there is no designated critical habitat within the project area, except for the freshwater habitat areas used by threatened Ozette Lake sockeye salmon. The depressed production of many West Coast salmonid stocks, particularly the ESA-listed stocks, is due to a combination of factors, including freshwater habitat degradation and unfavorable ocean conditions during the 1990s. The population sizes of some of these salmonid species have increased in recent years, presumably in part due to improved ocean survival conditions (Pacific Fishery Management Council 2003b). As noted above, run sizes of salmonid stocks over decadal time scales appear to be strongly affected by the Pacific Decadal Oscillation ocean climate cycle. Salmonid species are also influenced by El Niño events, with the effect depending on the preferred water depth of the given species. Salmon that prefer more shallow habitats, such as coho, are more likely to be affected by El Niño than other salmon species, such as Chinook (Pacific Fishery Management Council 2003b).

The Pacific Fishery Management Council and NMFS identified essential fish habitat for salmon in estuaries and marine areas extending from the shoreline to the 200-mile limit of the EEZ and beyond. In freshwater, salmon essential fish habitat includes all lakes, streams, ponds, rivers, wetlands, and other bodies of water that have been historically accessible to salmon (Pacific Fishery Management Council 2006). The Pacific Fishery Management Council may use gear restrictions, time and area closures, and harvest limits to reduce negative impacts on salmon essential fish habitat. Salmon essential fish habitat occurs throughout the year in the project area.

Highly Migratory Species

Highly migratory species include tuna, billfish, and sharks. These species exhibit a wide-ranging distribution throughout the Pacific Ocean and are not typically associated with the specific substrata or benthic habitats (e.g., kelp forests or rocky substrata). Rather, their distribution often reflects large-scale oceanographic features with preferred levels of physical characteristics (for example, temperature, salinity, and oxygen), or concentrations of preferred prey (Pacific Fishery Management Council 2003a).

For a general description of gray whale feeding on pelagic prey, see Section 3.4.3.1.3, Feeding Ecology and Role in the Marine Ecosystem. For a description of variable and dynamic gray whale habitat use and distribution in the project area related to pelagic prey distribution and climatic and

ocean condition variability, see Section 3.4.3.3.1, Summer Range Distribution and Habitat Use, Southern Portion of the Summer Range.

3.3.3.2 Benthic Environment

3.3.3.2.1 Physical Features and Processes

Substrata

Nearshore Habitats

As with the pelagic environment, nearshore benthic habitats are dynamic environments subject to energetic disturbances from climatic, oceanographic, and terrestrial processes. Nearshore habitat characteristics and species composition are strongly influenced by the dominant forms of marine algae, tidal range, depth, and type of substrate (Proctor et al. 1980). The nearshore habitats in the project area are composed of rocky shores, sandy beaches, and gravel beaches (Department of the Navy 2006). These habitats can be divided into several vertical zones: the splash zone, the upper intertidal zone (submerged for a short time and exposed to the widest range of temperatures), the mid-littoral zone (alternately submerged and exposed for moderate periods of time), the swash zone (submerged for approximately 12 hours per day), the low intertidal zone (exposed for brief periods of time during the lowest tides), and the subtidal zone (substrata below the lowest tides that are always submerged). These vertical zones reflect the intensity of the physical forces affecting nearshore habitats and structuring the ecosystems that inhabit them.

Coastal Benthos

The continental shelf off the project area varies from 15 to 40 miles wide, including habitats of hard and soft substrata. Beyond the depths of kelp beds (more than 100 feet), approximately 3 percent of the sea floor consists of hard-bottom substrata (Department of the Navy 2006). Hard-bottom habitats may be composed of bedrock, boulders, cobble, or gravel.

The Columbia River is a major source for sediment for soft-bottom habitats along the Pacific coastline. The sediment is initially deposited near the mouth of the Columbia River. As winter storms pass through the Pacific Northwest much of this sediment is transported northward along the coast resulting in a 30-foot-thick deposit of silt overlying the Washington continental shelf (Hickey and Banas 2003). Offshore soft-bottom habitats are composed primarily of silt and mud with sandy areas occurring closer to the coastline.

Submarine Canyons

The otherwise smooth bathymetry along the project area is broken by two submarine canyons, the Juan de Fuca and Quinault canyons, running perpendicular to the shore (Strickland and Chasan 1989). These habitats are dynamic, highly productive, and complex ecosystems. Submarine canyons facilitate locally increased upwelling, high nutrient availability, and vigorous productivity (Freeland and Denman 1982; Hickey *in press*). Submarine canyons are also sites of accumulation for organic debris from drift macroalgae, surfgrass, and plankton detritus produced in surface waters. The complex habitat structure of submarine canyons (such as vertical cliffs, ledges, talus, cobble and boulder fields, and soft sediments) also provides cover for numerous fish and invertebrate species.

Dynamic Processes and Variability

Nearshore community structure and species composition in rocky tidal and beach habitats are principally determined by the frequency and magnitude of physical disturbances (Sebens 1987), intense intra- and inter-specific competition and predation (Connell 1978; Paine 1969; Robles and Desharnias 2002), and highly variable recruitment dynamics (Gaines and Roughgarden 1985; Menge and Sutherland 1987; Roughgarden et al. 1988). These nearshore habitats and the organisms that inhabit them are subjected to nearly constant and intense physical agitation and disturbance (Proctor et al. 1980; Airamé et al. 2003) from wind, waves, tides, temperature, desiccation, sediments, and sand scouring. Despite some protection from offshore islands, submarine ridges, projecting headlands, and large offshore kelp beds, the coast of the project area is subject to strong wave action even in calm weather.

Soft substrata habitats of the coastal benthos are structured by depth gradients in temperature, disturbance by storms and wave action, and movement and accumulation of sediments (Maragos 2000). Submarine canyons that indent the Washington coastal shelf, such as the Juan de Fuca and Quinault canyons in the project area, facilitate locally increased upwelling and nutrient availability in nearshore areas (Freeland and Denman 1982; Hickey *in press*). Turbidity currents associated with submarine canyons represent episodic disturbance events that serve as major conduits for sediment transport to the deep sea. These turbidity currents erode canyon walls, transport loose sediments and detrital material, and represent significant disturbance events structuring infaunal communities associated with submarine canyons (Vetter and Dayton 1998; Vetter and Dayton 1999).

3.3.3.2.2 Biological Resources

Marine Algae, Marine Plants, and Associated Biota

Surfgrass (*Phyllospadix* spp., and associated macroalgae) and kelp (bull kelp *Nereocystis* sp., giant kelp *Macrocystis* sp., and other brown algae) communities are associated with the rocky nearshore habitats. Surfgrass (*Phyllospadix* spp.) is an aquatic plant species present in rocky subtidal and intertidal habitats with high wave exposure. Surfgrass occurs from the intertidal zone to 23 feet deep (Ramírez-García et al. 2002), exhibits very high rates of production (Proctor et al. 1980), and hosts a diverse community of invertebrates and fishes. Kelp communities are found 6 to 200 feet deep (Rodriguez et al. 2001) and can persist in areas subject to severe wave action and tidal currents. The overlying canopies, understory, turf, and corraline algae layers of kelp forests provide essential refuge, forage, and nursery habitats for associated algal, invertebrate, and fish communities (Proctor et al. 1980; Rodriguez et al. 2001). Kelp forests also provide an important food resource for inhabitants of soft and rocky benthic habitats, submarine canyons, deep channel basins, sandy and gravel beaches, rocky shores, and coastal lagoons (Airamé et al. 2003). Several marine mammal species, including sea otters and gray whales, forage and find refuge from predators in kelp forests (Cummings and Thompson 1971; Deysher et al. 2002; Nerini 1984). Kelp forests exhibit extremely high rates of primary production, growing up to 4 inches per day. Temperature, light, sedimentation, substrate, relief, wave exposure, nutrients, salinity, and biological factors (i.e., grazing, competition with other species) determine the distribution and abundance of kelp (Graham 1997). The highest densities are found on moderately low relief rocky substrata with moderate to low sand coverage (Deysher et al. 2002), while areas with very low relief and abundant sand are less favorable to persistent stands of kelp (Foster and Schiel 1985; Graham 1997). In addition to the primary habitat that kelp forests provide, they also provide secondary habitat for juvenile fishes, invertebrates, and seabirds in the form of drifting rafts of detached kelp.

Infaunal, Benthic, and Epibenthic Organisms

Rocky benthic subtidal habitats support extensive communities of benthic marine algae and invertebrates, as well as demersal invertebrates (e.g., mysiids and euphausiids) living in close association with the sea floor (see previous description of marine algae ecosystems). Sessile benthic invertebrates in these habitats are subject to less severe physical agitation and disturbance than in rocky intertidal habitats. As with intertidal communities, however, intense intra- and inter-

specific competition and predation, along with highly variable recruitment dynamics, are principal forces in structuring the abundance, composition, and variability of these communities.

Soft-bottom subtidal habitats also support a rich diversity of infaunal invertebrates, including amphipod crustaceans, echinoderms, and polychaete worms, as well as highly motile epibenthic invertebrate species (such as dungeness crab). Benthic infauna are organisms that live in the sediments by attaching to the soft substratum, dwelling in tubes, or burrowing through the sediments. Infaunal communities are often used as baselines for ecological assessments because they tend to exhibit more stable species composition and population dynamics than more mobile epifaunal assemblages such as crabs or bottom fish. This apparent stability is, however, subjected to considerable physical disturbance and variability and should not be interpreted to reflect a static environment. Soft-bottom benthic habitats along the Washington coast, including the project area, are productive biological environments influenced by a variety of complex physical processes (Braun 2005). The major short-term processes that affect infaunal communities include tidal-, wind-, and wave-induced turbulence, currents, sedimentation from the Columbia River plume and local rivers, storms, and variability in food availability associated with upwelling and plankton blooms. The infauna that inhabit this environment are adapted to these high-energy environments with high sediment deposition, erosion, and sediment transport. Large storms with large waves, large freshwater outputs from the Columbia River and other rivers, and semi-diurnal tides act to suspend sediments and organic particulates. The organisms that inhabit these constantly shifting substrata tend to be highly motile rapid burrowers, rapid tube builders, or rapid colonizers with regular recruitment. Seasonal and interannual variability in the species composition and abundance of infaunal communities off the Washington coast is considerable, particularly at inshore locations influenced by sediment movement due to winter storms and river outfalls (Richardson et al. 1977). In summary, benthic soft-bottom habitats are subject to frequent high-intensity disturbances and are inhabited by infaunal communities of opportunistic colonizers exhibiting strong seasonal variability and spatial patchiness (Richardson et al. 1977; Oliver et al. 1980; Hancock 1997).

For a general description of gray whale feeding on benthic prey, see Section 3.4.3.1.3, Feeding Ecology and Role in the Marine Ecosystem. For a description of gray whale benthic feeding in the northern portion of the summer range, see Section 3.4.3.3.1, Summer Range Distribution and Habitat Use, Northern Portion of the Summer Range. For a description about gray whale benthic

feeding occurring in the project area, see Section 3.4.3.3.1, Summer Range Distribution and Habitat Use, Southern Portion of the Summer Range.

Groundfish

Benthic habitats along the continental shelf support a large biomass of demersal (bottom-dwelling) groundfishes (Dark and Wilkins 1994). Adult groundfish species (e.g., rockfish, *Sebastes spp*.; sablefish, *Anoplopoma fimbria*; Pacific hake/whiting, *Merluccius productus;* spotted ratfish, *Hydrolagus colliei*; and spiny dogfish, *Squalus acanthius*) typically are associated with hard substrata of offshore reefs, banks, and submarine canyons. As with pelagic species, physical oceanographic processes such as currents, upwelling, the Columbia River plume, fronts, and eddy features influence the distribution and abundance of groundfish species (Doyle 1992; Dower and Perry 2001; Nasby-Lucas et al. 2002; Williams and Ralston 2002; Bosley et al. 2004; Emmett et al. 2004; Emmett et al. 2006). The groundfish community in the Pacific Northwest also exhibits a strong depth gradient in species composition and diversity (Tolimieri and Levin 2006). Many groundfish species produce pelagic larval and juvenile life stages, which generally float or swim near the sea surface and may be associated with floating debris such as kelp rafts. Pelagic larval and juvenile life stages are widely dispersed by storms, upwelling events and ocean currents and have limited associations with specific nearshore or benthic habitats (NOAA 1993). Older life stages, however, exhibit stronger habitat associations based on specific zones, depths, or substrate characteristics. Other groundfish species may exhibit seasonal migrations, resulting in an annual variation in habitat preferences (NMFS 2005a). The distribution, abundance, and recruitment of groundfish species is also strongly affected by climatic/oceanographic variability such as El Niño events. During periods of El Niño there is an overall northward shift of tropical and temperate species (Cross 1987; Cross and Allen 1993). Rockfish are particularly sensitive to El Niño, demonstrating a decline in overall biomass as a result of recruitment failure and reduced growth of adults as poor overall condition in the region becomes evident (Lenarz et al. 1995; Moser et al. 2000).

With respect to conservation status, nine West Coast groundfish species occurring in the project area are designated as overfished under the Magnuson-Stevens Act (NMFS 2005a) (an overfished species is defined as a population below 25 percent of its natural [unfished] population size). These species are darkblotched rockfish (*Sebastes crameri*), bocaccio (*S. paucispinis*), cowcod (*S. levis*), widow rockfish (*S. entomelas*), canary rockfish (*S. pinniger*), yelloweye rockfish (*S.

ruberrimus), Pacific Ocean perch (*S. alutus*), lingcod (*Ophiodon elongatus*) and Pacific hake/whiting (NMFS 2005a). Lingcod has been rebuilt to above 40 percent of its unfished level (NMFS 2005a). The Pacific Fishery Management Council and NMFS have established the Yelloweye Rockfish Conservation Area in the project area to limit the incidental catch of this overfished species. The following groundfish species are designated as emphasis species (species in need of ongoing conservation efforts and noted for their importance to commercial and recreational fisheries): sablefish, Dover sole (*Microstomus pacificus*), English sole (*Paraphrys vetulus*), Petrale sole (*Eopsetta jordani*), arrowtooth flounder (*Atheresthes stomias*), chilipepper rockfish (*S. goodei*), yellowtail rockfish (*S. flavidus*), black rockfish (*S. melanops*), longspine thornyhead (*Sebastolobus altivelis*), shortspine thornyhead (*S. alascanus*), and cabezon (*Scorpaenichthys marmoratus*) (NMFS 2005a). NMFS also recently listed North American green sturgeon (*Acipenser medirostris*) spawned in the Sacramento River (California) as threatened under the ESA (71 FR 17757, April 7, 2006). Although there are limited data concerning the marine distribution of this species, it too, may occur in the project area.

Essential fish habitat has been designated by the Pacific Fishery Management Council and NMFS for groundfish in the project area. A comprehensive description of essential fish habitat off the coast of Washington is available in the Final Groundfish Essential Fish Habitat EIS (NMFS 2005a). In addition to designating essential fish habitat for groundfish, NMFS also recently identified habitat areas of particular concern. Habitat areas of particular concern include seagrass, canopy kelp, rocky reef, and estuaries along the Pacific coast, including the project area (NOAA 2006).

3.4 Eastern North Pacific Gray Whale

3.4.1 Introduction

Any Makah whale hunt would target ENP gray whales. The status, population structure, distribution, and habitat use of the gray whale are relevant when analyzing the effects of any hunt on the population and on whales that migrate through or stop to feed in the waters off the Washington coast. It is also important to establish information to analyze and understand how an individual gray whale may be affected by a hunt.

3.4.2 Regulatory Overview

The regulatory information presented for the MMPA and WCA in Chapter 1, Section 1.2, Legal Framework, describes the statutory and regulatory processes that apply to the Makah's proposal.

The regulatory information in this section describes substantive requirements of the MMPA and WCA, and as well as their implementing regulations.

3.4.2.1 Marine Mammal Protection Act Management

NMFS has jurisdiction over cetaceans and most other marine mammals (e.g., walruses and sea otters are under the jurisdiction of the FWS) under the MMPA, the primary federal law governing marine mammal conservation and protection in the United States (Section 1.2.3, Marine Mammal Protection Act, for more details about the Act). Because an understanding of NMFS' management scheme for marine mammal populations is key to understanding the agency's management of ENP gray whales, some basic principles of marine mammal management are described below. More information about NMFS' management of marine mammal stocks in general is available in the annual stock assessment reports submitted to Congress, found online at http://www.nmfs.noaa.gov/pr/sars/.

3.4.2.1.1 Defining Marine Mammal Population Parameters

Optimum Sustainable Population — OSP

NMFS (and the FWS for walrus, polar bears, sea otters, and manatees) receives general management direction from Congress through Section 2 of the MMPA. Congress has specified that the primary objective of marine mammal management under the MMPA is to maintain the health and stability of the marine ecosystem and has directed agencies to manage, whenever consistent with this primary objective, in a manner to obtain an optimum sustainable population (OSP) of marine mammal stocks (16 USC 1361(6)). OSP was adapted from the concept of maximum sustained yield used in fisheries management and large whale harvest management in the IWC arena. OSP, rather than maximum sustained yield, is the model used in domestic marine mammal management to reflect the shift in conservation philosophy introduced by the MMPA to ensure that the value of marine mammals should not be measured by economic criteria alone. Congress noted, for instance, that "marine mammals have proven themselves to be resources of great international significance, esthetic and recreational as well as economic" (16 USC 1361(6)).

The OSP is defined statutorily as "the number of animals which will result in the maximum productivity of the population or the species, keeping in mind the carrying capacity of the habitat and the health of the ecosystem in which they form a constituent element" (16 USC 1362(9)). NMFS has further defined OSP in agency implementing regulations as "a population size which falls within a range from the population level of a given species or stock which is the largest

supportable within the ecosystem [known in biological terms as carrying capacity, abbreviated as K] to the population level that results in maximum net productivity level [MNPL]" (50 CFR 216.3). NMFS manages impacts to marine mammal populations according to congressional directives with the goal of maintaining the number of animals within OSP (between K and MNPL). To understand the operating theory of OSP, it is important to understand the biological implications of K and MNPL, the endpoints of the OSP range.

Carrying Capacity - K

K (the upper limit of OSP) can generally be understood as the population level that can be supported in the ecosystem as determined by the key constituent elements, such as food, habitat, temperature, ice cover, etc. As population density increases, birth rates often decrease, and death rates typically increase. K is the point at which these two rates are equal. It is, thus, the number of individuals an environment can support without significant negative impacts and is the largest size of a density-dependent population at which the population maintains equilibrium (population size neither increases nor decreases). For a particular environment, K will vary by species and can change over time due to a variety of factors, including food availability, disease, competition, predation, environmental conditions, and space. It is possible for a species to exceed its K temporarily.

Maximum Net Productivity Level — MNPL

MNPL (the lower limit of OSP) is a population level related to maximum net productivity, a rate of change defined in NMFS regulations as "the greatest net annual increment in population numbers or biomass resulting from additions to the population due to reproduction and/or growth less losses due to natural mortality" (50 CFR 216.3). In practical terms, MNPL is the population level (i.e., number of animals) that will yield the maximum recruitment into a marine mammal population (i.e., births minus deaths). Sometimes MNPL is expressed as a fraction of K.

3.4.2.1.2 Calculating Marine Mammal Population Parameters

Although the OSP concept is understandable from a theoretical or conceptual perspective, it has been difficult to quantify K and MNPL for some species or stocks of marine mammals (Ragen 1995). Although analytical techniques exist (e.g., dynamic response analysis [Goodman 1988]) that allow an assessment of whether a population is within its OSP without the need to estimate K or MNPL, such methods have not been used successfully in a management context and are not addressed further.

NMFS has been able to determine OSP for some species either by measuring pre-exploitation abundance (e.g., Cook Inlet beluga) or by back-calculating pre-exploitation abundance (e.g., eastern tropical Pacific dolphins) and treating it as K (carrying capacity) for the upper limit of OSP. In a logistic model of population growth, MNPL (the lower limit of OSP) is 50 percent of K, but it is generally accepted that because marine mammals are long-lived with slow rates of reproduction, they have MNPL closer to K (Eberhardt and Siniff 1977). In the absence of direct measurements of MNPL, NMFS has chosen the model-derived value of 60 percent of K (45 FR 72178, October 31, 1980). NMFS has also been able to assess OSP for other species such as harbor seals (Jeffries et al. 2003; Brown et al. 2005) by monitoring abundance of the population as it recovers from exploitation to an equilibrium level. By fitting logistic growth models to the abundance estimates through time, both MNPL and K can be measured for the population (Wade and Perryman 2002; Brown et al. 2005).

3.4.2.1.3 Linking Marine Mammal Population Parameters to Removals

To help the agency determine whether particular take levels would maintain the level of any given stock at OSP or not impede the stock's recovery to OSP, NMFS developed a management tool referred to as the potential biological removal (PBR) approach. In 1992, NMFS submitted a legislative proposal to Congress outlining the PBR approach for determining how many individuals could be removed from a population stock of marine mammals while allowing the stock to recover to, or be maintained within, its OSP (NMFS 1992).[1]

3.4.2.1.4 Defining and Calculating PBR

In 1994, Congress amended the MMPA to incorporate a regime to govern the taking of marine mammals incidental to commercial fishing operations (Section 118); many aspects of this

[1] To reduce confusion, it is worth clarifying that NMFS and the IWC use different methods for calculating allowable removals from marine mammal populations. NMFS operates under the protection and conservation purposes and policies of the MMPA by applying the PBR approach to the MMPA's OSP model, as described above. The IWC operates under the ICRW, which historically had a harvest focus. Therefore, the IWC calculates allowable removals or catch limits by focusing on sustainable yield under the maximum sustainable yield model. As described in Section 1.2.4.1.3, IWC Aboriginal Subsistence Whaling, the IWC acts on the advice of the Scientific Committee to set catch limits for large cetacean stocks based on the maximum sustainable yield model. The Scientific Committee advises the IWC on a minimum stock level for each stock, below which whales are not taken, and on a rate of increase towards the maximum sustainable yield level for each stock (footnote to IWC Schedule, Paragraph 13(a)(2)). The ENP gray whale stock is at or above maximum sustainable yield level, so aboriginal subsistence catches are allowed as long as they do not exceed 90 percent of that maximum sustained yield (Paragraph 13(a)(1)).

provision of the statute were based on the legislative proposal NMFS prepared and submitted to Congress in 1992 (NMFS 1992). The concept of PBR was among the aspects of NMFS' proposal included in the 1994 MMPA amendments. Under 16 USC 1362(20), PBR level is defined as the "maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population."

The MMPA (16 USC 1362(20) also prescribes a formula for calculating PBR, which is the product of three factors:

$$PBR = N_{min} * 0.5R_{max} * F_r$$

- N_{min} is the minimum population estimate of the stock.
- $0.5R_{max}$ is one-half the maximum theoretical or estimated net productivity rate of the stock at a small population size.
- F_r is a recovery factor of between 0.1 and 1.0.

As long as the total number of animals removed from the population due to human sources is no more than the calculated PBR of an affected stock of marine mammals, then such taking (by removal) will not prohibit the stock from recovering to or being maintained within its OSP.

3.4.2.1.5 Implementation of PBR Approach

Before its initial implementation of the PBR approach (Barlow et al. 1995), NMFS selected default values for the parameters of the PBR formula that would meet specific performance criteria and ran simulations to test the efficacy of maintaining OSP or allowing recovery to OSP. In these performance trials, numerous individuals from a hypothetical marine mammal stock were removed from the population at levels up to the calculated PBR each year. One of the following two conditions was satisfied for at least 95 percent of simulation trials: (1) populations at the MNPL (i.e., the low end of the OSP range) would remain at that level or above it after 20 years; and (2) populations below OSP (i.e., depleted populations at 30 percent of K) would recover to OSP within 100 years. In their conclusions, Barlow et al. (1995) noted that the PBR approach, as recommended and tested, would satisfy the objectives of the MMPA and would facilitate the Section 2 mandate to develop marine mammal stocks to the greatest extent feasible. In other words, for marine mammal stocks at OSP, the PBR approach would not cause them to fall below OSP, and for marine mammal stocks below OSP, the PBR approach would not prevent them from achieving OSP. Wade (1998) reported on more extensive simulation trials related to the

implementation of NMFS' PBR approach and confirmed the major conclusions related to the performance of PBR that were included in Barlow et al. (1995).

Wade and Angliss (1997) discussed the review of, and recommendations for, minor revisions to NMFS' initial PBR approach. This report, which summarized the results of a NMFS-convened workshop, indicated that the initial guidelines were adequate in most areas. Workshop participants recommended some minor revisions to the use of abundance estimates in calculating PBR. The most notable recommendation is that PBR levels should be reported as unknown when the supporting abundance estimate for the affected marine mammal stock is at least 8 years old, unless there is compelling evidence that the stock has not declined since the last abundance estimate. NMFS adopted and implemented this recommendation. In 2003, NMFS reviewed its PBR guidelines again and, after public review and comment, made no substantive changes to PBR calculations when the final guidelines were completed in 2005 (70 FR 35397, June 20, 2005).

3.4.2.1.6 Take Permits

Under Section 104(a) (16 USC 1374(a)) NMFS may issue permits for the taking or importation of a marine mammal. The permit must be consistent with applicable regulations and must specify the number of animals authorized to be taken; the location and manner (which NMFS must determine to be humane) in which they may be taken; the period during which the permit is valid; and other terms or conditions the agency deems appropriate (16 USC 1374(b)). If the agency waives the take moratorium, it is to issue regulations deemed necessary and appropriate "to insure such taking will not be to the disadvantage of those species and population stocks and will be consistent with the purposes and policies" of the MMPA (16 USC 1373(a)). The statute identifies certain factors the agency must consider fully in prescribing regulations governing the taking, including the effect of the regulation on existing and future levels of marine mammal species and population stocks; existing international treaty and agreement obligations of the United States; the marine ecosystem and related environmental considerations; the conservation, development, and utilization of fishery resources; and the economic and technological feasibility of implementation (16 USC 1373(b)).

3.4.2.2 Whaling Convention Act

3.4.2.2.1 Whaling License

Under the WCA (16 USC 916d) and NMFS regulations (50 CFR 230.3(b)), no person may engage in whaling without a license. NMFS by regulation has issued a license "to whaling captains identified by the relevant Native American whaling organization" (50 CFR 230.5(a)). NMFS may suspend the license of any captain who fails to comply with NMFS' regulations. NMFS' regulations further specify that any aboriginal subsistence whaling quota shall be allocated to each whaling village or captain by the appropriate Native American whaling organization. At least annually, NMFS is to publish aboriginal subsistence whaling quotas and any restrictions on subsistence whaling in the Federal Register. When NMFS published aboriginal subsistence whaling quotas for the use of the Makah Tribe in the past, it executed agreements with the Makah Tribal Council that described the way NMFS recognized the Tribe as a Native American whaling organization (see, for example, 63 FR 16701, April 6, 1998).

3.4.2.2.2 Equipment, Crew, Supplies, and Training

WCA Section 916d(d) requires an applicant for a whaling license to furnish evidence or an affidavit that the whaling vessel is adequately equipped and competently manned to engage in whaling in accordance with the provisions of the ICRW, the regulations of the IWC and NMFS' regulations. NMFS' regulations regarding aboriginal subsistence whaling prohibit whaling without adequate crew, supplies, or equipment (50 CFR 230.4(d)). In the past, when NMFS published aboriginal subsistence whaling quotas for the use of the Makah Tribe, it executed agreements with the Makah Tribal Council that specified the details regarding the supplies, equipment, crew, and training.

3.4.2.2.3 Wasteful Manner Restrictions

WCA regulations prohibit whaling captains from engaging in whaling in a wasteful manner (50 CFR 230.4(k)). Wasteful manner means "a method of whaling that is not likely to result in the landing of a struck whale or that does not include all reasonable efforts to retrieve the whale" (50 CFR 230.2). Related to reasonable efforts to retrieve any whale, WCA regulations also require whaling captains to use harpoons, lances, or explosive darts that bear a permanent distinctive mark identifying the whaling captain (50 CFR 230.4(j)). The mark allows struck and lost whales that wash ashore, or are found later, to be identified and reported as struck and lost whales. WCA regulations also prohibit whaling for any calf or parent accompanied by a calf (50 CFR 230.4(c)).

3.4.2.2.4 Recording and Reporting

WCA regulations require the Native American whaling organization to monitor the hunt, keep a tally of the number of whales struck and landed, and close the season when the quota is reached (50 CFR 230.7(b)). Whaling captains must provide oral or written reports on whaling activities to the Native American whaling organization, including, but not limited to, striking, attempted striking, or landing of a whale, and (where possible) specimens from a landed whale (50 CFR 230.8(b)). The report is to include information on the number, dates, and locations of each strike, attempted strike, or landing; the length and sex of the whale landed; and an explanation of the circumstances involving any whale struck and not landed. NMFS is also authorized to provide technical assistance to facilitate prompt reporting and collection of specimens from landed whales, including, but not limited to, ovaries, ear plugs, and baleen plates (50 CFR 230.8(b)). Following the 1999 and 2000 hunts, the NMFS observers to the hunt provided their own reports to NMFS (Gosho 1999; Gearin and Gosho 2000). The Makah Tribe and NMFS also published a joint report for the 1999 hunt.

3.4.3 Existing Conditions

3.4.3.1 General Life History and Biology

3.4.3.1.1 Identifying Physical Characteristics

Adult gray whales are 36 to 50 feet long and weigh between 16 and 45 tons; females are larger than males. They have two to five deep longitudinal creases on their throats, and their heads appear narrowly triangular when viewed from above; there is no head ridge (Leatherwood et al. 1988). Ventral blubber can be 3 inches (7 cm) thick (Gulland et al. 2005). Migrating gray whales breathe at regular intervals, generally blowing three to five times at intervals of 30 to 50 seconds, then lifting their flukes and submerging for 3 to 5 minutes (Leatherwood et al. 1988). Gray whales make shallow dives of 50 to 165 feet, but they may dive as deep as 390 feet to feed.

3.4.3.1.2 Global Distribution and Population Structure and Status

Historically, gray whales occurred in both the North Pacific and North Atlantic Oceans (Fraser 1970; Mead and Mitchell 1984), but are currently found only in the North Pacific Ocean (Rice et al. 1984). At one time, the whales may have accessed both the Pacific and Atlantic Oceans by swimming through migratory corridors in the Arctic (Gilmore 1978), but the distribution of the species probably changed due to periodic closures of the Bering Sea during ice ages (Swartz et al. 2006). Glaciation dropped sea levels and exposed underlying continental shelf

regions, including the Bering Isthmus, which effectively blocked access to the Arctic (Berta and Sumich 1999). Gray whales disappeared in the North Atlantic by the end of the seventeenth century (Mead and Mitchell 1984).

Management authorities, including the International Whaling Commission (IWC) and NMFS, have identified two management units for this species based on the best scientific information available: a western North Pacific population and an eastern North Pacific population (Rugh et al. 1999; Swartz et al. 2006). The two populations are recognized as separate under the World Conservation Union (IUCN) International Convention for the Conservation of Nature and Natural Resources (Baillie et al. 2004; Swartz et al. 2006). The western North Pacific gray whale population (also known as the Korean or Korean-Okhotsk population) migrates annually along the east coast of Asia. The eastern North Pacific (ENP) gray whale population (also known as the California-Chukchi population) migrates annually along the west coast of North America, generally between a summer range as far north as the Bering, Chukchi, and Beaufort Seas and a winter range as far south as the Baja Peninsula in northwestern Mexico (Rice et al. 1984; Swartz et al. 2006) (Figure 3-3). Available data indicate that management at this population level is appropriate for three reasons:

1. **Geographic Separation** – the North Pacific populations of gray whales are geographically separated. They occupy different coastal migratory corridors and feeding and breeding areas, with an apparent gap in distribution along the eastern shore of the Kamchatka Peninsula between the Okhotsk and Bering Seas (IWC 1993; Swartz et al. 2006);

2. **Genetic Differentiation** — the North Pacific populations of gray whales are significantly genetically distinct, based on analysis of mitochondrial deoxyribonucleic acid (mtDNA, as inherited through the mother's lineage) (LeDuc et al. 2002; Lang et al. 2004);

3. **Demographic Independence** — the North Pacific populations of gray whales have exhibited different rates of recovery and levels of abundance following overexploitation due to commercial harvest (Rugh et al. 1999; Swartz et al. 2000; Swartz et al. 2006).

The western North Pacific population was listed as critically endangered by the IUCN in 2000 (Hilton-Taylor 2000; Baillie et al. 2004) and remains critically depleted. It is estimated to contain 100 or fewer whales (Wade et al. 2003; Weller et al. 2005). By contrast, the ENP population is thought to have recovered to pre-exploitation numbers, and NMFS removed it from the

endangered species list in 1994 (59 FR 21094, June 16, 1994) after three decades of research supported the conclusion that it had recovered (Buckland and Breiwick 2002). Recently, Alter et al. (2007) used a genetic approach to estimate prewhaling abundance of gray whales and reported DNA variability indicative of an ENP gray whale population of approximately two to four times more numerous than today's average census size (the ENP gray whale population was last estimated to be 20,110 whales (Rugh et al. 2008)). Alter et al. (2007) note that their estimate likely measures both the eastern and western gray whale stocks together, and that an important question is whether carrying capacity has declined over time. If it has, then gray whales may be reduced from historical numbers but may have reached a new, lower carrying capacity today.

Figure 3-3. Approximate Rangewide Distribution of the ENP Gray Whale Population

The lower range of the confidence interval reported in Alter et al. (2007) is consistent with a historic abundance of about 30,000 whales each for the western and eastern North Pacific stocks of gray whales. An abundance of 30,000 gray whales in the Eastern North Pacific stock is within the confidence limits for estimates of carrying capacity reported by Wade (2002). Some scientists (e.g., Palsboll et al. 2008) have questioned the results and conclusions of Alter et al. (2007). NMFS intends to address the findings of Alter et al. (2007) and other researchers as part of the next update of the stock assessment report for the ENP gray whale stock.

For the remainder of this chapter, all references to the gray whale will be to the ENP population only.

3.4.3.1.3 Feeding Ecology and Role in the Marine Ecosystem

Gray whales use various feeding techniques, including (1) suction feeding, also called benthic feeding or bottom feeding, which allows them to feed on crustaceans that live burrowed in (infauna) and just above (epifauna) the sea floor; and (2) engulfing or skimming prey in the water column and on the sea surface. This broad foraging capability allows gray whales to feed on a wide variety of prey throughout their range (Nerini 1984; Darling et al. 1998; Dunham and Duffus 2001; Moore et al. 2003; Moore et al. 2007). This capability may account for the gray whale's more rapid recovery from commercial whaling when compared with other large whale species (Nerini 1984; Moore et al. 2001).

Gray whales regularly consume benthic prey (Nemoto 1970; Nerini 1984), often creating furrows or pits (Johnson and Nelson 1984; Kvitek and Oliver 1986). Gray whales display an adaptation to bottom feeding because their baleen plates are thicker and the hairs are coarser sturdy than those of other whales. This allows them to excavate coarse bottom sediments on a regular basis (Nemoto 1959; Nerini 1984). Nerini (1984) listed prey of more than 19 genera from gray whale stomachs, including a wide variety of benthic and epibenthic invertebrates, such as amphipods, decapods, molluscs, polychaete worms, and sponges. Moore et al. (2007) also recently documented tens to hundreds of gray whales feeding off Kodiak Island, primarily on epibenthic marine crustaceans commonly referred to as hooded shrimp.

Excavation of bottom sediments by feeding gray whales may play a role in maintaining the benthic habitat in some areas, though its relative importance is not clear. Some investigators hypothesize that gray whale benthic feeding may help maintain the substrate (Johnson and Nelson 1984; Oliver and Slattery 1985), or otherwise have an important influence on the benthic community (Nelson and Johnson 1987; Grebmeier et al. 1989). Excavated sites also trap woody

debris, which affects benthic productivity (Oliver and Slattery 1985). Gray whale excavation has been proposed as a major source of disturbance and part of a cycle of exploitation, recolonization, succession, and maturing of the prey community (Nerini 1984; Oliver et al. 1984; Oliver and Slattery 1985). Conversely, some investigators have proposed that the growing gray whale population has reached carrying capacity and that the population's overexploitation of benthic amphipods in the Bering Sea may have led to a decrease in amphipod abundance during a documented period from 1986 to 1988 (Highsmith and Coyle 1992). It has further been suggested that gray whale foraging can lead to permanent localized loss of amphipod or other prey communities, forcing whales to forage elsewhere (Highsmith and Coyle 1992; Weitkamp et al. 1992). In the project area, gray whales may be feeding on both pelagic and benthic prey. It appears that benthic communities in the project area are influenced primarily by large-scale oceanographic and climatic processes (Section 3.3.3.2.1, Physical Features and Processes).

Gray whales excavating the benthos may also make food available for surface-feeding seabirds. As the whales stir up the benthos, particularly in shallow waters, feed rises to the surface. Observations in the Bering Sea suggested this association (e.g., Grebmeier and Harrison 1992), but no similar studies have been conducted in the project area. When gray whales die, decomposing whale carcasses also deliver large pulses of organic material to the seafloor. This material may serve as islands of habitat for unique assemblages of deep-sea macrofauna (Dahlgren et al. 2004; Goffredi et al. 2004).

Although gray whales are consistently characterized as benthic feeders in the literature, they also feed on pelagic prey, including mysid crustaceans, crab larvae, herring eggs and larvae, ghost shrimp, and eupahusiids (Murison et al. 1984; Nerini 1984; Oliver et al. 1984; Weitkamp et al. 1992; Duffus 1996; Darling et al. 1998; Benson et al. 2002; Dunham and Duffus 2002; Bluhm et al. *in revision*). They feed in the water column by making short dives and random movements in kelp beds and within the surf zone of rock and islets (Murison et al. 1984; Nerini 1984; Darling 1998). When they skim feed on the sea surface, they move along the surface, biting down on plankton streams along the tide line (Darling 1998).

Over the years, researchers have observed gray whales aggregating in particular areas to feed where prey densities are high, especially in areas of benthic prey densities in the northern seas (e.g., Berzin 1984; Yablokov and Bogoslovskaya 1984; Clarke and Moore 2002; Moore et al. 2000; Moore et al. 2003; Highsmith et al. 2007). The term 'feeding aggregation' has been used in scientific literature to describe these concentrations of feeding whales (e.g., Berzin

1984; Calambokidis et al. 2002). Areas where whales congregate to feed on a regular basis have been referred to as 'feeding grounds' or 'feeding areas' (e.g., Berzin 1984; Calambokidis et al. 2002; Moore et al. 2003; Calambokidis et al. 2004a), though the whales also feed continuously along their migration route. Some scientists have proposed that whales primarily feed on benthic prey in higher latitudes and switch to pelagic prey in lower latitudes (Nerini 1984), or that prey are in primary, secondary, or tertiary feeding grounds with pelagic prey occurring further south in the range (Kim and Oliver 1989). Others have proposed that whales select pelagic prey first when available because it is easier to obtain than benthic prey (Dunham and Duffus 2001). Dunham and Duffus (2001) hypothesize that pelagic prey disperses in the water column, making a relatively easy filter-feeding target, and that the distribution of pelagic prey is not as patchy or unpredictable as benthic prey. Rather than exhibiting strong regional or prey-type preferences, whales probably exhibit highly plastic and opportunistic foraging behavior using a variety of prey resources, both benthic and pelagic, within a given feeding area (Darling et al. 1998). After 26 years of observations off the southwest coast of Vancouver Island, some researchers noted that whales could be observed feeding in discrete pockets of habitat over short time frames, depending on prey availability. Over longer time frames, however, virtually all of the southwest coast study area was used by feeding gray whales (Darling et al. 1998; Dunham and Duffus 2001). Darling et al. (1998) proposed that gray whales are attuned to natural patterns of abundance and absence occurring within a prey assemblage and that different prey species play equal roles over a season or several years.

Because both feeding aggregations (the whales) and feeding areas (the prey) are dynamic, with both small- and large-scale changes over time and space, the following discussion examines the entire range in which gray whales feed. As described below in Section 3.4.3.3, Distribution and Habitat Use, gray whales change location and habitat to exploit the optimum prey species at any one time, based on abundance, density, size, caloric content, and predation pressure. Such factors may vary by season and year, depending on environmental variability and the population dynamics of prey (Darling et al. 1998; Clarke and Moore 2002; Moore et al. 2007).

3.4.3.1.4 Seasonal Migrations

Seasonally predictable sources of food broadly shaped gray whale life history into two major periods: summers, when whales feed in higher latitudes with abundant food and minimal sea ice, and winters, when whales migrate to lower latitudes to escape sea ice and inclement weather and to calve in warmer waters (Swartz 1986; Swartz et al. 2006). Long-distance migrations of gray whales thus evolved in the spring and the fall/winter, primarily as an evolutionary response to the

seasonal production of prey species in the shallow waters of polar regions (Lipps and Mitchell 1976; Swartz et al. 2006).

Gray whales generally migrate seasonally along the coast of North America between a summer range as far north as the Chukchi and Beaufort Seas and a winter range as far south as the Baja California Peninsula and Gulf of California in northwestern Mexico (Rice et al. 1984; Urbán-Ramírez et al. 2003) (Figure 3-3). The general characteristics, timing, and migratory distance relative to shore for fall/winter southward and spring northward migrations are described more specifically below, while shorter- and longer-term aspects of distribution and habitat use are discussed later in Section 3.4.3.3, Distribution and Habitat Use.

Fall/Winter – Characteristics and Timing of the Southward Migration

The onset of the southward migration is difficult to define (Rugh et al. 2001) and is typically associated with the primary breeding period (Section 3.4.3.1.5, Reproductive Physiology and Calf Birth, Growth, and Development, for more detail about breeding activities). Timing may be influenced by several environmental variables, including the extent of ice coverage, availability of food resources, and photoperiod (Rugh et al. 2001; Clarke and Moore 2002; Swartz et al. 2006). It is also related to how widely the whales are distributed for foraging (Rugh et al. 2001). Most whales migrate out of northern seas sometime around mid-October to November, but some have been seen swimming south near Point Barrow as early as mid-August, and some have been seen along the Chukotkan Peninsula as late as mid-December (Rugh et al. 2001).The southward migration is generally grouped into two phases by age, sex, and reproductive status (Rice and Wolman 1971). The first migrant phase consists of near-term pregnant females, followed by non-pregnant females and mature males. The second migrant phase consists of immature whales of both sexes (Swartz et al. 2000; Swartz et al 2006). Poor weather conditions and widely scattered offshore distribution of gray whales make it difficult to survey whales migrating through the area (Green et al. 1995; Shelden et al. 2000; Rugh et al. 2001), but some studies are available. Shelden et al. (2000) reported observations of gray whales off the coast of Washington and in the Strait of Juan de Fuca near Port Angeles in early to mid-November. Observational studies also support the presence of southbound gray whales off the coast of Washington in December (Pike 1962; Darling 1984; Shelden et al. 2000). Using data from surveys at other locations, along with measured travel speeds of migrating gray whales, Rugh et al. (2001) calculated January 5 as the peak of the southward migration past Tatoosh Island.

The most routine observations of the gray whale migration have been in California (Rugh et al. 2001). Data from shore-based stations have shown a one-week shift in timing of median dates of southbound migrants (from January 8 to January 16) after 1980. This might have been due to an oceanographic regime shift in the northern portion of the summer range. The shift caused extreme ice retreats and may have expanded the distribution of gray whales on the feeding grounds and increased the distance of the southward migration (Miller et al. 1994; Hare and Mantua 2000; Rugh et al. 2001; Moore et al. 2003; Shelden et al. 2004; Moore 2005). Concurrent with these findings, southbound calf sightings have increased near San Diego (southern California) and Carmel (central California) since 1980; the one-week delay in the southward migration has meant that calving has occurred farther north than the Baja lagoons during the southward migration (Shelden et al. 2004). Gray whales generally reach their wintering grounds starting in late December or early January and reach maximum densities in February.

Spring – Characteristics and Timing of the Northward Migration

In mid-February, as the southward migration comes to an end in California and Mexico, the northward migration begins. This overlap suggests that not all of the gray whale population winters near the Baja California Peninsula. Some whales may only go as far south as the coastal waters of California before they turn around again to head north (Herzig and Mate 1984; Swartz 1986; Swartz et al. 2006). The northward migration to summer feeding areas occurs in two generally grouped phases according to age, sex, and reproductive condition (Poole 1984; Swartz 1986; Swartz et al. 2006). The first migrating phase consists of newly pregnant females, followed 2 weeks later by adult males and non-pregnant females, then by immature whales of both sexes another week later (Swartz et al. 2006). In mid and late February, as the first phase of the migration is underway, mothers with newborn calves move from interior lagoons to lagoon inlets and coastal waters previously occupied by the single whales (Swartz et al. 2006). These mother and calf pairs comprise the second migrating phase of whales and are the last to leave wintering areas, departing between late March and May and generally arriving in their summer feeding range from May to June (Swartz et al. 2000; Swartz et al. 2006).

Poole (1984) reported the first phase of northbound migrants off the coast of central California from early February to early April. Gilmore (1960) reported similar dates (mid-February, peaking in March and April, and tapering off in early May) past San Diego. Herzig and Mate (1984) reported the first phase of northbound migrants passing through the waters off Oregon in mid-February through April, peaking in mid-March. A study conducted at Unimak Pass, Alaska,

reported a peak passage of northbound phase-one migrants in the last week of April, indicating an approximate lag of 4 to 5 weeks between Oregon and Alaska (Hessing 1981; Herzig and Mate 1984). The cow-calf migrants in the second migrating phase travel more slowly than the whales in the first migrating phase to accommodate nursing and calves (NMFS 2001a), and they have been reported to follow the first phase by 7 to 9 weeks (Herzig and Mate 1984). The predominantly cow-calf pair migrants in the second phase of the northward migration have been sighted passing through the waters off central California from early April to mid-May (Poole 1984) and passing by Oregon from late April to May, peaking in mid-May (Herzig and Mate 1984). Hessing (1981) observed cow and calf pairs passing Unimak Pass, Alaska, from May through mid-June, peaking on June 4. Taking both migration phases into account, northbound whales of all ages and both sexes are present off the Washington coast from late February through June. There are no direct observations that establish the timing of either phase of the northward gray whale migration through the project area, nor are there any published estimates based on observations from other areas (as Rugh et al. [2001] calculated for the southward migration). Given the available observational data, it is reasonable to estimate that migrants in the first phase of the northward migration would be in the project area from March through early May, and migrants in the second phase would be in the project area from roughly early May until June.

Migratory Distribution Relative to Shore (Location and Width of the Migratory Corridor)

The migratory distribution of gray whales relative to shore (i.e., location, width, and extent of the migratory corridor) varies based on environmental conditions (such as bottom topography, climate, and water depth), migration season and phase, and use of the migratory corridor (such as feeding, breeding, or migrating). Generally, gray whales migrate closer to shore where the continental shelf is narrow, such as near Granite Canyon, California, and distribute farther offshore where the continental shelf is broader, such as near the Channel Islands, California (Shelden 2007). There is also evidence that northbound whales travel closer to shore during spring than do southbound whales in fall and winter (Herzig and Mate 1984; Green et al. 1995).

Off the coast of Oregon, where the continental shelf is relatively narrow, Herzig and Mate (1984) systematically documented the offshore distribution of both northward and southward migrations, including both phases of migrants, from November to May, 1978 to 1981. They determined that more than 50 percent of all whales in the first phase of the southward and northward migration passed between 1 and 2 miles (1.6 km and 3.2 km) from shore, 131 to 197 feet (40 to 60 meters) deep. They also estimated that 90 percent of the second phase of northbound migrants, consisting

predominantly of cow-calf pairs, passed less than 2,625 feet (800 m) from shore. Herzig and Mate (1984) noted that, as the northward migration progressed, pod size decreased and whales moved progressively closer to shore, traveling within 1 mile (1.6 km) from shore.

These nearshore patterns of migration for northbound whales are consistent with observations made off the coast of California from 1980 to 1982 (Poole 1984). Poole (1984) determined that the first phase of northbound migrants moved slightly farther offshore than the second phase; the first phase traveled within a straight-line corridor from one major point of land to another to avoid bights in the coastline, while the second phase (consisting of 90 percent cow-calf pairs) hugged the contours of the coastline. Sixty percent of the first phase of northbound migrants passed between 2 miles and 0.5 mile from shore (between 3.2 km and 800 m), 20 percent between 0.5 mile and 0.1 mile from shore (between 800 m and 200 m), and 13 percent within 0.1 mile (200 m) of shore. Ninety-nine percent of the second phase of northbound migrants passed within 0.1 mile of shore in 1980, and 96 percent passed within that distance in 1981. Poole (1984) and Braham (1984) noted potential biological advantages of nearshore migration, including the availability of productive food sources in shallow nearshore waters (such as eel grass meadows and swarms of mysid shrimp in kelp beds) and protective cover from predators provided by nearshore rocks, bottom topography, and kelp beds.

Off the coast of Washington, Pike (1962) used logbooks from the M/V *Pacific Ocean*, a fur seal research vessel operating during March to May of 1958 to 1960, to observe gray whale northward migrations. Pike (1962) reported that most whales probably passed within 1.2 miles (1.9 km) of the coast during the spring northward migrations, similar to the results of Herzig and Mate (1984) and Poole (1984). Pike (1962) also described northbound whales farther offshore. Logbooks from the Umatilla Lightship, stationed 5.2 miles (8.4 km) from shore south of Cape Flattery at Umatilla Reef, reported many gray whales passing close to the lightship from March to May. Whales engaged in various behaviors such as playing, mating, circling, rolling, or feeding, often remaining in the area for up to 4 hours. Pike (1962) also noted sightings 5.8 miles (9.3 km) off Cape Flattery, and a sighting of two adults and one calf as far as 23 miles (37 km) off Cape Flattery. These sightings farther offshore are consistent with Green et al. (1995), who documented phase-one northbound migrants off the coast of Washington from March 11 through 16, 1990, as far out as 12.4 miles (20 km), and averaging a distance of 7.3 miles (11.8 km).

For the fall/winter southward migration, Herzig and Mate (1984) reported the farthest extent of southbound migrants off the coast of Oregon as 12.4 miles from shore at less than 90 meters deep

(Herzig and Mate 1984). When Mate and Poff (1999) repeated the Oregon coast surveys of Herzig and Mate (1984) in 1999, they noted that whales were distributed farther offshore than described in the prior studies. Whereas Herzig and Mate (1984) had reported that 50 percent of both northbound and southbound migrants passed within 1 and 2 miles from shore, Mate and Poff (1999) estimated that 60 percent of the southbound whales were 5 miles or more offshore and 20 percent of the whales were within 3 miles of shore. These results are consistent with Green et al. (1995), who documented two groups of whales at 14.3 miles (23 km) as the furthest southbound migrants sighted off the coast of Oregon during aerial surveys conducted from January 3 to 12, 1990, and five groups of whales at 26.7 miles (43 km) as the furthest southbound migrants off the coast of Washington.

Green et al. (1995) noted a significant latitudinal variation between Oregon and Washington for offshore distances of both northbound phase-one and southbound migrations, with the variation more pronounced during the southward migration. They reported that southbound migrants averaged 15.7 miles (25.2 km) from shore off Washington and 7.4 miles (11.9 km) from shore off Oregon. Green et al. (1995) hypothesized that the difference between offshore distances for north and southbound whales either supports the occurrence of a single, very broad migratory corridor, or the occurrence of alternate offshore routes. Like Poole (1984) had noted for the California Bight area, Green et al. (1995) concluded that some portions of the ENP gray whale population may take a more direct route between Washington and the central coast of Vancouver, rather than following the longer coastal route past Cape Flattery. Shelden et al. (2000) neither confirmed nor rejected that hypothesis, but noted that distance offshore may not be a function of migration alone, since gray whales have been observed 31.1 miles (50 km) off the Vancouver Island coast and 28 to 56 miles (45 to 90 km) off the Washington coast during summer months when the whales are not migrating.

3.4.3.1.5 Reproductive Physiology and Calf Birth, Growth, and Development

Female gray whales become sexually mature and begin giving birth between five and 11 years of age (mean eight years; Rice and Wolman 1971). The sexual cycle in female gray whales lasts approximately two years and includes copulation, pregnancy, lactation, and a resting period after reproduction (Yablokov and Bugoslovskaya 1984). A calf is, therefore, produced every other year, a cycle that is tied to annual migrations and environmental conditions favorable for the early development of calves (Swartz 1986; Swartz et al. 2006). Both male and female gray whales are promiscuous breeders and copulate repeatedly with more than one mate (Jones and Swartz 1984).

Mating behavior is observed during most seasons (Gilmore 1960; Rice and Wolman 1971; Jones and Swartz 1984; Swartz 1986; Berta and Sumich 1999).

Female gray whales come into oestrus primarily during a three-week period from late November to early December, at the onset of, and during, the southward migration to wintering grounds from summer feeding areas (Rice and Wolman 1971; Shelden et al. 2004). At this time, whales congregate in nearshore areas of the summer feeding range at or near the top of the migratory corridor, possibly to find mates (Swartz et al. 2006). The mean conception date is approximately December 5 (Rice and Wolman 1971). Mating occurs throughout the southward migration in the migratory corridor. Females that have not successfully bred may enter a second oestrus cycle within 40 days (Rice and Wolman 1971), such that a few females may breed as late as the end of January while present on the winter grounds (Jones and Swartz 1984). Oestrus females and mature males in the second breeding cycle have been observed in Baja lagoons at highest densities near lagoon inlets and in adjacent coastal waters (Swartz et al. 2006). The gestation period lasts approximately 13.5 months (or approximately 418 days) (Rice et al. 1984), so newly pregnant females can calve about a year later.

Calves are born in the winter. Some gray whales calve in the shallow, protected Baja lagoons (often referred to in scientific literature as birthing lagoons, calving lagoons, or breeding lagoons), starting around December 26 and ending approximately at the beginning of March (Swartz and Jones 1983; Sánchez-Pacheco 1998), with a median birth date around January 27 (Rice and Wolman 1971). Since the late 1970s and early 1980s, calf sightings have increased near San Diego (southern California) and Carmel (Shelden et al. 2004). Scientists currently believe that perhaps one-quarter to one-half of the calves are born north of Carmel (well north of the Baja lagoons) during the southward migration (Shelden et al. 2004). Shelden et al. (2004) propose that some mothers that reach parturition along the southward migration may winter with their calves in the Southern California Bight, near the Channel Islands, until the calves are large enough to return north.

Calves are approximately 15 feet long and weigh 1,000 pounds at birth (Rice 1986). The sex ratio of calves is 1:1 for the ENP gray whale, but it is closer to 68 percent males and 32 percent for western Pacific gray whales (Rice and Wolman 1971; Jones and Swartz 1984; Weller et al. 2005). The mothers' rich milk is more than 50 percent fat and nourishes the calves for several weeks while they prepare for the long northward migration to summer feeding areas. Calves grow rapidly and stay with their mothers for 6 to 7 months; they are weaned in August and become

independent while in the summer feeding areas (Rice and Wolman 1971; Swartz et al. 2006). Gray whale calves are approximately 28 to 30 feet long before migrating southward (Rice 1986).

3.4.3.1.6 Natural Mortality

Sources of natural mortality for gray whales include predation, disease, entrapment in ice (IWC 2003), and starvation. Killer whales are the primary natural predator of gray whales. There are many anecdotal reports of killer whale interactions with gray whales, but it is difficult to quantify the proportion of the gray whale stock killed or approached by killer whales each year (Rice and Wolman 1971; Fay et al. 1978; Jones and Swartz 1984; Poole 1984; Goley and Straley 1994; George and Suydam 1998). Predation is by transient (mammal-eating) killer whales, and studies suggest that gray whale calves may be particularly vulnerable during their northward (spring) migration (Ternullo and Black 2002). The frequency of tooth scars on gray whale carcasses indicates that killer whale attacks often are not fatal (56 FR 58872, November 22, 1991). Other predators are sharks, including the great white shark (*Carcharodon carcharias*) and tiger shark (*Galaeocerdo cuvier*) off California and Mexico (Jones and Swartz 2002).

3.4.3.2 Historic Status of the Gray Whale Population

3.4.3.2.1 Estimates of Historic Abundance

Estimates of ENP gray whale population size (i.e., abundance) before commercial exploitation vary. Reilly (1981) estimated that there may have been 24,000 gray whales before 1846. Henderson (1984) estimated that the original population was between 15,000 and 20,000 whales. The carrying capacity of the gray whale population was recently estimated to be 23,686 whales (standard error [SE] equals 1,788)(Rugh et al. 2008). The standard error is the measure of certainty (precision) for the estimate of population size, and it is used to construct a confidence interval around the estimate; for further discussion of population estimates and confidence intervals, see Section 3.4.3.4.1, Abundance Data. Scammon (1874) proposed that the population numbered about 30,000 whales from 1853 to 1856. From 1845 to about 1900, American whalers took gray whales from the winter grounds in Baja to the summer feeding areas in the subarctic, removing approximately 11,300 whales from the population between 1845 and 1874 (Scammon 1874; Henderson 1984). Hunts in and near the lagoons greatly reduced the reproductive capacity of the population by killing the females with calves (Swartz et al. 2006). From approximately 1914 to 1946, modern industrial whaling by the United States, Japan, Norway, and the Soviet Union in the North Pacific took an estimated 940 gray whales in all seasons (Reeves 1984).

More recently, Alter et al. (2007) used a genetic approach to estimate prewhaling abundance of gray whales and reported DNA variability indicative of an ENP gray whale population of approximately two to four times more numerous than today's average census size. (The ENP gray whale population was last estimated to be 20,110 whales (Rugh et al. 2008)). Alter et al. (2007) note that their estimate likely measures both the eastern and western gray whale stocks together, and that an important question is whether carrying capacity has declined over time. If it has, then gray whales may be reduced from historical numbers but may have reached a new, lower carrying capacity today. The lower range of the confidence interval reported in Alter et al. (2007) is consistent with a historic abundance of about 30,000 whales each for the western and eastern North Pacific stocks of gray whales. An abundance of 30,000 gray whales in the Eastern North Pacific stock is within the confidence limits for estimates of carrying capacity reported by Wade (2002).

Estimates of gray whale population size after commercial exploitation also vary. Reilly (1981) estimated that the population declined to below 12,000 whales, Henderson (1984) estimated that the population did not exceed 8,000 to 10,000 whales, and Butterworth et al. (2002) estimated a number between 4,000 to 5,000 whales, down to as low as 1,500 to 1,900 whales after commercial whaling stopped in 1937 and 1938. For a discussion of aboriginal subsistence whaling for ENP gray whales, refer to Section 3.4.3.6.1, Aboriginal Subsistence Whaling.

3.4.3.2.2 Protection and Recovery after Commercial Exploitation

Gray whales have been protected by a suite of international agreements and federal laws initiated in 1937. As a result, the gray whale population recovered since its depletion caused by commercial whaling in the early 1900s (Rugh et al. 2005). For a summary of aboriginal subsistence whaling for ENP gray whales conducted during this time, refer to Section 3.4.3.6.1, Aboriginal Subsistence Whaling. A summary of treaties and laws relevant to protection and recovery of gray whales is provided below, and they are explained in more detail in Section 1.2, Legal Framework.

Two federal laws are discussed both here and in Chapter 1. The ESA is explained more fully here because the gray whale population has recovered to population levels that supported delisting (i.e., the ESA no longer applies to the extent of the other laws described in Chapter 1). The listing history and associated abundance estimates provide context relevant to describing recovery of the population after commercial exploitation.

1. 1937 International Agreement for the Regulation of Whaling — The 1937 Agreement protected gray whales from commercial whaling, but included an exception to allow for aboriginal subsistence use. Norway, the United States and others signed it in 1937 (Reeves 1984) and Canada, the Soviet Union, and Japan signed it later (1938, 1946, and 1951, respectively). Consequently, since 1951, all nations with factory ships operating in the North Pacific Ocean have been subject to the provisions protecting gray whales from commercial whaling (Reeves 1984). During the fall southward and spring northward migrations between 1959 and 1969, scientists in the United States took 316 gray whales off the coast of central California under IWC special research permits to establish the status of the population (Rice and Wolman 1971).

2. 1946 International Convention for the Regulation of Whaling — The ICRW continued the 1937 Agreement's prohibition on commercial whaling of gray whales, as well as allowing aboriginal subsistence whaling (Section 1.2.4.1, International Whaling Governance under the ICRW, contains more detail).

3. Whaling Convention Act — The WCA prohibits commercial whaling, except for aboriginal subsistence whaling consistent with the IWC Schedule (i.e., regulations of the IWC that are an integral part of the ICRW) (Section 1.2.4, Whaling Convention Act, for more detail).

4. Endangered Species Act — The gray whale was listed as an endangered species under the statute preceding and replaced by the ESA (35 FR 8495, June 2, 1970). Following a comprehensive evaluation of its status (Breiwick and Braham 1984), NMFS concluded on November 9, 1984 (49 FR 44774), that the population should be listed as threatened, instead of endangered. No further action was taken until 1991 when a subsequent review, made available to the public on June 27, 1991 (56 FR 29471), showed that the best available abundance estimate (in 1987/1988) was 21,296 whales, recalculated to be 22,250 whales in 1987/1988 after Rugh et al. (2005) applied new correction factors. The latest available abundance estimate is 20,110 whales (SE equals 1,766) for the census conducted in 2006/2007 (Rugh et al. 2008). The estimate of increase is 2.59 percent (SE equals 0.28 percent) when using data from 1967/1968 to 1997/1998, 1.86 percent (SE equals 0.32 percent) when using data from 1967/1968 to 2001/2002, and 1.59 percent (SE equals 0.31 percent) when using data from 1967/1968 to 2006/2007 (Rugh et al. 2005; J. Breiwick, pers. comm.. 2008; Rugh et al. 2008). There are indications that this population

is approaching the K of its environment (Reilly 1992; Wade and DeMaster 1996; Wade 2002; Wade and Perryman 2002; Moore 2005; Rugh et al. 2008).

On November 22, 1991, NMFS proposed to remove the gray whale population from the list of endangered and threatened wildlife (56 FR 58869). NMFS published a final notice of determination (58 FR 3121, January 7, 1993) to remove the population from the list because the species had recovered to near its estimated original population size and was neither in danger of extinction throughout all or a significant portion of its range, nor likely to again become endangered within the foreseeable future. On June 16, 1994 (59 FR 21094), the gray whale population was formally removed from the list of endangered and threatened wildlife. As required under Section 4(g) of the ESA, NMFS drafted a plan to monitor the status of the stock for at least five years following the delisting. NMFS' comprehensive status review, completed in August of 1999, recommended that the population continue under a non-threatened classification (Rugh et al. 1999).

In 2001, NMFS received a petition to relist the gray whale under the ESA, but found that the petition did not present substantial scientific or commercial information indicating that relisting was warranted (66 FR 32305, June 14, 2001). NMFS has continued monitoring the population since delisting.

The Pacific stock of gray whales is no longer a threatened or endangered species. Therefore, the requirements of the ESA no longer apply to this population.

5. Marine Mammal Protection Act – The MMPA established a moratorium on the taking of gray whales, along with all marine mammal species, subject to certain exceptions (Section 1.2.3, Marine Mammal Protection Act, for more detail).

3.4.3.3 Distribution and Habitat Use

This section describes the areas that whales occupy and their feeding, breeding, or calving activities over various periods. Distribution and habitat use on a seasonal timescale are described above in Section 3.4.3.1.4, Seasonal Migrations, in the context of the long-distance migrations that are thought to have evolved in response to seasonal mixing and upwelling of oceanic waters affecting the production, dispersion, and concentration of prey (Moore 2005; Swartz et al. 2006). These seasonal migrations have led to a description in the scientific literature of 'summer feeding grounds' and winter 'breeding (or calving) grounds.' These categories are misleading because feeding and mating behavior occur throughout the range during all seasons (Rice and Wolman 1971; Swartz et al. 2006). Gray whales feed opportunistically on a diversity of prey

species throughout their entire range, including along the migratory corridor and in their winter range (Nerini 1984). Similarly, they breed in the fall in their summer range at the onset of the southward migration, breed and calve along the migratory corridor, and breed and calve in the winter on the winter grounds (Shelden et al. 2004; Rugh et al. 2005; Swartz et al. 2006). The summer range is primarily a feeding area, but also serves as a weaning and breeding area. The winter range is primarily a resting or nursing area where there is also breeding, calving, and feeding. The migratory corridor supports a continuum of behaviors (feeding, breeding, and calving) as whales shift between summer and winter ranges.

Gray whale distribution and habitat use exhibit within-season and year-to-year variability within their range (Yablokov and Bogoslovskaya 1984; Gardner and Chávez-Rosales 2000). Additionally, their entire range shifts over longer time frames in response to long-term environmental variability such as oceanic climate cycles (e.g., El Nino-Southern Oscillation, Pacific Decadal Oscillation, and Arctic Oscillation). Gray whale distribution and habitat use are dynamic and inherently linked to the variability of the prey base and changing physical properties of the ocean environment (Section 3.4.3.1.3, Feeding Ecology and Role in the Marine Ecosystem).

3.4.3.3.1 Summer Range Distribution and Habitat Use

Most of the whales in the gray whale population migrate north of the Alaska Peninsula during the spring northward migration, but some gray whales remain south of the Alaska Peninsula to feed throughout the summer and fall. This discussion uses the Alaska Peninsula/Aleutian Island chain as a conceptual north/south line dividing the summer range into the northern and southern portions. The northern portion of the summer range is also referred to in the literature as 'northern seas' (Nerini 1984; Gardner and Chávez-Rosales 2000) and 'primary,' 'principal,' 'traditional,' 'northern,' or 'summer' feeding grounds (e.g., Braham 1984; Nerini 1984; Swartz 1986; Darling et al. 1998; Moore et al. 2000; Dunham and Duffus 2002; Findlay and Vidal 2002), while the southern portion of the summer range is also referred to as the southern feeding grounds 'alternative feeding grounds [or area]' (Moore et al. 2007) and sometimes the 'migratory [or migration] corridor' (e.g., Braham 1984; Nerini 1984). Distribution and habitat use in both the northern and southern portions of the summer range are described below.

Northern Portion of the Summer Range

The extent of gray whale distribution and habitat use in the northern portion of the summer range (Figure 3-3) is not well-documented, and patterns are difficult to discern; much of the data come

from historical whaling records or observational efforts that are not consistent or comparable (Berzin 1984; Clarke and Moore 2002). Sighting data from Soviets and Americans throughout 1958 to 1993 are summarized in Clarke and Moore (2002), but the information is of limited value due to the inconsistent methods by which the data were collected. Generally speaking, whales are distributed as far east as the Canadian Beaufort Sea (Rugh and Fraker 1981), as far west as the Eastern Siberian Sea along the coastal shelf of Siberia and near Wrangel Island (Berzin 1984; Reilly 1984; Miller et al. 1985; IWC 2006a), along the north and south coasts of the Chukotkan Peninsula (Berzin 1984; Miller et al. 1985), at shoals in the northeastern Chukchi Sea near Barrow, Alaska (Moore et al. 2000), and in the northern Bering and southern Chukchi Seas in areas between the Bering Strait and St. Lawrence Island (Moore et al. 2003).

Sea ice cover probably influences distribution to some extent, but the primary factor influencing distribution and habitat selection appears to be availability of prey (Moore 2000; Clarke and Moore 2002). During the summer months in the Alaska Beaufort Sea (i.e., western Beaufort Sea) and southern Chukchi Sea, gray whales selected coastal and shoal habitats (less than 115 feet [35 meters] deep) with less than 20 percent ice cover (Moore et al. 2000). Scientists at the 2006 IWC meeting reported that six satellite-tagged individual whales were also monitored moving north to these regions in open ice leads (i.e., open water paths in the ice) during mid-June, but they moved through areas that had 30 to 40 percent ice cover at times (IWC 2006a). In the fall months, whales have been observed feeding in more than 70 percent ice cover. Moore et al. (2000) concluded that gray whale habitat selection is not strongly related to ice conditions (ratios for numbers of whales at various depths were similar for both light and heavy ice years); instead, gray whale distribution is primarily linked to prey density. During years when strong surface winds result in the cross-shelf transport of upwelled, nutrient-rich waters, benthic prey species are probably more productive and densely aggregated in nearshore coastal and shoal habitats (Moore 2000). During years of moderate to low wind mixing and transport, gray whales select shelf and trough habitats further offshore, where currents are directed by bathymetric features (i.e., seafloor geology) and may provide migration cues to southbound whales (Moore et al. 2000). The overall abundance of the gray whale population also probably influences distribution in the northern portion of the summer range (and elsewhere) because, as the gray whale population increases, the range may expand as individuals forage more widely for limited food resources. Rugh et al. (2001) proposed that the week's delay in southward migration timing after 1980 may have been due to a wider distribution of the population as their search for food covered increasingly greater areas, making

the trip south longer. This effect of a larger population leading to a wider dispersal was also noted by other authors (Yablokov and Bogoslovskaya 1984; Stoker 2001).

Within-season movement of gray whales has been documented over the years, leading researchers to the conclusion that whales in the northern portion of the summer range exhibit constant and extensive local migrations between feeding areas; they do not stay in one area for the entire season (Yablokov and Bogoslovskaya 1984; IWC 2006a). Individual whale movement in the northern portion of the summer range has not been documented to the extent of individual whales in the southern portion of the summer range (photographic-identification [photo-id] is impractical in such a large and remote area), but scientists at the 2006 IWC meeting reported preliminary results from a recent satellite-tagging study. The tagging data show that four individual whales used the southern Chukchi Sea for more than three months, with the distribution of the individual whales overlapping by only 3 percent within this area (IWC 2006a).

Long-term shifts in the summer range have also been described recently and are thought to be related to the operation of two major oceanic climate cycles: the Arctic Oscillation and the Pacific Decadal Oscillation. These two cycles generally occur in the North Pacific every 10 to 30 years, last 30 to 40 years, and have distinct warm and cool phases due to changes in sea surface pressure and sea surface temperature. The operation of both the Arctic Oscillation and Pacific Decadal Oscillation appears to be causing a major ecosystem shift in the Bering Sea, a transitional area that is at a crossroads between the Pacific Ocean and the Arctic Ocean and is, therefore, influenced by both cycles (Bond 2006; Grebmeier et al. 2006).

The Bering Sea (northern Bering and southern Chukchi Sea) was once considered the primary gray whale feeding ground (Braham 1984; Moore et al. 1986; Kim and Oliver 1989; Moore et al. 2000). During the late 1970s to early 1980s, it was characterized by cold climate conditions with extensive seasonal ice cover and high benthic productivity (Grebmeier et al. 2006). Time-series studies from the Chirikov Basin (between St. Lawrence Island and the Bering Strait) show that in 1980, *Ampeliscid* amphipods were the primary prey items of gray whales, sampled at record-high densities from the 1970s to mid 1980s (Stoker 1981; Yabolokov and Bogoslovskaya 1984; Grebmeier et al. 1989; Highsmith and Coyle 1990). The amphipod prey base declined by 30 percent between 1986 and 1988 (Highsmith and Coyle 1992; Sirenko and Koltun 1992). This reported decline in benthic biomass did not have an immediate observable effect on gray whale abundance. A subsequent gray whale mortality event in 1999/2000, coupled with observations of emaciated whales, led scientists to conduct aerial surveys of the Chirikov Basin in 2002 to

compare distribution and relative abundance with the 1980s data (Moore et al. 2003). Sighting rates of gray whales in the Chirikov Basin were 3 to 17 times lower than they had been in the 1980s (Moore et al. 2003; Grebmeier et al. 2006). Benthic productivity of the prey had declined precipitously, and only the southern Chukchi Sea supported dense aggregations of whales (Moore et al. 2007).

The Bering Sea is now characterized by warmer conditions with less sea ice cover and lower benthic productivity (Grebmeier et al. 2006). Gray whales have responded by foraging in other areas (Moore et al. 2003; Moore 2005; Moore et al. 2007). Observers are now seeing larger feeding aggregations in different parts of the northern portion of the summer range, north of the Bering Strait in the south-central Chukchi Sea and just north of St. Lawrence Island in the northern Bering Sea (south of the Chirikov Basin), an area that was previously recorded as devoid of gray whale feeding (Clarke and Moore 2002; Moore et al. 2003). Scientists recently reported at the 2006 IWC Scientific Committee meeting that a large proportion of 17 satellite-tagged whales fed extensively in the Chukchi Sea; six whales retained their tags for more than 100 days, and all six spent most of their time in the Chukchi Sea (IWC 2006a). These data support an increase in foraging in that area. Observers have also documented feeding that has not been seen previously in the southern portion of the summer range, such as near Kodiak Island and in the Gulf of Alaska (near Sitka) (Moore et al. 2003).

Southern Portion of the Summer Range

Not all ENP gray whales make the full migration every year north of the Alaska Peninsula/Aleutian Island chain. Some whales spend all or part of the summer feeding in the southern portion of the summer range. There is no evidence that the whales feeding in this portion of the summer range are genetically or demographically unique, and both NMFS and the IWC continue to treat ENP gray whales as a single stock for management purposes. Nevertheless, in its 2001 EA, NMFS considered the effect that a Makah hunt might have on the group of whales using the southern portion of the summer range, which it termed the 'Pacific Coast Feeding Aggregation' or PCFA. The following discussion describes the studies of whales in the southern portion of the summer range and how information from these studies is relevant to analyzing the effects of a potential gray whale hunt in the Makah Tribe's U&A.

For more than four decades, gray whales have been observed feeding south of the Alaska Peninsula and Aleutian Island chain during the late spring, summer, and fall feeding periods, past the times typically associated with the end of the spring northward migration and before the times

typically associated with the onset of the fall southward migration. Between late spring and fall, gray whales have been observed off coastal Mexico (Patten and Samaras 1977); southern, central, and northern California (Mallonée 1991; Calambokidis et al. 2004a); southern and central Oregon (Herzig and Mate 1984; Sumich 1984); northern Washington and northern Puget Sound; southwest and western Vancouver Island; British Columbia and north British Columbia (Darling 1984); and Sitka and Kodiak Alaska (Calambokidis et al. 2002; Calambokidis et al. 2004a; Moore et al. 2007). During line transect vessel surveys conducted in the Olympic Coast National Marine Sanctuary from mid-June through late July, 1995 through 2002, for instance, Calambokidis et al. (2004b) documented the presence of five gray whales in the migratory corridor off the Washington coast, averaging 3.1 miles (5 km) from shore in 65.6 feet (20 m) of water. Feeding gray whales occurred off California even in the 1920s when population numbers were very low (Clapham et al. 1997; Moore et al. 2007). In the literature, these observations have often been described as summer sightings (Gosho et al. 2001), and the whales have been referred to as summer feeders or summer residents, a term first used by Pike (1962) to describe gray whales that occurred off British Columbia from June through September. Researchers have used the term 'summer' to refer to a longer period than is generally associated with the season, describing sightings off the Washington coast between June 1 and November 30 as summer feeding (e.g., Calambokidis et al. 2002; Calambokidis et al. 2004a).

In the early 1970s scientists discovered they could identify individual whales by dorsal area shape, scars, and coloration patterns that are visible above the surface of the water when the whales arch to dive (Darling 1984). Photographing and identifying individual whales, noting the location and time of sighting, and comparing photographs within and between years has allowed scientists to study abundance, distribution, movements, and survival of whales using the southern portion of the summer range. Over time researchers have established summer survey areas either because the area is one where whales were likely to be found feeding or because the area is one where a management activity occurs (for example, a counting station along the migration route, or an area where a hunt is proposed). The following discussion focuses on survey areas because that is how data are collected, reported and analyzed. Although a researcher's designation of a survey area will not necessarily correspond to areas that are biologically meaningful to individual whales or groups of whales, they are nevertheless useful for analyzing local effects.

From 1972 to 1981, researchers conducted photo-id studies in survey areas off the west coast of Vancouver Island, British Columbia (Hatler and Darling 1974; Darling 1984). Both effort and survey areas varied between years. Survey effort ranged from less than 5 days in 1972 to 54 days

in 1976. Five discrete areas were surveyed. Surveys began in the 24.9-mile [40-kilometer] stretch of coast around Wickaninnish Bay near Tofino on the central west coast of Vancouver Island (surveyed from 1972 to 1981). Later surveys extended north to include three more discrete survey areas (Estevan Point, between Clayoquot Sound and Nootka Sound, surveyed from 1976 to 1981; Cape Scott, surveyed in 1977 and 1979; and Calvert Island, surveyed in 1977 and 1979), then survey efforts expanded south to include the West Coast Trail survey area (surveyed from 1979 to 1981). In 1976 and 1977, the greatest number of whales identified in any one summer was 34 (some individuals were resighted from prior years), corresponding to maximum effort and including one year when four of the five survey areas were surveyed (excluding West Coast Trail, which was added later in 1979). Flights to locate whales missed by the boat-based surveys were carried out weekly in 1976 and sporadically in other years. Sixty-three percent of the identified whales were seen in more than one summer, and thirty-seven percent were identified in only one summer (i.e., they were never resighted). One whale was seen in seven consecutive years and others were seen across spans of time as long as eight summers but were not seen in every summer.

On the basis of these data, Darling (1984) surmised that 35 to 50 whales were present during 1972 to 1981 off the coast of Vancouver Island in any one summer, but they were not all the same whales each year. During 1975 to 1981, Darling (1984) identified 93 total individual whales that were present in this study area for at least one year. Darling (1984) noted that other researchers surveying in areas off of Oregon thought there were approximately 75 total individual whales identified each year of their effort, so he surmised that there were at least 100 gray whales in the British Columbia-Washington-Oregon area in any one summer.

Within-season and between-year movement of identified and resighted whales was also recorded. Some identified whales remained in the same survey area throughout the summer; for example, two whales remained in Wickaninnish Bay survey area for at least 80 days. Other whales traveled considerable distances in search of food; for example, a whale identified in the Wickaninnish Bay survey area reappeared in the Estevan Point survey area 47.9 miles (77 kilometers) away. Between years, identified whales reappeared at least 93.3 miles (150 kilometers) away from where they were in a prior year.

More recently, from 1984 to 1993, researchers from Cascadia Research Collective conducted photo-id studies of eight discrete survey areas in the inland waters of southern, central, and northern Puget Sound and Hood Canal; the Strait of Juan de Fuca; and the outer Washington

coast, including Grays Harbor (Calambokidis et al. 1994). Survey efforts varied between summers and areas, ranging from 16 days in 1990 to 50 days in 1991. Calambokidis et al. (1994) developed a catalog of photo-identified whales; 76 individual photo-identified whales were in the catalog by 1993. Of these 76 photo-identified whales, only 17 whales (22.3 percent) were resighted in more than one year, either in the same area or a different area including British Columbia. Between-year resightings of photo-identified whales were most common in the northern Puget Sound survey area, where five of seven identified whales were resighted in subsequent years. They were least common in the southern and central Puget Sound and Hood Canal survey areas, where 1 of 18 identified whales was resighted in subsequent years. Individually identified whales were resighted an average of 47 days later, and the longest time between first and last sightings in a season was 112 days.

These photo-id efforts collectively demonstrate that some of the gray whales feeding in the southern portion of the summer range remain for extended periods and that some of the whales return to the same general feeding areas in later years, though not necessarily every year (Darling 1984; Calambokidis et al. 1994). The studies also demonstrate that many of the gray whales photo-identified were not resighted in subsequent years, that new individuals were photographed every year, and that some whales inhabited different areas in different years (Darling 1984; Calambokidis et al. 1994). These observations were important because they suggest a lack of strong site fidelity (returning to the same previously occupied breeding or feeding location), which can indicate that a particular group of animals is different from the rest of the population in a biologically meaningful way (i.e., genetic or behavioral differences). Such differences can indicate stock structure and demographic independence, which have management implications. Animals with strong site fidelity may be unlikely to move or select new habitats if their traditional habitat becomes less favorable (Switzer 1993; Quan 2000).

In response to the Makah request to resume their traditional hunt of gray whales, NMFS initiated photo-id studies of gray whales off the coast of Washington in 1996 to better understand distribution (including site fidelity and habitat use) and abundance (Gearin and DeMaster 1997; Gosho et al. 1999; Gosho et al. 2001). The agency was responding to federal conservation and management obligations pursuant to the ESA monitoring plan following the 1994 delisting and was also operating under federal trust obligations, triggered by the Makah Tribe's request to hunt gray whales starting in the 1998 to 2002 five-year IWC catch limit time frame (Gearin and DeMaster 1997). NMFS was investigating whether the proposed level of harvest was sustainable for the area. The agency focused its survey efforts in the Strait of Juan de Fuca (from Tatoosh

Island to Sekiu), the northern Washington coast (Tatoosh Island to Carroll Island), and southern Vancouver Island. NMFS noted that the survey area had limitations and indicated that effort should be extended beyond these three areas south to Grays Harbor (the area surveyed by Calambokidis et al. 1999) and north to west Vancouver Island (the area surveyed by Darling 1984) to increase the probability of sighting gray whales in Washington and British Columbia waters (Gosho et al. 1999).

From 1998 to the present, NMFS funded and collaborated with Cascadia Research Collective and other researchers to photo-id gray whales. This collaboration has allowed researchers to combine resources and results and cover broader survey areas within the southern portion of the summer range, from southern California to Kodiak Island. Effort within survey areas varied, with most intensive coverage in the survey areas along the southern and western coast of Vancouver Island and just north of Vancouver Island (Calambokidis et al. 2002; Calambokidis et al. 2004a). Researchers obtained photographic identifications of between 1,159 and 1,499 whales each year from 1998 to 2003. From those photographs, 600 individual whales were identified (multiple photographs were taken of most whales in each year, and some whales were seen in more than one year, so the number of photos taken exceeds the number of whales uniquely photo-identified). From those 600 whales, 477 individual whales were identified between California and Kodiak during the June 1 through November 30 summer feeding period, outside the time period of the northward migration (Calambokidis et al. 2004a). Calambokidis et al. (2004a) limited most of their analyses to the 408 whales seen in the core survey region from northern California to northern British Columbia (which they also call the 'Pacific Coast Feeding Aggregation' or PCFA survey area – see Figure 3-4 and Figure 3-5). Whales sighted in northern and southern Puget Sound were rarely seen in other feeding areas during the summer feeding period, so they were excluded from the analysis in Calambokidis et al. (2004a).

Of the 408 unique whales seen in the core region, 49 percent were seen between June 1 and November 30 in only one of the six years (excluding those first seen in 2003), which demonstrates that many of the newly seen whales did not return in subsequent years. Twenty-five percent of the whales were seen in every summer after their initial identification, including 49 whales that were seen in all six years. The remaining 26 percent were seen more than once but not in every year. Some of the latter whales were seen in Kodiak and Southeast Alaska in years that they were not seen in the core region (Calambokidis et al. 2004a). Five of the ten whales identified in Southeast Alaska and eight of the 46 whales seen in Kodiak had been seen farther south in the core survey region. For example, Whale 130 was only seen in Southeast Alaska in

1999, but had been seen in every other year somewhere between Oregon and northern Vancouver Island. Likewise, Whale 232 was only seen in Kodiak in 2002, but was seen along Vancouver Island in 2000, 2001, and 2003. Whale 152 was photo-identified in Kodiak in 2002, but previously had been seen along the west coast of Vancouver Island in 1999, as early as 1995 in the Cape Caution, British Columbia, area, and in 1992 in the Clayoquot Sound, British Columbia, survey area (Calambokidis et al. 2003). Another example is Whale 68, which was seen in Southeast Alaska in 1998 and 1999, was not seen in the core region from 1998 to 2003, and was seen in northern Washington during 1996 and 1997. While these are only a few examples of whale movements, they illustrate the extensive inter-year movement of whales, which partially explains the gaps in the observations for some whales and the disappearance of others from the core survey region.

Whales using the core survey area exhibited a wide range of movement across and within years. The 49 whales seen in each of the six years provide a useful example. None of those whales was seen exclusively in a single area, and 49 percent were seen in at least four of the six survey areas from 1998 to 2003. However, whales did regularly visit the same areas across years. Seventy-one percent were seen in at least one of the areas during five or more of the six years. Those areas were primarily along Vancouver Island, which partially reflects the larger amount of survey effort (Calambokidis et al. 2004a). Thus, some whales regularly visit an area, but they use other areas as well. Calambokidis et al. (2004a) showed that whales seen in more years appeared in more regions.

Within-season movement of photo-identified and resighted whales in the summer feeding period was extensive (Calambokidis et al. 2004a). For each survey area examined, there was a pattern of decreasing movement between survey areas within season for each survey area farther to the north or south (Calambokidis et al. 2004a). This pattern demonstrates that whales do focus on specific areas within the summer season, but they will move in search of food, most likely to neighboring areas. There have been examples of large-scale movements within a year. One whale, originally photo-identified in a southeastern Alaska survey area around September 1999, was resighted far south about a month later in a northern California survey area (Calambokidis et al. 2004a). Another whale moved in the opposite direction; researchers originally identified it off southern Vancouver Island during June 2003, it swam at least 1,104 nautical miles in 34 days or less, and it reappeared off Kodiak on August 9, 2003 (Calambokidis et al. 2004a). Within-season and between-year movements of gray whales likely relate to changes in productivity and prey availability. Darling et al. (1998), for example, noted a long-term change in the use of the

Wickaninnish Bay survey area off the central west coast of Vancouver Island, British Columbia. From 1966 to 1977, whales were consistently present from May to September, but use of the habitat during summer was becoming less consistent by 1977. Since 1989, whales have been observed feeding mostly on pelagic prey (e.g., crab larvae and swarming amphipods), although occasional bouts of benthic feeding also occurred throughout this time, such as in April 1996 (Darling et al. 1998).

Similarly, Moore et al. (2007) noted that tens to hundreds of gray whales have been seen consistently along the southeastern coast of Kodiak Island since 1999; 350 to 400 feeding gray whales were counted during a single aerial survey in July of 2000. Moore et al. (2007) proposed that the high counts of whales near Kodiak in 2000 and 2001 may be a result of prior oversight (i.e., the whales may not have been sighted because Kodiak has long been considered part of the migratory corridor and not part of the summer range). The high counts may also be related to feeding opportunities resulting from ecosystem responses to the 1997 to 1998 El Nino in the North Pacific (see El Nino discussion below in the Winter Range Distribution and Habitat Use Section). The repeat occurrences of whales at certain sites, appearance at new sites, and discontinued use of other sites are probably related to gray whale foraging patterns and behavior, prey distribution, abundance, and predictability (Darling et al. 1998).

In deriving estimates of 35 to 50 gray whales for Vancouver Island and 100 whales for the Pacific Northwest, Darling (1984) defined abundance as the number of gray whales he could find in his study sites in any particular year. In its 2001 EA, NMFS based its evaluation of effects on gray whale abundance using (1) a larger survey area than Darling considered and (2) the entire group of whales seen in the area (in more than one year), not just those seen in a single year. Recognizing that whales are highly mobile and move freely in a larger area than the Makah U&A during the summer feeding period, NMFS considered the survey area from northern California to northern British Columbia to be the most appropriate area to use for managing a gray whale harvest to avoid local depletions, and termed the whales using that area during the summer feeding period the 'Pacific Coast Feeding Aggregation' (PCFA). For evaluating effects on abundance, NMFS also considered the entire group of whales seen in the area in more than one year, not just the number of whales seen in a single year (some of which might return and some of which never return).

The Ninth Circuit in *Anderson v. Evans* (2004) found that the scale of NMFS' inquiry in the 2001 EA was not sufficiently fine – that NMFS must consider not just effects to the ENP gray whale

stock as a whole and the PCFA group of whales, but effects to the smaller group of whales frequenting the Makah Tribe's U&A – the "relatively small group of whales [that] comes into the area of the Tribe's hunt each summer,... about sixty percent of [which] are returning whales (although, again, not necessarily whales returning annually)" (*Anderson v. Evans* 2004). In holding that NMFS was required to prepare an EIS, the court focused on impacts to the local area.

> Even if the eastern Pacific gray whales overall or the smaller PCFA group of whales are not significantly impacted by the Makah Tribe's whaling, the summer whale population in the *local* Washington area may be significantly affected. Such local effects are a basis for a finding that there will be a significant impact from the Tribe's hunts. *See* 40 C.F.R. § 1508.27(a). Thus, if there are substantial questions about the impact on the number of whales who frequent the Strait of Juan de Fuca and the northern Washington Coast, an EIS must be prepared (*Anderson v. Evans* 2004).

Subsequent to NMFS' preparation of the 2001 EA, which focused on the PCFA area as an appropriate scale for managing a Makah gray whale hunt, Calambokidis et al. (2004a) proposed that a smaller survey area within the PCFA survey area, from Oregon to Southern Vancouver Island (ORSVI), was most appropriate for managing a Makah gray whale hunt. To reach this conclusion, they focused on whales identified in the survey areas corresponding to the Makah U&A (the northern Washington coast and Strait of Juan de Fuca survey areas). They examined the degree to which whales sighted in these survey areas were also sighted in the ORSVI and PCFA survey areas (Figure 3-5).

They found that of the whales seen in the PCFA survey area during the six years of their study, 30 percent were also seen in the Makah's U&A (northern Washington coast and Strait of Juan de Fuca survey areas). In contrast, of the whales seen in the ORSVI survey area during the six years of their study, more than half were also seen in the Makah's U&A. Based on the relatively high rate of interchange between the ORSVI and the Makah U&A, compared to the rate of interchange between the PCFA and the Makah U&A, they concluded that "it is both logical and reasonable to use ORSVI as the region for abundance estimation in setting quotas for a harvest of whales from the [Makah U&A] region."

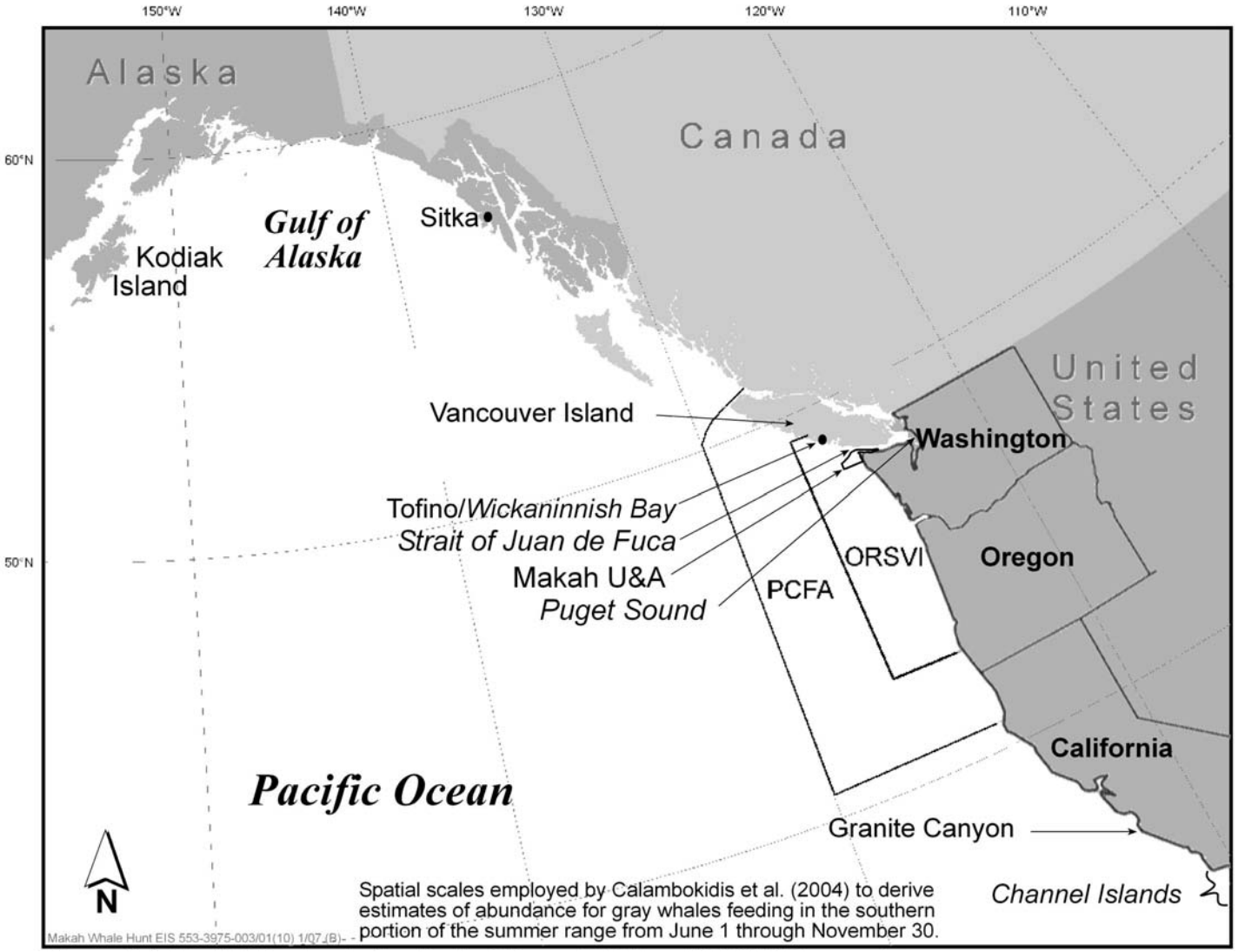


Figure 3-4. Spatial Scales in the Project Area – PCFA and ORSVI Survey Areas

Individual Survey Areas (North to South)	Combined Survey Areas		
	Makah U&A	ORSVI	PCFA
Coastal Waters			
Kodiak Alaska			
Southeast Alaska			
Northern British Columbia			
Western British Columbia			
Southern Vancouver Island			
Strait of Juan de Fuca			
Northern Washington Coast			
Grays Harbor			
Northern Oregon			
Southern Oregon			
Northern California			
Central California			
Inland Waters			
North Puget Sound			
Puget Sound & Hood Canal			

Figure 3-5. Individual Survey Areas Within the Makah U&A, ORSVI, and PCFA Survey Areas

Gray whales seen in any of the survey areas each year include (1) immigrating whales (not previously identified, either because they were new to the area or because they were there in a prior year but were not photographed); (2) returning whales (previously identified); and (3) emigrating whales (previously identified but not sighted during the subsequent summer(s), either because they never returned, because they may return in later summers, or because they were there but not photographed). Calambokidis et al. (2004a) proposed that it was more appropriate to use open population models than closed population models to estimate abundance of gray whales in the PCFA and ORSVI survey areas. Because new whales are entering a given

area each year (gains through immigration and recruitment) and some new whales never return (losses through emigration and death), closed population models are not appropriate.

Calambokidis et al. (2004a) developed estimates of abundance from the open-population models that would be unlikely to yield higher results than true abundance. They assumed that all whales using either the PCFA or ORSVI survey areas in any one or more years were photographically identified (an assumption that most likely results in underestimating the true abundance of whales in these areas, since it is likely not all whales using the area are seen, photographed, and identified). Calambokidis et al. (2004a) estimated abundance in 1998 as the total number of whales seen in 1998. They estimated abundance in 1999 as the total number of new whales seen in 1999 and the predicted number of whales from the 1998 cohort that survived and would return at some time (not permanently emigrate) in subsequent years. Researchers constructed the estimates for the remaining years similarly as the sum of the newly seen whales and returning surviving whales from cohorts of previous years. They also constructed abundance estimates of returning whales by excluding the newly seen whales.

For the PCFA survey area, Calambokidis et al. (2004a) estimated that abundance increased from 129 whales in 1998 (count of all photographically identified whales) to a peak of 225 whales in 2002 (standard error equals 6.6). They estimated abundance increases of returning whales from 102 whales (standard error equals 5.7) in 1999 to a peak of 176 whales (standard error equals 20.5) in 2003. The average annual increase of returning whales was 18.5 whales from 1999 to 2003. For the smaller ORSVI region, estimated abundance increased from 84 whales in 1998 (count of new whales) to a peak of 150 in 2003 (standard error equals 20.5), and abundance estimates of returning whales increased from 61 whales (standard error equals 5.0) in 1999 to a peak of 122 whales (standard error equals 20.5) in 2003. The average annual increase of returning whales was 15.2 from 1999 to 2003. The estimates of immigrants into the area may be too high due to the assumption that all whales appear in each year. This ignores the possibility of a whale immigrating in a previous year and, thus, being missed. The data nevertheless demonstrate sightings of many new whales each year, some of which return in subsequent years.

Calambokidis (2007) and Laake (2007, pers. comm.) provided updated information on gray whale identifications throughout the southern portion of the summer range. During 1 June-30 November for 1998-2005, 464 unique whales were seen in the PCFA (from northern California to northern British Columbia) (Table 3-2). Sixty-seven percent (311 of the 464 whales seen in the PCFA) were seen within the smaller ORSVI region (Oregon to southern Vancouver Island)

(Table 3-3) and approximately 25 percent (115 of the 464 whales seen in the PCFA) were seen within the smaller Makah U&A (northern Washington Coast and Strait of Juan de Fuca) (Table 3-4).

The average number of whales identified in any one year was 160, 87, and 22 in the PCFA, ORSVI and Makah U&A regions respectively. However, those numbers do not represent the total numbers of whales that use each of these areas because not all whales using a region in a year are seen, not all whales return to the same region each year, and not all of the whales return to the PCFA each year.

The annual average number of newly seen whales (excluding 1998 when all are new by definition) was 47.9, 32.4, and 11.4 for PCFA, ORSVI, and Makah U&A, respectively. The annual average number of newly seen whales that were "recruited" (seen in a subsequent year), excluding 1998 and 2005, was 21.7, 15.3, and 4.7 for PCFA, ORSVI, Makah U&A respectively. Thus, there were a substantial number of new whales seen each year and about 45 percent of those were seen again in a subsequent year.

The plots (also known as "discovery curves") of the cumulative number of unique whales for the PCFA, ORSVI and Makah U&A (Figure 3-6) also demonstrate that this is not a closed population of whales. All of these curves continue to climb because there have been new individuals seen each year. The same pattern holds for the plots of whales that are sighted in more than one year (Figure 3-7). These latter plots are only shown for 1998-2004 because whales seen in 2005 have not had a chance to be resighted within the scope of the data. Also, latter years will appear to increase more slowly because there have been fewer opportunities for resighting whales that were first seen in one of the later years (a whale first seen in 2004 has only had one year, 2005, in which to be resighted).

TABLE 3-2. CLASSIFICATION OF WHALES SEEN WITHIN THE PCFA (NORTHERN CALIFORNIA TO NORTHERN BRITISH COLUMBIA).

YEAR	TOTAL SEEN[2]	NEWLY SEEN[3]	NEWLY SEEN & SEEN AGAIN[4]
1998	129	129	103
1999	152	75	17
2000	139	56	32
2001	174	66	25
2002	206	57	28
2003	158	22	17
2004	182	35	11
2005	142	24	-
Total		464	233

TABLE 3-3. CLASSIFICATION OF WHALES SEEN WITHIN THE ORSVI (OREGON TO SOUTHERN VANCOUVER ISLAND).

YEAR	TOTAL SEEN	NEWLY SEEN	NEWLY SEEN & SEEN AGAIN
1998	84	84	63
1999	71	26	12
2000	67	26	16
2001	127	56	17
2002	102	40	21
2003	110	26	18
2004	113	30	8
2005	101	23	-
Total		311	155

[2] "Total Seen" is the number of unique whales seen in each year
[3] "Newly seen" is the number of whales seen that year that had not been seen prior to that year (but within the 1998-2005 period).
[4] "Newly Seen & Seen Again" is the number of whales that were seen in at least one more year within the PCFA (Table 3-2) or ORSVI (Table 3-3) subsequent to the first year they were seen.

TABLE 3-4. CLASSIFICATION OF WHALES SEEN WITHIN THE MAKAH U&A (NORTHERN WASHINGTON COAST & STRAIT OF JUAN DE FUCA).

YEAR	TOTAL SEEN[5]	NEWLY SEEN[6]	NEWLY SEEN & SEEN AGAIN[7]
1998	35	35	12
1999	11	6	4
2000	14	11	7
2001	32	20	5
2002	8	1	1
2003	22	12	4
2004	22	16	7
2005	35	14	-
Total		115	40

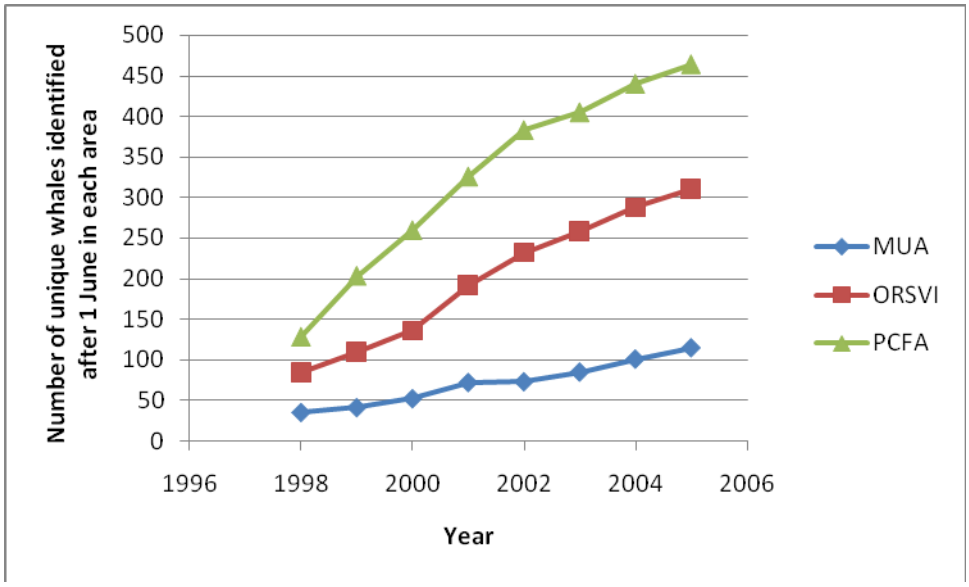


Figure 3-6. Cumulative number (i.e., "Discovery curve") of unique gray whales photo-identified in PCFA, ORSVI, and Makah U&A during 1998-2005.

[5] "Total Seen" is the number of unique whales seen in each year
[6] "Newly seen" is the number of whales seen that year that had not been seen prior to that year (but within the 1998-2005 period).
[7] "Newly Seen & Seen Again" is the number of whales that were seen in at least one more year within the Makah U&A subsequent to the first year they were seen.

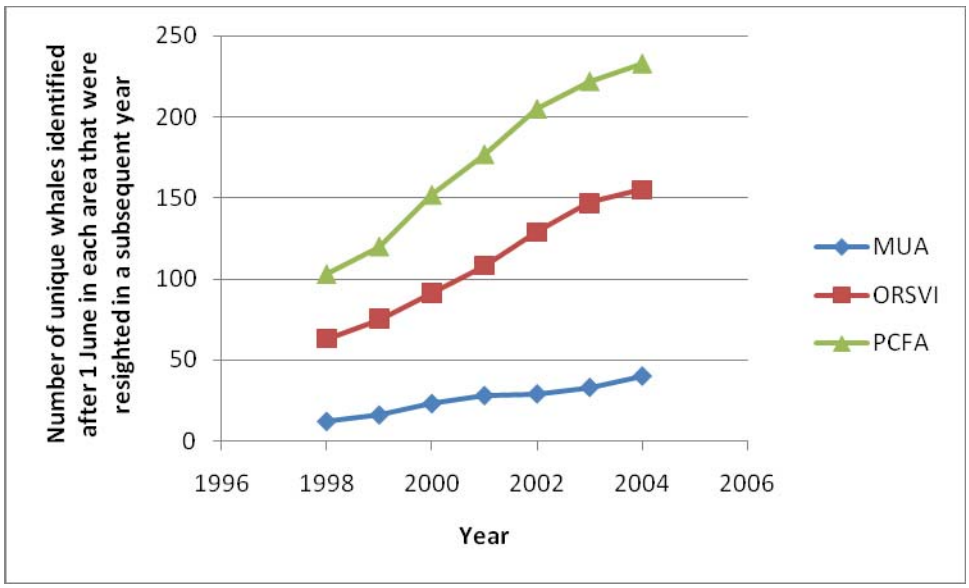


Figure 3-7. Cumulative number (i.e., "Discovery curve") of unique gray whales photo-identified in PCFA, ORSVI, and Makah U&A during 1998-2004 and resighted in a subsequent year.

Even though some whales are sighted annually or interannually returning to the southern portion of the summer range, there is no evidence that returning whales are genetically unique relative to the larger gray whale population (Swartz et al. 2006). If the gray whales in the southern portion of the summer range represented a distinct lineage of mothers, and their offspring exhibited high site fidelity (with adult males exhibiting wider dispersal and less site fidelity), this complex social structure would be reflected in differences in maternally derived genes (i.e., mtDNA) relative to the larger population. Researchers have documented such differences in mtDNA reflecting strong site fidelity for humpback whales in the North Atlantic and North Pacific in their summer feeding grounds (Baker et al. 1990; Larsen et al. 1996). The documented mtDNA differences between humpbacks in different feeding areas indicate that calves learn to use specific feeding areas from their mothers, and they subsequently pass that knowledge through the generations (a concept known as maternally directed fidelity or familial recruitment) (Palsbøll et al. 1995; Larsen et al. 1996; Palsbøll et al. 1997). Long-term resighting histories of individual humpback whales in the North Atlantic further demonstrate very high annual return rates to specific feeding grounds and minimal interchange among such regions (Clapham et al. 1993; Stevick et al. 2006).

In the case of ENP gray whales in the southern portion of their summer range, Ramakrishnan et al. (2001) analyzed the mtDNA of whales sampled in the PCFA survey area and concluded that

they do not differ genetically from the larger population. These data suggest that there is not a genetically distinct group of mothers teaching their offspring to feed in the PCFA survey area. The apparent difference in site fidelity between humpback and gray whales may be due to the geographic structure of the migratory route between the summer and wintering grounds. For humpback whales, the migratory routes to isolated feeding areas are direct and often cross deep ocean basins (Baker et al. 1990; Calambokidis et al. 1996; Clapham and Mead 1999; Calambokidis et al. 2002). In contrast, gray whales follow a coastal migratory route passing all known feeding areas. Thus, even if mothers introduce calves to a feeding area, there is a natural mechanism for all gray whales to adopt and/or revisit productive feeding areas (Calambokidis et al. 2004a). Additionally, Ramakrishnan et al. (2001) observed a statistically significant male bias in the sex ratio of gray whales sampled in the PCFA survey area of 1.8 males to 1 female (with a sample of 45 animals). The male-skewed sex ratio is further evidence that the whales in the southern portion of the summer range during the summer feeding period are not demographically independent from the larger gray whale population because such a sex ratio would not likely sustain a population without external recruitment.

Using open-population models, Calambokidis et al. (2004a) demonstrated that new whales were more likely to be seen in subsequent years if they were seen for longer periods of time during their first year. They proposed that this relationship resulted from the whale's foraging success/failure, which would affect the whale's propensity to return in subsequent years. They also proposed that the annual northbound migration along the Pacific coast provided a natural mechanism for recruitment of gray whales because the whales would stop to forage and, if they were successful, would be more likely to return in subsequent years.

In summary, available data indicate there is no evidence that the gray whales in the southern portion of the summer range are genetically or demographically different from the larger population. Sighting (photo-identification) data show a continuum of gray whale distribution in the southern portion of the summer feeding range during summer and fall feeding periods from at least the southernmost survey area in northern California to Southeast Alaska near Sitka and Kodiak Island (Calambokidis et al. 2003; Calambokidis 2004a; Moore et al. 2007). Although some gray whales return to the same general feeding area in at least some later years, photo-id data have demonstrated large-scale movements of whales and variability in gray whale distribution and habitat use within season and between years. These movements and variability are likely due to shifts in prey availability, the opportunistic and diverse nature of the species' feeding ecology (Section 3.4.3.1.3, Feeding Ecology and Role in the Marine Ecosystem), and the

ability of gray whales to respond rapidly to changes in prey composition and density throughout the range (Darling et al. 1998; Dunham and Duffus 2001; Moore et al. 2003; Moore 2005; Moore et al. 2007). The discovery of feeding areas along the migration route provides a natural mechanism for recruitment of new whales into the PCFA survey area (Calambokidis et al. 2004a).

3.4.3.3.2 Winter Range Distribution and Habitat Use

Gray whales occupy a large area in their winter range, (Reilly 1984). Researchers think the winter range extends along the west coast of the Baja Peninsula, as far north as Point Conception and the Channel Islands in central California (near Santa Barbara) to Cabo San Lucas (Reilly 1984; Jones and Swartz 2002; Urbán-Ramírez et al. 2003), where most investigators have concentrated their observations (Findlay and Vidal 2002). Findlay and Vidal (2002) also reported that some of the population migrates farther south, around the tip of the peninsula in the Gulf of California. A few isolated sightings of gray whales over the years have also occurred in more southern localities along the Pacific coast of mainland Mexico and at the oceanic Revillagigedo Islands (Findlay and Vidal 2002). Researchers reported two sightings around the Chilean-Peruvian coastal waters of South America, showing that gray whales can cross the equator in search of suitable feeding grounds (Yablokov and Bogoslovskaya 1984).

As in the summer range, gray whales in the winter range often aggregate in specific areas of the ocean, particularly near and within coastal lagoons and bays of Baja, including Lagunas Guerrero Negro, Ojo de Liebre (Scammon's Lagoon), San Ignacio, Bahia Magdalena, Bahia Almejas, and Santo Domingo Channel (Urbán-Ramírez et al. 2003). The whales segregate spatially and temporally, such that their distribution, gross movements, and timetable of lagoon occupation differ for each age-sex group (Jones and Swartz 1984; Urbán-Ramírez et al. 2003; Swartz et al. 2006). Females with calves concentrate within the interiors of lagoons or lagoon nurseries, and the whales shift to the lagoon inlets and coastal waters occupied by the single whales without calves (i.e., oestrus females and mature males) when those whales depart for the northward migration (Jones and Swartz 1984; Swartz et al. 2006). Although there is repeated use of some lagoons, whales move among and between lagoons and spend some amount of the winter in waters outside of lagoons (Urbán-Ramírez et al. 2003).

The aggregating behavior of the whales and their within-season movement between different areas on the wintering grounds relate to both reproductive and feeding activities, although some literature reports that whales mostly fast throughout the winter and rely on reserves of body fat to

carry them through the winter period. Most of the feeding in the wintering grounds appears to be pelagic, rather than benthic, although researchers have seen mud plumes indicative of benthic feeding (Nerini 1984). Pelagic prey species include sardines, bait fish, spawning squid, and crustaceans associated with eel grass mats (Nerini 1984). Feeding areas foraging gray whales frequent, as documented by Nerini (1984), include San Ignacio Lagoon, Magdalena Bay, Punta San Juanico, and Laguna de San Quentin in Baja Mexico, and La Jolla and Point Loma, California. In addition, Yablokov and Bogoslovskaya (1984) noted two sightings of gray whales around the Chilean-Peruvian coastal waters of South America.

On a longer-term basis, evidence indicates that distribution and habitat use within the wintering range varies according to environmental conditions. As one example, Bryant et al. (1984) observed that whales apparently deserted the Laguna Guerrero Negro, the northernmost lagoon, during the late 1960s but reestablished during the 1970s, increasing steadily until an observed decline in 1982. They postulated that the whales recolonized the area after commercial shipping and dredging activities stopped in 1967, but they also noted that year-to-year fluctuations in relative abundance had previously been reported and observed that some individual whales enter lagoons in successive years whereas others return after longer intervals. Bryant et al. (1984) ultimately concluded that time would tell whether the number of whales using the lagoon was still increasing over the long term and whether the decrease in 1982 was a short-term fluctuation.

Recent studies have attributed shifts in the winter range to the El Nino-Southern Oscillation, a multi-year climatic cycle occurring irregularly in the tropical Pacific every two to seven years and lasting 6 to 18 months. When El Nino events occur, driven by low atmospheric pressure between Tahiti and Australia, sea surface temperatures warm, and biological productivity drops near Baja. Whales shift farther north in their distribution, such as during the 1998 wintering season. When El Ninos subside (and La Ninas occur), the sea surface temperatures are cooler near Baja (e.g., the 1989 and 1999 calving seasons), the biological productivity is higher, and whales shift south in their distribution (Gardner and Chávez-Rosales 2000; Urbán-Ramírez et al. 1990; Sánchez-Pacheco et al. 2001; Urbán-Ramírez et al. 2003). The observation of this shift led Gardner and Chávez-Rosales (2000) to conclude that environmental conditions may be more important factors in determining breeding locations than site fidelity.

Section 3.4.3.1.4 (Seasonal Migrations) describes the timing and characteristics of the ENP gray whales' southward and northward migrations, and Section 3.4.3.3 (Distribution and Habitat Use) describes the use of the southern portion of the summer range by whales that do not make the entire

northward migration. Of particular interest for this EIS are whales identified during the summer feeding period (June 1 through November 30) in the Makah U&A (northern Washington coast and Strait of Juan de Fuca), ORSVI and PCFA survey areas. The number of these identified whales is a small fraction (less than 1 percent) of the total ENP gray whale population, almost all of which migrates through these survey areas on the northward migration. If these identified whales are randomly mixed in the population during the migration period (December 1 through May 30), less than one percent of the encounters between whales and Makah hunters during that time would be with one of these identified whales. Available information suggests this percentage would be greater than suggested based on random mixing and depends on the sighting location within the Makah U&A.

The photo identifications from 1998 to 2005 demonstrate a strong difference in the expected probability that a whale sighted within the northern Washington coast is part of the PCFA compared with a whale sighted within the Strait of Juan de Fuca survey areas (Table 3-5). A total of 67 unique whales were seen in the Makah U&A before June 1 during 1998 to 2005 (most in May 1999). Those seen off the northern Washington coast were less likely to be seen after June 1 in the Makah U&A or elsewhere in the PCFA survey area than those that were seen before June 1 in the Strait of Juan de Fuca. One whale was identified before June 1 in both areas, as reflected in the total.

Only 17.9 percent (10 of 56) of the whales identified in the northern Washington coast survey area prior to June 1 were seen in the PCFA in one or more years from 1998-2005. In comparison, 91.7 percent (11 of 12) of the whales seen prior to 1 June in the Strait of Juan de Fuca were also seen somewhere in the PCFA after 1 June during 1998-2005. If harvesting occurred in the northern Washington coast area from Dec 1 through May 31, 17.9 percent, 17.9 percent, and 12.5 percent of whales harvested could have been expected to be later seen between June 1 and November 30 in the PCFA, ORSVI, and Makah U&A, respectively (the percentages are the same for PCFA and ORSVI because zero whales were seen outside the ORSVI).

TABLE 3-5. UNIQUELY IDENTIFIED WHALE SIGHTINGS IN THE PCFA

	Seen before 1 June in:		
After 1 June 1998-2005	**Northern Washington Coast**	**Strait of Juan de Fuca**	**Total**
Not seen after 1 June in PCFA	46	1	47
Seen after 1 June in Makah U&A	7	5	11
Seen after 1 June in ORSVI outside Makah U&A	3	3	6
Seen after 1 June in PCFA outside ORSVI	0	3	3
Total	56	12	67

3.4.3.4 Current Status of the Gray Whale Population

3.4.3.4.1 Abundance Data

NMFS' National Marine Mammal Laboratory (NMML) estimates gray whale population size based on systematic shore-based surveys conducted during the whales' southbound migration. Since 1967, NMML has conducted shore-based counts of southbound gray whales near Carmel, at either Yankee Point or Granite Canyon stations (Rugh et al. 1999; Buckland and Breiwick 2002; Rugh et al. 2005, Rugh et al. 2008). NMML selected these observation areas because the continental shelf and the corresponding gray whale migratory corridor are relatively narrow. Few whales migrate beyond the visual range of observers on shore. Aerial surveys showed that 96 percent of southbound gray whales pass within 3 miles of the shore (Sund and O'Connor 1974), and fewer than 2 percent of the whales migrate beyond the sighting range of observers (Shelden and Laake 2002). These methods and data have been reviewed and accepted by the IWC, the internationally recognized authority on large cetacean management.

Single observers conduct the southbound counts by working in three-hour shifts throughout daylight hours, from mid-December to mid or late-February (Rugh et al. 2005; Rugh et al. 2008). The observers work independently, scanning the viewing area using binoculars with reticles (vertical marks in the optics) and magnetic compasses to track whale groups as they migrate past the station. When observers spot gray whales, they hand-record the following data: (1) time of

sighting, (2) horizontal bearing, (3) vertical angle, (4) pod size estimate, (5) calf sightings, (6) environmental conditions, and (7) any unusual behaviors (Rugh et al. 2005; Rugh et al. 2008). The horizontal bearing and vertical angle allow for estimates of distance from shore. On most days during January, when whale counts are at their highest, paired, independent searches are conducted by having a second observer conduct counts nearby (in the same viewing area), but out of sight of the primary observer (i.e., the observers are stationed in separate observation sheds). These independent searches provide a test of the repeatability of the census effort. More detail about survey protocol is in Rugh et al. (1993), Shelden et al. (2004), Rugh et al. (2005), and Rugh et al. (2008).

Data are entered on a computer at the end of each day and field-checked. Following further quality reviews of the database, researchers compare sighting locations and counts of paired observers to establish the probability of missing whales within the viewing area. In the abundance analysis, correction factors are applied to data to account for (1) whales that passed during periods when observers were not present (before and after the census season, at night, or when visibility was poor); (2) whales within the viewing range of observers that were missed (i.e., one observer saw a whale, but the other did not); (3) differential sightability by observer, pod size, distance offshore, and various environmental conditions; (4) errors in pod size estimation; (5) covariance within the corrections due to variable sightability by pod size; and (6) differential travel rates between day and nighttime travel (Hobbs et al. 2004; Rugh et al. 2005, Rugh et al. 2008). Rugh et al. (2005) adjusted the correction factor for nighttime travel from 1.020 (SE equals 0.023) based on radio-tagged whales (Swartz et al. 1987) to 1.0875 (SE equals 0.0363), based on Perryman et al. (1999) where thermal imagery provided quantifiable evidence that whales pass the shore at a higher rate at nighttime.

Table 3-6 lists abundance estimates of the gray whale population based on the NMFS counts of the southbound migration (Rugh et al. 2008). Population estimates are always subject to a certain level of variability, and this is represented by the confidence interval, a range of values that is relatively certain (95 percent) to include the true population size. Even though researchers provide point estimates, the confidence interval is a better representation for the estimates of abundance and their precision. For example, the point estimate of the most recent abundance was 20,110 whales, but NMFS can only be relatively certain that the true abundance in 2006/2007 was probably somewhere between 17,000 and 24,000 whales (using rounded figures for the 95 percent confidence interval).

TABLE 3-6. GRAY WHALE POPULATION ESTIMATES FROM 1967 TO 2002

YEAR	POPULATION ESTIMATE	CONFIDENCE INTERVAL
1967/1968	13,776	11,814 to 16,064
1968/1969	12,869	11,555 to 14,333
1969/1970	13,431	12,026 to 15,000
1970/1971	11,416	10,317 to 12,633
1971/1972	10,406	9,271 to 11,681
1972/1973	16,098	14,545 to 17,817
1973/1974	15,960	14,341 to 17,761
1974/1975	13,812	12,365 to 15,428
1975/1976	15,481	13,765 to 17,411
1976/1977	16,317	14,792 to 17,999
1977/1978	17,996	15,710 to 20,615
1978/1979	13,971	12,571 to 15,527
1979/1980	17,447	15,622 to 19,485
1984/1985	22,862	20,316 to 25,727
1985/1986	21,444	19,360 to 23,752
1987/1988	22,250	21,485 to 26,954
1992/1993	18,844	16,651 to 21,326
1993/1994	24,638	21,911 to 27,704
1995/1996	24,065	21,485 to 26,954
1997/1998	29,758	24,241 to 36,530
2000/2001	19,448	16,097 to 23,496
2001/2002	18,178	15,011 to 22,013
2006/2007	20,110	16,936 to 23,879

Sources: Rugh et al. (2005) and Rugh et al. (2008)

Gray whale population estimates rely on the assumptions that all whales migrate as far south as Carmel when observers are studying the southward migration and that most whales will pass offshore within view of the observers. As discussed below in more detail, it has not been demonstrated that the entire gray whale population migrates past Carmel every year (Laake et al. 1994; Rugh et al. 2005), illustrating the importance of obtaining a long time-series of estimates across years from which to determine the trend in population size (Laake et al. 1994; Rugh et al. 2005). Observers conducted the last southbound count in 2006/2007.

3.4.3.4.2 Stranding Data

A stranding is an event where a marine mammal is dead on a beach or in the shallow water, or a marine mammal is alive on a beach or in shallow water, but is unable to return to its natural habitat without assistance (50 CFR 216.3). In the 1992 MMPA Amendments, Congress designated NMFS as the lead agency to coordinate a Marine Mammal Health and Stranding Response Program. Through the Marine Mammal Stranding Network, NMFS oversees, coordinates, and authorizes volunteers from non-profit organizations, aquaria, universities, and state and local governments to respond to marine mammal strandings throughout the coastal states. The NMFS Marine Mammal Health and Stranding Response Team also coordinates with partners in neighboring countries when strandings cross national lines. Stranding network volunteers collect and report stranding data to NMFS, and the agency maintains a database.

Annual gray whale stranding data from Alaska to Mexico for the years 1995 to 2005 are in Table 3-7 and Figure 3-8. The number of gray whale strandings along the west coast of North America averaged 41 animals from 1995 to 1998. Stranding detection effort during these times was not directed; reports were compiled from opportunistic reports that were later relayed to NMFS' regional stranding coordinators (Gulland et al. 2005). In 1999 and 2000, gray whales stranded dead, or moribund, in unprecedented numbers from Alaska to Baja California Sur, Mexico, with the highest numbers reported in Mexico and Alaska (Norman et al. 2000; Gulland et al. 2005). For comparison, 29 dead gray whales were found on the Alaska coast in 1989 during surveys associated with assessment of impacts caused by the *Exxon Valdez* oil spill (Loughlin 1994). The 1999 and 2000 strandings and the subsequent return to normal conditions from 2002 through 2005 are discussed in detail below.

TABLE 3-7. SUMMARY OF ENP GRAY WHALE STRANDING DATA FROM ALASKA TO MEXICO, 1995 TO 2006

REGION	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Alaska	1	0	3	3	73	55	5	0	5[1]	0	5[2]	NA
Canada	2	0	5	2	10	22	0	0	2	2	2	NA
Washington	7	2	3	4	28	23	1	2	3	2	11	8
Oregon	4	3	3	0	3	2	0	3	2	4	5	4
California	12	13	10	30	45	59	5	7	8	17	7	NA
Mexico	13	3	22	17	124	207	10	15	NA	2	12	NA
Total	**39**	**21**	**46**	**56**	**283**	**368**	**21**	**27**	**-**	**27**	**42**	**-**

NA – not available.
[1] One of these five reported strandings was unconfirmed.
[2] One of these five reported strandings was unconfirmed.
Source: Gulland et al. 2005; National Marine Mammal Stranding Response Program 2007

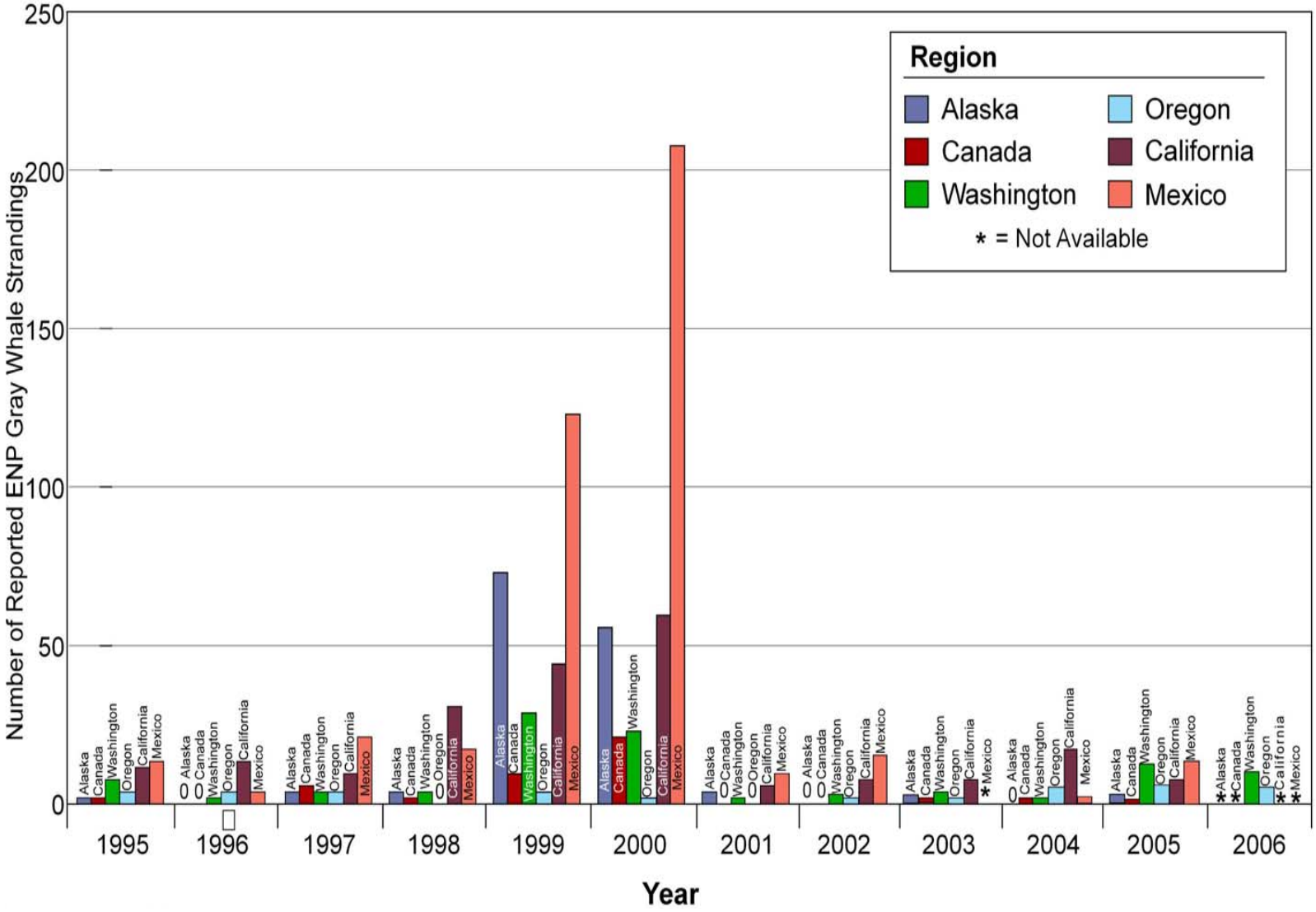


Figure 3-8. ENP Gray Whale Strandings Reported from Alaska to Mexico, 1995-2005

In 1999, the number of gray whale strandings documented along the west coast of North America increased to approximately 7 times the annual mean (41) reported between 1995 and 1998 (Gulland et al. 2005; Table 3-7). NMFS consulted the Working Group on Marine Mammal Unusual Mortality Events (Working Group) in July 1999, due to the unusually high number (283 whales) of stranded whales in 1999 (Gulland et al. 2005). The Working Group is an advisory board created under Section 404 of the MMPA, comprised of 12 members with expertise in marine science, including conservation and veterinary science, whose expertise is consulted when marine mammals are dying in an unusual way.

The Working Group weighed the 1999 stranding evidence against the following seven criteria developed to determine whether a stranding event is unusual:

1. A marked increase occurs in the magnitude of strandings when compared with prior records.
2. Animals strand at a time of the year when strandings are unusual.
3. An increase in strandings occurs in a localized area (possibly suggesting a localized problem), occurs throughout the geographical range of the species/population, or spreads geographically with time.
4. The species, age, or sex composition of the stranded animals differs from that of animals that normally strand in the area at that time of the year.
5. Stranded animals exhibit similar or unusual pathologic findings or the general physical condition (e.g., blubber thickness) of stranded animals is different from that normally seen.
6. Mortality accompanies unusual behavior patterns observed among living individuals in the wild, such as occurrence in habitats normally avoided or abnormal patterns of swimming and diving.
7. Critically endangered species are stranding. Stranding of three or four right whales, for example, may be cause for great concern, whereas stranding of a similar number of fin whales may not.

A single criterion or a combination of criteria may indicate the occurrence of an unusual mortality event.

The Working Group concluded that the 1999 stranding event was an unusual mortality event because the animals were stranding throughout their range, stranding rates had increased precipitously, animal behavior and body condition were different from those reported previously (emaciated), and animals were stranding in areas where such events had not been historically noted (behavioral change) (Gulland et al. 2005). The Working Group recommended increasing evaluations and examinations of carcasses, providing a small team to summarize the available information for the working group, and coordinating and exchanging information between the four countries in which the gray whale stock occurs (Mexico, the United States, Canada, and Russia) (Gulland et al. 2005).

After the 1999 mortality event was declared unusual, coordination between the stranding networks increased; two workshops were held in Mexico to enhance coordination (LaPax March 2000 and Guerrero Negro March 2001) (Gulland et al. 2005). Stranding detection effort varied significantly, both geographically and temporally; because of the high stranding report rates, an increased emphasis on timely reporting started in April 1999 and continued through 2002 to allow for real-time analysis of trends (Gulland et al. 2005). NMFS prepared a provisional report for the Working Group in 2000 (Norman et al. 2000), and preliminary findings were presented to the Scientific Committee of the IWC (Pérez-Cortés Moreno et al. 1999). In 2000, the number of stranded animals remained high, with 368 carcasses reported, representing a nine-fold increase from the 1995 to 1998 average (Gulland et al. 2005). At the annual Working Group meeting in March 2001, the Working Group recommended keeping the unusual mortality event open for monitoring, but when only 20 strandings had occurred by October 2001, they recommended closing the event (NMFS 2001b). Based on this information, NMFS closed the event (NMFS 2001b).

NMFS examined and synthesized stranding network information for 1999 and 2000 in Gulland et al. (2005). The authors observed that most of the strandings in 1999 and 2000 occurred in Mexican waters during the winter season. Researchers consistently surveyed stranding effort in the wintering lagoons of Mexico, and the effort in 1999 and 2000 was comparable with that of previous years, except that records of gray whales that stranded outside their normal winter range were obtained opportunistically (Gulland et al. 2005). Increases in all regions, except Oregon, were significant. Fairly consistent stranding detection and reporting in California, Oregon, and Washington (except for remote areas of the Olympic Peninsula) took place from 1995 to 2002. Effort in British Columbia was opportunistic, due to the complex coastline. Detection effort and geographic coverage in Alaska differed significantly from year to year, but dedicated surveys were conducted in some areas of the Alaska coast from 1999 to 2001 (Gulland et al. 2005).

Although each stranding was examined as thoroughly as was practical, only 3 (0.5 percent) of the 651 animals that stranded in 1999 and 2000 were examined thoroughly enough to determine the cause of death (including detection of pre-existing conditions). One whale was diagnosed with a viral infection not previously reported in stranded whales (equine encephalitis), one whale had an unusually intense infection of parasites normally associated with baleen whales, and one whale was intoxicated with domoic acid (Section 3.4.3.6.3, Harmful Algal Blooms). Researchers considered several factors as possible causes for the high number of gray whale strandings reported in 1999 and 2000. Factors include starvation, chemical contaminants (see Environmental Contaminants below), biotoxins (see Harmful Algal Blooms below), disease, parasites, fisheries interactions and ship strikes, variability in detection effort and reporting, and effects of winds and currents on carcass decomposition (Norman et al. 2000; Gulland et al. 2005). The emaciated condition of the stranded whales, combined with evidence of low lipid concentrations and organochlorines in the stranded animals (Krahn et al. 2001) and decreases in calf production in the population during the same time frame (Perryman et al. 2002), led many scientists to conclude that starvation was the most likely cause of mortality. Some of the animals that stranded were in good to fair nutritional condition, suggesting that not all of the strandings link logically to food resource limitation and starvation (Gulland et al. 2005).

The cause of such large-scale starvation remains unknown (Gulland et al. 2005). Some scientists think that the starvation was related to a climatically based decline in prey availability, especially related to the 1997 and 1998 El Nino events in the winter range and the Pacific Decadal Oscillation and Arctic Oscillation in the summer range (LeBouef et al. 2000; Moore et al. 2001; Moore et al. 2003). Section 3.4.3.3, Distribution and Habitat Use, discusses oceanic climatic events throughout the gray whale range. Perryman et al. (2002) also showed that seasonal changes in ice distribution in the Bering and Chukchi Seas might influence the duration of whale feeding. Because gray whales feed opportunistically on a broad suite of prey species throughout their range and move to alternate areas when the food runs out (Section 3.4.3.1.3, Feeding Ecology and Role in the Marine Ecosystem), these explanations seemed simplistic (Nerini 1984; Moore et al. 2001; Moore et al. 2003; Moore 2005; Moore et al. 2007). Others postulated that the starvation related to density-dependent population effects—animals approaching K experience heightened competition for food resources and decreased reproductive success (Section 3.4.3.4.5, Estimates of Carrying Capacity (K), OSP, and PBR). This explanation for the starvation is imperfect, given the suddenness of the demographic change and the relatively larger amounts of adult whales that stranded (Moore et al. 2001). Gulland et al. (2005) suggested that the starvation

was probably a result of both density dependence and environmental variability; populations of cetaceans that are at or near K probably are more vulnerable to environmental variability due to nutritional stress.

Recently, researchers investigating one of the main calving-breeding lagoons in Mexico have noted large numbers of whales that are "skinny" in appearance, suggesting malnourishment (Swartz et al. 2007; Urban-Ramirez and Swartz 2007; Urban-Ramirez et al. 2007). Photographic data collected during 2007 in Laguna San Ignacio indicated that 11 to 13 percent of the whales photographed exhibited obvious signs of malnutrition and/or disease, including noticeable depressions in the head region, sub-dermal protrusions of bony parts (e.g., the scapula), and concave rather than convex profiles to whale dorsal flank areas (Swartz et al. 2007). Urban-Ramirez and Swartz (2007) noted other studies where some "skinny" whales that were pregnant returned to their summer feeding areas with apparently healthy calves, suggesting that "skinniness" may not be a fatal condition but instead reflect "a tolerable reduction [in] nutritional resources." Researchers from NMFS and other institutions plan to continue photographing and monitoring the condition and health of gray whales as part of the Laguna San Ignacio Ecosystem Science Program (Urban-Ramirez et al. 2007).

Since the 1999 and 2000 stranding events, stranding levels have returned to the normal range, decreasing to 21 and 26 whales in 2001 and 2002, respectively. Most of the 2002 to 2005 dead whales that biologists examined died of unknown causes. In a few cases, biologists found evidence of ship strikes (propeller cuts) or entanglement in fishing gear (Gulland et al. 2005).

3.4.3.4.3 Calf Production Data

Gray whale calf production trends have been monitored using three methods. They are presented below:

1. Surveying for calves from shore and from aircraft in central California during the northward migration (Perryman et al. 2002; Perryman et al. 2004)
2. Counting calves from shore at Granite Canyon, California during the southward migration (Shelden et al. 1995; Shelden and Rugh 2001; Shelden et al. 2004)
3. Conducting aerial and vessel surveys for calves in the lagoons of Baja California (Urbán-Ramírez et al. 2003)

NMFS' Southwest Fisheries Science Center conducted shore-based sighting surveys of northward migrating whales from 1994 to 2005 to estimate the number of calves passing Piedras Blancas,

California (Perryman et al. 2002; Perryman 2005). Additional research included (1) aerial surveys to determine offshore distribution 1994 and 1995; and (2) concurrent replicate watches near the peak of each migration to estimate sightings missed by the standard watch team. Data from these surveys, including calf counts, corrected calf estimates (to account for periods not on watch and for calves missed), and calf production indices (calf estimate/total population estimate) are summarized in Table 3-7 and illustrated in Figure 3-9.

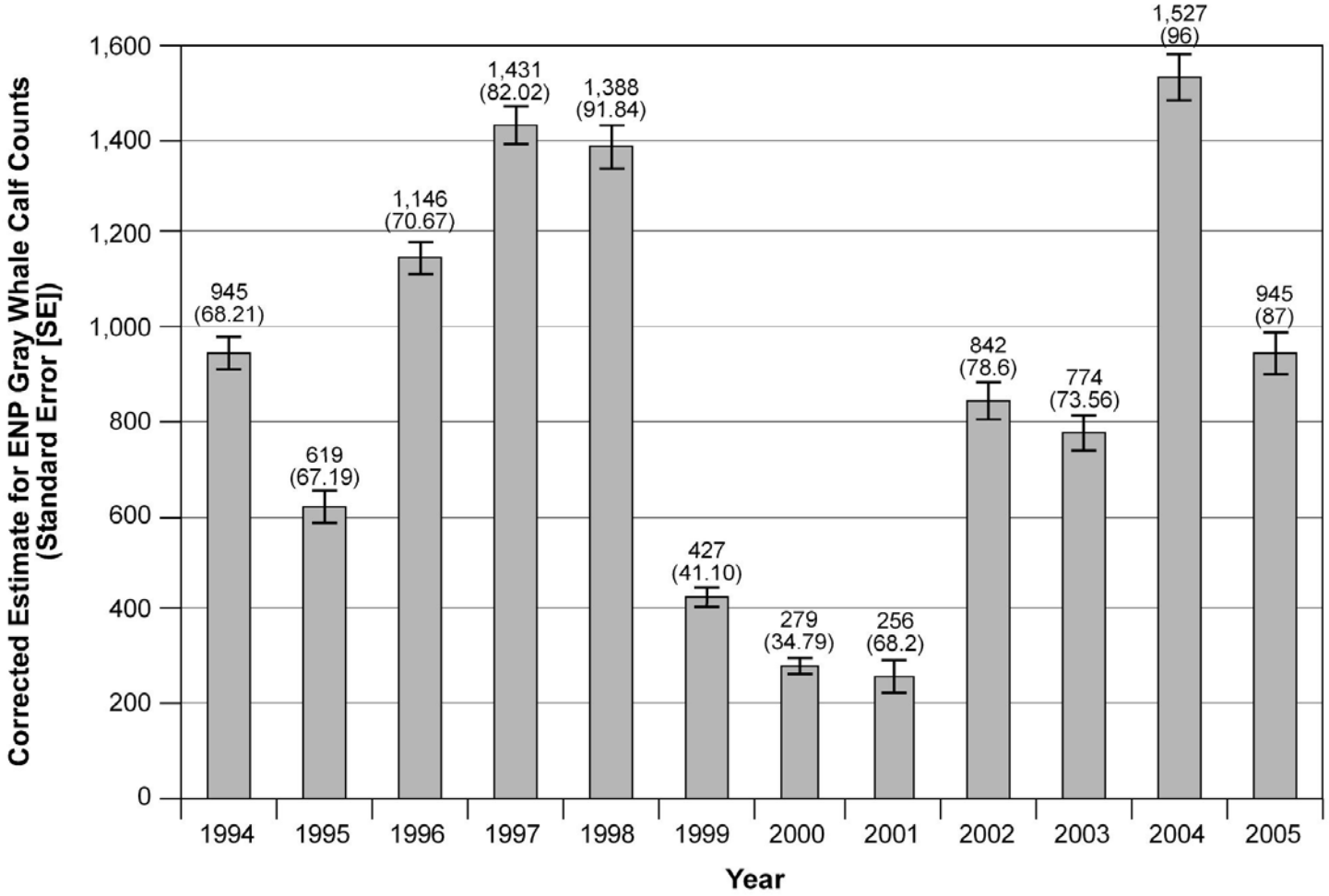


Figure 3-9. ENP Gray Whale Calf Counts in California, 1994-2005

The calf estimates and calf production index indicate that the gray whale population experienced a period of decreased production from 1999 to 2001. It is apparent that, although calf production dipped from 1999 to 2001, it seems to have recovered by 2002 (Table 3-8). Fluctuations in calf production over this period positively correlated with the length of time that primary feeding habitat was free of pack ice during the previous year (Perryman et al. 2002; Perryman et al. 2004). Additional evidence of changes in calf production comes from observations at the Mexican calving lagoons. Estimates of annual calf production in the lagoons (1997 to 2002) suggest a decrease in calf production from the 1997 high (910 calves) to a low of 286 calves in 1999, followed by a gradual increase to 670 calves in 2002 (Urbán-Ramírez et al. 2002). Production has returned to normal, and one of the highest recorded counts occurred in 2004.

3.4.3.4.4 Population Dynamics and Trends

The ENP gray whale population recovered from as low as 3,000 to 5,000 whales post exploitation to over 20,000 whales today (Rugh et al. 2005; Rugh et al. 2008). From 1968 to 1998, the gray whale population increased by about 2.6 percent per year (Rugh et al. 2005). However, the most recent estimates indicate substantial declines from the peak abundance in 1997/1998 (Table 3-8). NMML analyzed the 2000/2001 and 2001/2002 southbound count data to determine whether the population size had truly decreased or whether there was an inaccuracy in the abundance estimates.

TABLE 3-8. SUMMARY OF ENP GRAY WHALE CALF COUNTS IN CALIFORNIA, 1994 TO 2005

YEAR	CALF COUNTS[1]	CORRECTED ESTIMATE (STANDARD ERROR)	CALF PRODUCTION INDEX (%)
1994	325	945 (68.21)	4.0
1995	194	619 (67.19)	2.7
1996	407	1,146 (70.67)	5.1
1997	501	1,431 (82.02)	6.8
1998	440	1,388 (91.84)	5.0
1999	141	427 (41.10)	1.6
2000	96	279 (34.79)	1.0
2001	87	256 (68.2)	1.4
2002	302	842 (78.6)	4.8
2003	269	774 (73.56)	4.1
2004	456	1,527 (96)	8.1
2005	345	945 (87)	5.0

1 Calf counts are corrected calf estimates and calf production index (calf estimate/total population estimate) for northbound migrating gray whale calves. Note: With the exception of data from 1994 to 2001, these estimates are preliminary data, and they should not be cited without the permission of W. Perryman, NMFS' Southwest Fisheries Science Center.

N.B.: The calf estimates and calf production index indicate that the gray whale population experienced a period of decreased production from 1999 to 2001.

Source: Perryman et al. 2002; Perryman 2005

The study indicated that visibility, offshore distribution of whales, and changes in observer performance were not likely explanations for the decline (Rugh et al. 2005). Rugh et al. (2005) proposed that the low counts in 2000/2001 and 2001/2002 could be due to a true drop in population size, and/or a change in the proportion of the southward migration that moves as far south as Granite Canyon (Section 3.4.3.1.4, Seasonal Migrations, Fall/Winter – Southward Migration). The number of mortalities recorded in the 1999 and 2000 stranding events did not exceed expected levels of natural mortality (Moore et al. 2000), but the stranding events are evidence of a true decline. The 1999 and 2000 unusual mortality events, and their possible cause, are discussed above in Stranding Data (with links to the Calf Production Data section and information about body condition). Current data indicate that the gray whale population is at or near its K; estimates of K and PBR are reported below.

3.4.3.4.5 Estimates of Carrying Capacity (K), OSP, and PBR

In 1994, Wade reported values of K and MNPL for the ENP gray whale stock based on then-current abundance estimates reported between 1967/1968 and 1993/1994. He estimated that the ENP gray whale population was at 51 to 97 percent of its K and that the rate of net production at the MNPL was 0.033 (95 percent confidence interval from 0.023 to 0.044) (Wade 1994). The IWC Scientific Committee discussed Wade's (1994) analysis at the 1994 IWC Scientific Committee meeting and proposed that the analysis may have been unduly influenced by the low abundance estimates in the 1992/1993 census, which likely caused the variance of the abundance estimate to be underestimated (i.e., negatively biased). Therefore, Wade (2002) incorporated an additional variance factor when he added the 1995/1996 census data to the K and MNPL analysis; the factor accounted for unexplained variation in the abundance estimate time series data. He also used an age and sex structured model. Later, Wade and Perryman (2002) incorporated the census data from 1997/1998, 2000/2001, and 2001/2002, as well as the calf production data from the northward migration (1994 to 2001), into a more complete analysis to increase the precision of the K estimate. They used a generalized logistic model, which included the added variance of Wade (2002) in the analysis. Based on these data, Wade and Perryman (2002) estimated that the K was 22,000 whales (confidence of 95 percent and confidence intervals ranging from 19,000 to 35,000 whales), and they concluded that the population was at or near carrying capacity. The most accurate abundance estimates for the ENP gray whale population between 1967/1968 and 2006/2007 (i.e., added nighttime correction factors, etc.) come from Rugh et al. (2008) who recently estimated a K of 23,686 whales (Figure 3-10).

In a recent stock assessment (Angliss and Outlaw 2008) NMFS reported that the assessments by Wade (2002) and Wade and Perryman (2002) support a conclusion that the Eastern North Pacific gray whale stock is within the OSP level (i.e., there is essentially zero probability that the population is below the stock's maximum net population level). Similar results are reported in an assessment by Punt et al. (2004). The Scientific Committee of the International Whaling Commission reviewed both assessments and agreed that management advice could be formulated from the results. Both assessments indicated that the population was above the maximum sustainable yield level, and was likely close to or above its unexploited equilibrium level (IWC 2002).

Even though the stock is within OSP, abundance will rise and fall as the population adjusts to natural and human-caused factors affecting the carrying capacity of the environment (Rugh et al. 2005, Rugh et al. 2008). In fact, it is expected that a population close to or at the carrying capacity of the environment will be more susceptible to fluctuations in the environment (Moore et al. 2001). The recent correlation between gray whale calf production and environmental conditions in the Bering Sea (Perryman et al. 2002) may be an example of this. For this reason, it can be predicted that the population will undergo fluctuations in the future that may be similar to the two-year event that occurred in 1999-2000 (Norman et al. 2000; Pérez-Cortés et al. 1999; Brownell et al. 2001; Gulland et al. 2005).

For all marine mammal stocks, NMFS prepares stock assessment reports, which include a calculation of the PBR for the stock and an assessment of whether all human-caused mortality exceeds PBR. If total average mortality remains below PBR, a stock at OSP will remain there, and any stock below OSP will continue to grow and will achieve OSP (Wade and Angliss 1997; Wade 1998). As long as the mortality average over the three-year period is less than PBR, it is considered sustainable within the framework of the PBR management strategy (Wade and Angliss 1997). Angliss and Outlaw (2005) reported that PBR for gray whales is 417 whales based on a minimum population size (N_{min}) of 17,752 whales derived from the mean of the 2000/2001 and 2001/2002 population estimates and the estimated R_{max} (maximum theoretical or estimated net productivity rate of the stock at a small population size of 0.047 multiplied by 0.5, or 0.0235) and a recovery factor of 1.0 (calculated thus: 17,752 x 0.0235 x 1.0 = 417). The annual averaged human-caused mortality and serious injury between 1999 and 2003 was 130.4 gray whales, which is considerably below the current PBR (417 whales) (Angliss and Outlaw 2005).

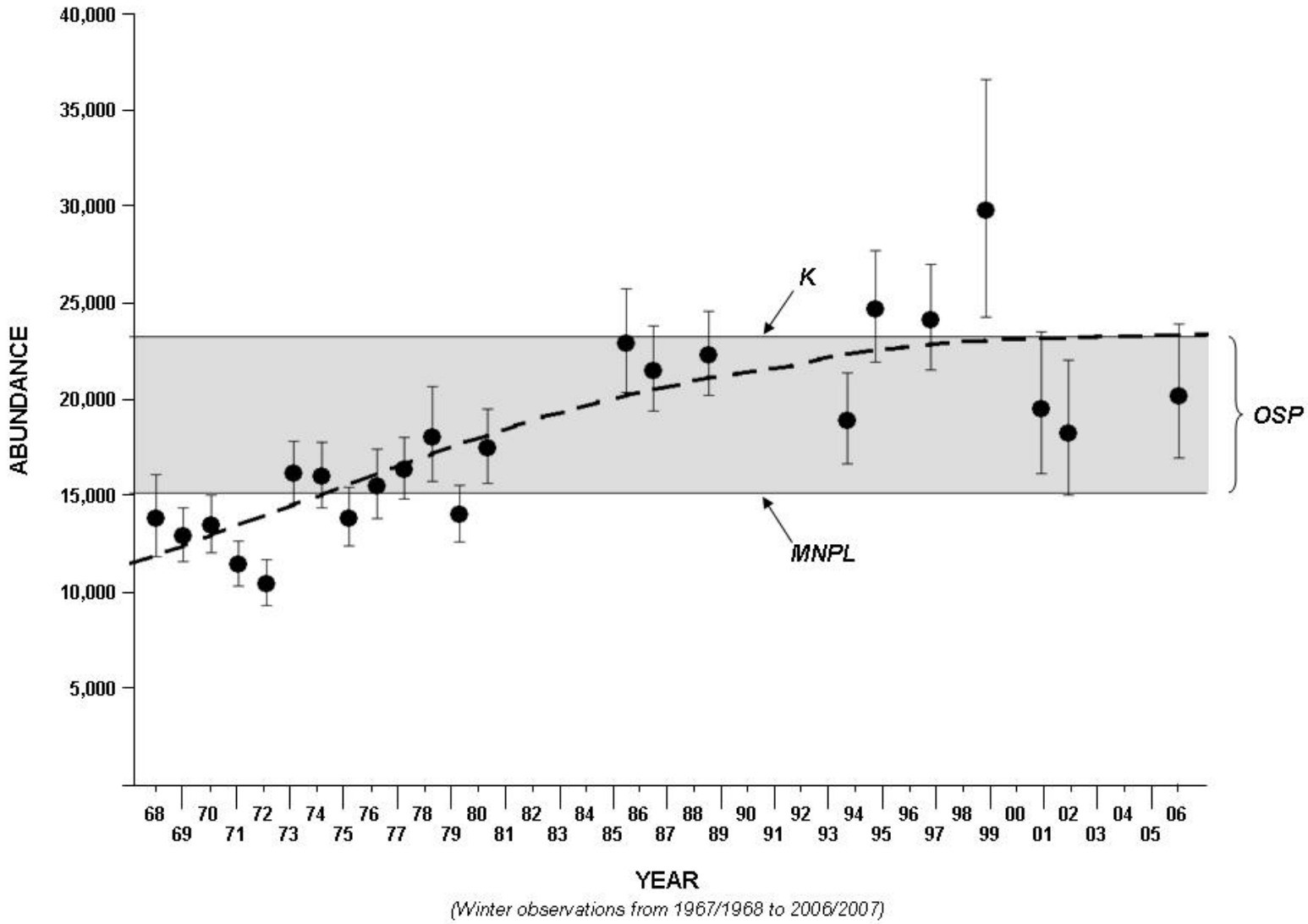


Figure 3-10. Trajectory of ENP Gray Whale Population Size

The average includes mortality associated with the Chukotka Native aboriginal harvest (122 whales), commercial fisheries (7 whales), and ship strikes (1 whale). The mortality is also considerably lower than the 463 whales per year that the IWC Scientific Committee considered a sustainable take for at least the medium term (approximately 30 years) when it conducted the last full stock assessment of ENP gray whales in 2002 (IWC 2003). The Scientific Committee concluded that that level of take is "likely to allow the population to remain above maximum sustained yield level" (IWC 2003).

3.4.3.5 Welfare of Individual Whales

The MMPA and WCA provisions discussed in Section 3.4.2, Regulatory Overview, describe considerations relevant to the welfare of individual whales in an aboriginal subsistence hunt. Any permit issued by NMFS under the MMPA must include a finding that the taking is humane, defined as inflicting the least possible degree of pain and suffering practicable (16 USC 1362(4); 50 CFR 216.3). The IWC has focused on reducing the length of time to death of a whale (i.e., reducing the amount of time between the strike and the death of a whale) to improve the humaneness of whaling (IWC 2004c; IWC 2007a). The IWC definition of humane killing is "[d]eath brought about without pain, stress, or stress, or distress perceptible to the animal. . . . Any humane killing technique aims first to render an animal insensitive to pain as swiftly as technically possible. In practice this cannot be instantaneous in a scientific sense" (IWC Resolution 2004-3). Aboriginal subsistence whalers are urged to do everything possible to reduce any avoidable suffering caused to whales in hunts (IWC Resolution 1997-1), and governments are encouraged to provide appropriate technical assistance (IWC Resolution 1999-1). The IWC criteria for determining the time to death and insensibility in hunted whales in the field are as follows: (1) relaxed lower jaw; (2) no flipper movement; or (3) sinking without active movement.

Pain has been defined as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (International Association for the Study of Pain 1979). Researchers have proposed assessing pain in animals by measuring physiological changes (such as pulse rate, blood pressure, or blood cortisol levels, etc.) and behavioral indicators (such as vocalization, avoidance, shaking, etc.) (Keefe et al. 1991).

Any hunting under the WCA must not be conducted in a wasteful manner. Two issues relevant to humaneness are also relevant to wastefulness: killing only as many whales as are needed for subsistence and subsistence uses (50 CFR 216.3), and ensuring that hunters quickly kill and land struck whales, rather than striking and losing them. The concept of waste includes issues beyond

welfare of individual whales, such as ensuring that hunters quickly tow killed whales to shore and butcher them rapidly to avoid spoilage. Factors relevant to the MMPA and WCA considerations include the response of individual whales to pursuit and the response of individual whales to the hunter's strike. These responses will be affected by the method of the hunt, the behavior of the whale species hunted, the behavior of the people associated with the hunt (including hunters, protesters, media, and law enforcement), and the prevailing weather and sea conditions.

3.4.3.5.1 Review of Hunting Methods

The method of the hunt includes total whaling operations and practices, including vessels and weapons. Primary weapons are those used initially to strike and secure the whale. Some primary weapons are also capable of killing the whale. If the primary weapon does not also kill the whale, a secondary weapon is used. The secondary weapon may be the same as the primary weapon, but used additional times. Hunting weapons are also discussed in conjunction with public safety in Section 3.15.3.5.2, Weapons Associated with the Hunt. This section discusses weapons in conjunction with the welfare of individual whales.

The Makah Tribe's proposed action includes hunting whales using a traditional wood canoe (with harpooner) accompanied by a motorized chase boat (with a rifleman and an observer). Because the speed of a swimming whale exceeds that of a paddled canoe, the Makah whalers would most likely position the canoe in the path of a swimming whale at a spot where the whale is expected to surface. After a Makah hunter struck a whale with the hand-thrown toggle point harpoon attached to a line and floats, a rifleman in the chase vessel would kill the whale by using a .50 caliber rifle aimed at the central nervous system (Section 3.15.3.5.2, Weapons Associated with the Hunt).

This EIS examines alternative weapons for hunting gray whales by Makah subsistence hunters. These include the use of a hand-thrown darting gun as the primary weapon for striking whales and explosive projectiles delivered by either a second darting gun or a shoulder gun as the secondary weapon for killing whales. Both the weapons proposed by the Makah Tribe and the alternative weapons examined are used in other subsistence whale hunts, as well as in commercial hunts. Information from these hunts may be relevant to assessing the impacts on the welfare of individual whales of the proposed weapons compared to alternative weapons.

Alaska Eskimos hunt bowhead whales in the Bering, Chukchi, and Beaufort Seas using hand-thrown darting guns as their primary weapons to strike whales, securing them with lines and floats. The darting gun delivers an explosive grenade, which may also kill the whale. The

secondary weapon in this hunt is also an explosive grenade, delivered either by another hand-thrown darting gun or a shoulder gun. The darting gun can deliver either a black powder or a penthrite projectile. For the shoulder gun, only black powder grenade technology is currently available (Section 3.15.3.5.2, Weapons Associated with the Hunt). The Alaska Eskimo hunters have conducted hunting trials with penthrite grenades (Øen 1995) but recently reported difficulty in obtaining necessary parts (Alaska Eskimo Whaling Commission 2006; IWC 2007a) (Section 3.15.3.5.2, Weapons Associated with the Hunt). The black powder grenade remains the main weapon used (Alaska Eskimo Whaling Commission 2006).

Aboriginal subsistence hunters (Chukotka Natives) in Russia hunt gray whales using hand-thrown toggle-point harpoons to strike whales and either smaller caliber rifles (for whales up to 10 meters [32.8 feet]), hand-thrown darting guns (for whales over 10 meters [32.8 feet]), or both to kill whales (IWC 2007a). [The use of larger caliber weapons by civilian personnel was prohibited in the Russian Federation under national legislation (IWC 1997).] Chukotka Natives have experience with penthrite grenades, but their use is not widespread.

Aboriginal subsistence hunters in West Greenland use deck-mounted harpoon cannons that also deliver penthrite grenades as the weapon both for striking and killing fin whales (Greenland Home Rule Government and Greenland Hunter's Organization 2006; IWC 2007a). They also use this weapon for striking minke whales. If the whale is not killed by the first strike, they use a high caliber rifle as the killing weapon (either a 7.62 mm with full metal jacket bullets, or a .375 with round-nosed bullets). In east and west Greenland north of Disko Bay, a collective subsistence hunt occurs for minke whales in which the hunters use hand-thrown harpoons (without explosive charges) to strike the whales and a 7.62 or .375 caliber rifle as the killing weapon.

Commercial hunters in Norway use deck-mounted harpoon guns that also deliver penthrite grenades as the primary weapon for striking minke whales (Øen 2006; IWC 2007a). If the penthrite grenade does not kill the whales, hunters use rifles as a backup (secondary) killing method, including 9.3, .375, and .458 caliber rifles with full metal jacket or round nosed ammunition. The deck-mounted cannons used in the Greenland and Norwegian hunts are not comparable to the two methods examined in this EIS (the darting gun and shoulder gun). Information about the use of rifles as secondary killing weapons in these hunts, however, may be relevant to analyzing impacts of the Makah Tribe's proposed killing weapon.

3.4.3.5.2 Whale Response to Being Pursued

The Makah Tribe's proposed action includes approaching and pursuing whales using a combination of traditional and modern methods, including the use of one or two non-motorized canoes accompanied by one or more chase boats with an outboard motor (Section 2.3.3.2.5, Overview of Proposed Hunting Method). This EIS does not examine alternative vessels to be used in a hunt (Section 2.4.5, Employ Different Hunting Methods). Based on its experience during the 1999 to 2000 hunts, the Tribe's proposal estimates there could be approximately 10 approaches and 4 unsuccessful harpoon attempts for every whale struck. An unsuccessful harpoon attempt means the whale would not be struck (that is, would not have a harpoon embedded and would not show evidence of potentially lethal injury). The Tribe also estimates that the number of whales subject to approaches with no harpoon attempts in any calendar year would not exceed 140.

At the 2003 IWC Workshop on Whale Killing Methods, the United Kingdom presented a paper raising concerns that whales experience stress as a result of being pursued and can exhibit stress-related symptoms such as impaired immune defense, reduced fecundity, failure to grow, and a disease called exertional myopathy (IWC 2004c). No data were presented to support this contention, nor are there data from other activities that involve pursuit (such as whale-watching) that would quantify gray whale response to pursuit. The response of gray whales to pursuit from whale-watching vessels (and vessel presence in general, such as those accompanying any potential whale hunt) is discussed in Section 3.4.3.6.6, Vessel Interactions. No data are available specifically regarding the response of gray whales to non-motorized (human-powered) vessels, but non-motorized vessels generally are regulated, along with motorized vessels, in whale-watching regulations globally (Carlson 2004). .

3.4.3.5.3 Whale Response to Being Struck

Under the Makah proposal, the harpooner in the canoe would strike the whale with a stainless steel toggle-point harpoon with a line and floats attached (for the definition of and evidence for a strike, see Section 2.3.3.2.2, Numbers and Status of Whales Harvested [Five-Year and Annual]). The harpoon point is intended to penetrate the whale's skin (blubber), toggle open, and secure the whale. The harpoon can penetrate and successfully secure the whale in numerous locations on the whale's body, although harpoons also dislodge from whales. Whether the harpoon holds or dislodges depends on, among other factors, the force at impact, the angle of the strike, and the surface characteristics (hard underlying connective tissue, barnacles, etc.). Hunters will often use additional harpoons to attach floats to keep the whale afloat. During the 1999 hunt, Makah

whalers struck the whale with three harpoons, the third of which was thrown moments after the rifle shot that rendered the whale motionless (Gosho 1999). Whale responses to being struck with a toggle-point harpoon may include increased swimming speed, diving (Øen 1995), thrashing, and ramming boats (Henderson 1984). A harpoon damages only the organ it hits, and its impact is likely too low to damage the central nervous system (Knudsen and Øen 2003); thus, it may not immediately cause the whale's death. Whales may subsequently die, however, due to a harpoon strike (see Angliss and Lodge 2002).

This EIS examines the use of a hand-thrown darting gun as an alternative method of striking and securing whales (Section 3.15.3.5.2, Weapons Associated with the Hunt). The darting gun delivers an explosive grenade, which can contain either black powder or penthrite as the explosive. The grenade has a time-delay fuse and is intended to detonate after penetrating the whale. Detonation of the grenade releases fragments, or shrapnel, causing hemorrhaging and damage to internal organs (O'Hara et al. 1999). The blast from a black powder grenade also emits shock waves that can cause concussion-related injuries to the brain or internal organs (O'Hara et al. 1999). The blast from a penthrite grenade emits a much higher energy shock wave, which is more likely to cause concussion-related injuries further from the blast site, including injuries to the whale's brain or internal organs. These injuries may cause insensibility or immediate death (Øen 1995; O'Hara et al. 1999). The blast injury from either type of grenade works independent of hemorrhage to induce insensibility and/or lethal injuries.

A grenade delivered by a hand-thrown darting gun may kill the whale, but a secondary method of killing is required more often (Øen 1995; O'Hara et al. 1999). Hand-thrown darting guns are aimed at the cervical (neck) and thoracic (chest) region, rather than the head, as the skull is not easily penetrated by the grenade (Butterworth and Brakes 2006; IWC 2007a). Whale responses to being struck with a grenade from a hand-thrown darting gun include death, insensibility, and stunning (Knudsen and Øen 2003), as well as diving (Øen 1995), thrashing, and ramming boats (Bockstoce 1986).

Little data are available for the proportion of whales killed by the first strike from a darting gun. Data regarding the number of bullets or harpoons used to kill whales do not necessarily indicate the proportion of whales killed by the first strike as hunters are encouraged to re-shoot whales if there is any doubt the whale is still alive (Knudsen 2005; IWC 2007a). In the Alaska Eskimo bowhead whale hunt, Øen (1995) reported that the shoulder gun is used almost routinely after the darting gun has been fired. The Alaska data reported to the IWC do not include the number of

whales killed by the first strike, possibly because of this routine firing of additional grenades and because of the difficulty in determining whether a struck whale is dead (IWC 2004c). Øen (1995) conducted field studies with penthrite grenades in the Alaska bowhead hunt in 1988 and reported that seven of the eight whales struck with penthrite grenades died from the first grenade thrown; the eighth whale required three grenades. The Russian data reported to the IWC also do not include the proportion of whales killed by the first strike from a darting gun. The data from the Greenland and Norwegian hunts, which use large vessels and deck-mounted harpoon guns and cannons, cannot be readily compared to the Makah (or Alaska Eskimo) hunts, which use small vessels and light weapons.

3.4.3.5.4 Method of Killing and Time to Death

Rifle as the Killing Weapon

Hunters killing a whale with a rifle aim for the whale's central nervous system (especially the brain), with the intent of causing immediate death or unconsciousness (Knudsen and Øen 2003). The accuracy of the first shot is important for the following reason:

> [H]unting with rifle or shotguns involves an inevitable risk of only wounding the animal, as the projectiles are fired from a distance and the animals often present a moving target. The area of impact of the first round will always be decisive with regard to how quickly the animal collapses and dies (Knudsen 2005).

The Makah propose to use a .50 caliber rifle to kill any whale struck and secured with the toggle-point harpoon. In 1999, two shots from the .577 caliber rifle used by the Tribe produced a time to death of eight minutes from the time the harpoon struck the whale until the second rifle shot rendered the whale motionless (Gosho 1999). During the unauthorized hunt in 2007, at least 16 shots struck the whale, but it is unknown what caliber rifle was used. Three separate reports (Ingling 1999; Beattie 2001; Graves et al. 2004) examined past Makah proposals and concluded that a .50 caliber rifle (or greater) is the appropriate caliber of rifle to use, after testing it alongside smaller caliber weapons. Ingling (1999) concluded that for large game, larger bullets are more effective in producing penetration deep enough to reach a vital organ or disabling site in the animal and, thus, require more power (i.e., heavier guns). In addition, rifles that are at least .50 caliber provide a better margin of error in targeting compared to smaller caliber rifles. Graves et al. (2004) added that "small caliber rifles simply will not do the job" of quickly dispatching whales with large size and thick bones, and he concluded that the .50 caliber weapon was the best choice. Graves et al. (2004) and Graves and Hazelton (2004) rejected the .577 rifle used by the

Makah whalers in the 1999 hunt due to difficulty of obtaining ammunition. The necropsy performed after the hunt indicated that the first shot that entered the whale hit the skull and stunned it, while the second shot that entered the whale penetrated its brain and likely killed it instantly (Gosho 1999; IWC 2004c). This EIS does not examine the use of a different caliber rifle as the killing weapon (Section 2.4.5.2, Kill Whales with Smaller Caliber Rifles, explains why this alternative was considered but eliminated from detailed study).

Chukotka Natives use smaller caliber rifles, as well as hand-thrown darting guns, to kill whales. Russia reported that during the 2002 harvest, approximately 28 percent of whales struck were killed with rifles. Hunters used from 3 to 100 bullets per whale and an average of 54 bullets per whale killed (IWC 2004c). Mean time to death for both the rifle and darting gun was 32 minutes for gray whales, with a maximum time to death of 56 minutes (IWC 2004c).

In the Greenland subsistence hunt using deck mounted cannons with a rifle as a back-up killing method, time to death using a rifle is not reported separately. In the Greenland collective minke whale hunt where whales are struck with hand-thrown harpoons and killed with rifles, the number of bullets used is not reported. The average time to death reported for 44 whales killed in the 2005 hunt was 21 minutes, with a maximum time to death of 90 minutes (Greenland Home Rule Government and Greenland Hunter's Organization 2006).

In the Norwegian commercial hunt, Knudsen and Øen (2003) concluded that the .357 and .458 caliber rifles and ammunition used to kill minke whales "are highly capable of causing permanent brain damage of sufficient severity to account for an instantaneous or rapid loss of consciousness." According to Knudsen (2005), "[a] whale that is shot in or near the brain with the rifle will also normally turn over immediately and the flippers and jaw will relax." In the Norwegian hunt almost all whales (95.5 percent) are killed with the first strike by a penthrite grenade (Øen 2006), and the time to death is not separately reported for whales killed with bullets. For whales killed with a rifle after the grenade failed to kill the whale, the mean number of bullets used was 2.6 (in the 1998/99 season), 2.2 (in the 2000/2001 season), and 2.2 (in the 2001/2002 season) (Knudsen 2005).

Explosive Grenade as the Killing Weapon

In addition to the Makah Tribe's proposal to kill whales using a .50 caliber rifle, this EIS examines use of an explosive projectile to kill the whale, delivered by either a hand-thrown darting gun or a shoulder gun (Section 2.3.3.2.5, Overview of Proposed Hunting Method). The cervical and cranial thoracic regions of a whale are the critical target areas for explosive

projectiles. Penetration into these regions results in detonation next to the skull and vertebrae, or within the thoracic cavity (O'Hara et al. 1999). How effective the grenade is in killing the whale quickly will depend on where the whale is hit and whether the projectile penetrates to a suitable depth (O'Hara et al. 1999).

Black powder projectiles burn slowly, and they kill whales mostly via secondary blast injuries. Fragments of shrapnel cause tearing of tissues and hemorrhage that can result in the animal's death (O'Hara et al. 1999). Blast trauma to the brain or central nervous system can also cause insensibility or death (O'Hara et al. 1999). Penthrite projectiles burn quickly; they kill whales mostly via primary blast waves, but they also cause extensive local tissue damage that can result in significant hemorrhage. These blast waves cause rapid expansion of gases, which propagates pulsating shock and pressure waves, resulting in concussion-induced brain injury and/or air emboli that travel from gas-containing organs to block blood vessels in the heart and brain, leading to rapid death (O'Hara et al. 1999; Øen 2000). If the grenade does not hit a target area, it has a higher probability of killing the whale than a black powder grenade because it can cause damage farther from the point of detonation (O'Hara et al. 1999; Smith 2007).

In 1988 through 1992, Øen (1995) conducted field trials using penthrite projectiles in the Alaska Eskimo bowhead hunts, comparing them to black powder projectiles used from 1984 to 1986. Data for black powder grenades were the most reliable for 1988 because the information was systematically collected. Results showed reduced time to death for penthrite as compared to black powder (Øen 1995). In 1988, five of the eight bowhead whales (63 percent) died in less than 5 minutes (Øen 1995). The grenades were modified subsequent to the initial penthrite field trials, and data in 1997 and 1998 indicated that time to death was 50 percent of the time to death for black powder grenades (O'Hara et al. 1999). At the 2006 Whale Killing Method Workshop, the Alaska Eskimo Whaling Commission reported that, when placed near the blow hole or within the thorax, the penthrite projectiles appear to give a more rapid time to death than traditional black powder (Alaska Eskimo Whaling Commission 2006; IWC 2007a). The chairperson of the Alaska Eskimo Whaling Commission weapons improvement program has also reported a general preference among Alaska Natives for penthrite, rather than black powder grenades, because "with black powder, the meat has a gas taste" (Associated Press 2005).

The Chukotka Natives use both rifles and darting guns to kill whales. They have used penthrite grenades, but they primarily use black powder grenades. At the IWC Annual Meeting in 2003, the Russian Federation reported that approximately 72 percent of whales killed were killed using the

darting gun. Mean time to death for gray whales using both methods was 43 minutes, with a maximum of 220 minutes. In the 2002 season, hunters used an average of 2.7 darting gun projectiles per whale killed (IWC 2004c).

3.4.3.5.5 Proportion of Whales Struck and Lost

During the Makah Tribe's 1999 and 2000 hunts, there were no whales struck and lost; the only whale struck was landed (Gosho 1999; Gearin and Gosho 2000). The Alaska Eskimo Whaling Commission reported to the 2006 Workshop on Whale Killing Methods that from 1996 through 2005 the average proportion of bowhead whales struck and landed in the Alaska Eskimo hunt was 80 percent (Alaska Eskimo Whaling Commission 2006; IWC 2007a). Most of the whales were hunted using hand-thrown darting guns and shoulder guns with black powder grenades. During a field trial of penthrite grenades in 1988, Øen (1995) reported that seven of the eight bowhead whales (88 percent) struck with the penthrite projectile were landed. For the 2003/2004 hunting season, Russia reported that the Chukotka Natives harvested 111 gray whales, including one struck and lost during towing (IWC 2005c). In 2005, the Chukotka Natives harvested 115 gray whales with 9 struck and lost (IWC 2005b). Also in 2005, no struck and lost whales were reported for the Greenland minke whale hunt using a harpoon, but 3 out of 48 minke whales were struck and lost during the Greenland collective hunt, and 2 of the 3 were lost due to adverse weather conditions (Greenland Home Rule Government and Greenland Hunter's Organization 2006).

3.4.3.5.6 Training and Weapons Improvement

The Makah's proposed action includes a training and certification program. It also proposes that the Tribe conduct research and development to refine hunting methods further and revise tribal regulations periodically to improve the safety, effectiveness, and humaneness of the gray whale hunt. This provision is similar to the Alaska Eskimo Whaling Commission's Weapons Improvement Program, which has worked since the late 1980s to develop newer technologies (including use of the penthrite grenade) to increase hunting safety and efficiency. Hunter training would likely reduce time to death and decrease the proportion of struck and lost whales (Alaska Eskimo Whaling Commission 2006; Greenland Home Rule Government and Greenland Hunter's Organization 2006).

3.4.3.5.7 Weather and Sea Conditions

Weather and sea conditions in the project area as they relate to safety are discussed in detail in Public Safety, Section 3.15.3.2, Weather and Sea Conditions. Weather and sea conditions,

including motion of the vessel, also may have implications for harpooner or rifleman accuracy, which could affect a whale's time to death and the proportion of whales struck and lost. The efficiency of the hunt could also be affected by these conditions if they improve the ability of the Tribe to successfully tow and land a killed whale. The Makah proposal includes the use of a motor-powered vessel to position the rifleman and to tow a killed whale to shore, and it includes maintaining a 30-foot maximum distance from the rifleman to the whale with minimum visibility of 500 yards.

3.4.3.5.8 Behavior of People Associated with the Hunt

The behavior of people associated with the Makah hunt, including protesters, is also discussed in detail in Public Safety, Section 3.15.3.4, Behavior of People Associated with the Hunt. Based on the 1999 and 2000 protester interventions on the water, and the continuing degree of public and media interest in this issue, vessels and people may interfere with whaling activities, increase the time to death, and increase the potential for not successfully landing a whale struck by Makah hunters.

3.4.3.6 Known and Potential Anthropogenic Impacts

Particularly along the coast of North America, gray whales are exposed to intense human activity. Moor and Clarke (2002) concluded that "[t]he recovery of the gray whale population in the face of long-term exposure to human activities along the North American coast suggests a strong degree of tolerance to such activities." The recovery of the ENP gray whale stock in the face of aboriginal subsistence hunting by Chukotka Natives similarly suggests a tolerance to such activity. The following discussion examines some of the more prominent activities affecting gray whales.

3.4.3.6.1 Aboriginal Subsistence Whaling

ENP gray whales have been hunted by various aboriginal groups for hundreds to thousands of years. In the whales' northern feeding areas, five groups of aborigines hunted along the Chukotkan Peninsula of northeastern Asia in the western Bering, northeastern Okhotsk, and western Chukchi Seas, including the Asiatic (Siberian) Eskimos, Chukchi, Koryaks, Kereks, and Itle'mens (Kamchadals) (Krupnik 1984). The (Alaska) Eskimos also hunted gray whales along the northwestern shores of North America in the eastern Bering and Chukchi Seas for thousands of years (O'Leary 1984). Along the whales' migratory corridors and in the more southern feeding areas south of the Alaskan Peninsula, several Indian tribes between the Aleutian Islands and California hunted gray whales and/or used drift whales for subsistence as a part of their cultural

and religious traditions, including the Aleuts, Koniag, Chugash, Tlingit, Haida, Tsimshian, Nootka, Makah (including Ozette), Quileute, Klallam, and Chumash (O'Leary 1984). Some of these tribes hunted during the American and industrial commercial whaling eras. The last Makah hunts in this timeframe were recorded in the 1920s.

Between 1948 and 1955, subsistence hunters in the Chukotkan Region took 241 total gray whales, averaging 30 whales annually (Zimushko and Ivanshin 1980). From 1956 to 1968, the catches in that region increased to an average 158 animals annually (Zimushko and Ivanshin 1980). From 1968 to 1977, the Soviet Ministry of Fisheries imposed catch limits: 140 to 150 whales from 1968 to 1972 and 200 whales annually from 1972 to 1977 (Zimushko and Ivanshin 1980). The IWC established aboriginal subsistence whaling catch limits for the ENP gray whale stock starting in 1978 (Table 3-9).

Gray whale catches the United States reported to the IWC from 1985 to 2005 included the one whale harvested by the Makah Tribe in 1999[8]. Although Alaska natives hunted whales prior to 1989, the United States had not presented a proposal to the IWC for this hunt, nor had NMFS published a quota under the WCA.

[8] The one whale illegally hunted by tribal members in 2007 will be reported to the IWC in 2008.

TABLE 3-9. ABORIGINAL SUBSISTENCE WHALING CATCH DATA FOR ENP GRAY WHALES REPORTED TO THE IWC

YEAR	TOTAL FIVE-YEAR ALLOCATION BY IWC	TOTAL ANNUAL ALLOCATION BY IWC	TOTAL TAKES	RUSSIAN FEDERATION (CHUKOTKANS)	UNITED STATES (ALASKA ESKIMOS)	UNITED STATES (MAKAH)
1978	Get	179	184	182	2	0
1979		179	182	178	4	0
1980		179	181	178	2	0
1981		179	135	135	0	0
1982		179	169	165	4	0
1983	Get	get	171	169	2	0
1984			168	168	0	0
1985			170	169	1	0
1986			171	169	2	0
1987			158	158	0	0
1988	Get	get	151	150	1	0
1989			180	179	1	0
1990			162	162	0	0
1991			169	169	0	0
1992			0	0	0	0
1993	Get	get	0	0	0	0
1994			44	44	0	0
1995			92	90	2	0
1996			43	43	0	0
1997			79	79	0	0
1998	Get	get	125	125	0	0
1999			124	123	0	1
2000			115	115	0	0
2001			112	112	0	0
2002			131	131	0	0
2003	620 (to Russian Federation and United States)	140	128	128	0	0
2004		140	111	111	0	0
2005		140	124	124	0	0
2006		140	NA	NA	0	0

Source: IWC 1980 for catch data from 1978, IWC 1987 for catch data from 1984

3.4.3.6.2 Environmental Contaminants

Environmental contaminants that enter the marine environment through atmospheric, ocean current, and terrestrial transport originate from a variety of urban and rural anthropogenic sources, including agricultural use of pesticides, industrial disposal of manufacturing or pharmaceutical by-products, industrial processing or burning of fossil fuels, and municipal discharge or runoff associated with landfills, wastewater treatment plants, and miles of streets and roads. Marine ecosystems in the northeastern Pacific receive pollutants from a variety of local,

regional, and international sources (Grant and Ross 2002; EVS Environmental Consultants 2003; Garrett 2004).

These chemicals and compounds include organochlorines (e.g., DDT, PCB, dioxins, and furans), heavy metals (e.g., copper, mercury, and lead), and newly emerging chemicals (i.e., those recently discovered, such as flame retardants), that may have direct lethal effects on individual animals or insidious effects on animal populations through impaired reproductive, metabolic, and immune functions (O'Hara and O'Shea 2005). Bioaccumulation through trophic transfer in the marine food chain allows relatively high concentrations of these compounds to build up in top-level marine predators, such as marine mammals (O'Shea 1999). Gray whales, in particular, may ingest these environmental contaminants when they bottom-feed in areas where the sediment and benthic prey are contaminated.

See Section 3.16.3.2, Environmental Contaminants in Gray Whales, for descriptions of concentrations of organochlorines in gray whale tissues; the descriptions are synthesized from various studies. Many organochlorines are highly fat-soluble and have poor water solubility, which allows them to accumulate in the fatty tissues of animals, where most storage occurs (O'Shea 1999; Reijnders and Aguilar 2002). Some are highly persistent in the environment and resistant to metabolic degradation. Pinnipeds and porpoises carry far greater amounts of PCBs and DDTs than baleen whales and fish, however, because of their higher positions in food chains (O'Shea and Aguilar 2001; Reijnders and Aguilar 2002).

Section 3.16.3.2 also addresses concentrations of heavy metals (including mercury, lead, and copper, among others) in gray whale tissues, synthesized from various studies. The three elements usually considered of greatest concern to cetaceans are mercury, cadmium, and lead (O'Shea 1999). Mercury, cadmium, and other metals accumulate primarily in the liver and kidneys, whereas lead concentrates mostly in bones (Reijnders and Aguilar 2002). Concentrations of most metals tend to increase throughout an animal's life. Most metals are stored in fatty tissues. There are, however, organic forms of metals, such as methylmercury, that accumulate in the lipids of prey species. Many marine mammal species can tolerate high amounts of metals or detoxify them (Reijnders and Aguilar 2002). Published accounts of metal-caused pathology are scarce (O'Shea 1999).

In the 1999 and 2000 mass stranding events, chemical contaminants were a possible factor contributing to the increased mortality (Gulland et al. 2005). Overall, however, no contaminant found would be the proximate cause for acute mortality of the observed magnitude

(Gulland et al. 2005). The mean concentrations of organochlorines in the blubber of gray whales stranded in 1999 were well below levels observed in apparently healthy gray whales harvested in Russia (Tilbury et al. 2002). Also, lower levels of total mercury and methylmercury were reported in the muscle, kidney, and liver tissues of four gray whales that stranded in the Gulf of California in 1999 than were reported for other marine mammals, though sampling differences and the effect of decomposition on blubber lipids may alter the results of chemical analysis (Gulland et al. 2005).

3.4.3.6.3 Harmful Algal Blooms

Single-celled algae are the base of the food chain in the marine environment, and they proliferate or aggregate to form dense concentrations of cells called blooms when certain environmental conditions prevail. Algal blooms can produce marine biotoxins, which can accumulate in fish, seabirds, and other marine biota. Harmful algal blooms occur in coastal marine environments throughout the United States, including waters of Puget Sound and off the coasts of Washington, Oregon, and California. There is evidence that harmful algal blooms have increased in frequency, magnitude, and seasonal duration over the past 10 years, possibly due to global climate change, toxic algal species extending to new areas, and human-related eutrophication of the coastal environment (Trainer 2001). Though less than 5 percent of the known dinoflagellate species and fewer than 25 species in one genus of diatoms produce compounds that are known to be toxic to marine mammals (Van Dolah 2005), some marine mammal morbidity and mortality, including mass strandings, have been associated with marine biotoxin exposure and harmful algal blooms. Along the west coast of the United States, some of the most deleterious biotoxins produced by harmful algal blooms include saxitoxin (the toxin that causes paralytic shellfish poisoning in humans), domoic acid, and *Heterosigma akashiwo* (Horner et al. 1997). Gray whales have thus far, been shown to be affected by saxitoxin or domoic acid, as explained below.

Saxitoxin

In 1987, acute levels of saxitoxin, produced by a dinoflagellate bloom, were associated with the death of 14 humpback whales off the coast of Cape Cod, Massachusetts (Geraci 1989; Van Dolah 2005). Saxitoxin was also a contributing factor in the mortality of bottlenose dolphins in a Florida lagoon in 2001 and 2002 (Van Dolah 2005). Scientists have also postulated that chronic, sublethal exposure to saxitoxin through ingestion of copepods may affect right whale reproductive rates by lowering diving rates and feeding time, decreasing overall fitness (Van Dolah 2005). Researchers have demonstrated that saxitoxin has a high affinity and specific binding to the nerve preparations

of the brains of gray whales, humpback whales, California sea lions, and manatees (Trainer and Baden 1999).

Domoic Acid

In 1991, the first evidence of domoic acid on the west coast of North America was a mass mortality of pelicans and cormorants in Monterey Bay, California (Van Dolah 2005). The first confirmed domoic acid poisoning of marine mammals occurred in 1998 in the same area, when more than 70 California sea lions stranded from San Luis Obispo to Santa Cruz (Scholin et al. 2000). Of the 70 sea lions that stranded, 57 sea lions died due to acute toxicity from eating anchovies (Van Dolah 2005). A similar event occurred in 2000 in the same region, when the stranding of 187 sea lions was associated with domoic acid (Gulland et al. 2002; Van Dolah 2005). Concurrent with the 2000 sea lion mortality event, abnormally high numbers of gray whale strandings occurred (Van Dolah 2005). One of the three gray whales whose cause of death was determined in the 1999 and 2000 unusual mortality event was likely intoxicated with domoic acid (Gulland et al. 2005). The levels of domoic acid in the necropsied whale would indicate acute toxicosis in a laboratory primate, but toxic doses for cetacea are undetermined (Truelove and Iverson 1994). Biotoxins thus were one of the factors listed as potentially contributing to the increased number of gray whale mortalities observed in 1999 and 2000, though too few carcasses were adequately sampled to assess their importance in the mortality event (Gulland et al. 2005). In February 2002, researchers documented a domoic acid event on the California coast; it involved nine marine mammal species and the deaths of thousands of sea lions; none of the reported strandings or deaths was a gray whale (Van Dolah 2005).

3.4.3.6.4 Oil Spills and Discharges

Exposure to petroleum hydrocarbons released into the marine environment through oil spills and other discharge sources represents another potential anthropogenic impact on gray whales in the project area. Inhalation of vapors at the water's surface and ingestion of hydrocarbons during feeding are the most likely pathways of exposure. Acute exposure to petroleum products can cause changes in behavior and reduced activity, inflammation of the mucous membranes, lung congestion, pneumonia, liver disorders, and neurological damage (Geraci and St. Aubin 1990). Marine mammals can generally metabolize and excrete limited amounts of hydrocarbons, but acute or chronic exposure poses greater toxicological risks (Grant and Ross 2002).

At the water's surface, gray whales have been observed lying in or swimming through oil from the *Exxon Valdez* oil spill along the Alaska coast (Moore and Clarke 2002), and they have been

observed migrating through natural seeps near Santa Barbara, California (Kent et al. 1983). Kent et al. (1983) observed that gray whales generally swam faster, stayed submerged longer, and took fewer breaths than whales that did not pass through oil; they also sometimes changed direction to swim around the surface oil, though it was not clear that the change in direction was in response to the oil. Some scientists have concluded that cetaceans have a thickened epidermis that greatly reduces the likelihood of petroleum toxicity from skin contact with oiled waters (Geraci 1990; O'Shea and Aguilar 2001). Geraci (1990) proposed that gray whales probably experience eyes and tactile hair follicle irritation upon contact with oil, but that long-lasting effects to skin tissue were less likely. This observation was based on laboratory tests on bottlenose dolphins; because the dolphins did not exhibit a vascular reaction to contact with petroleum products (Geraci 1990). Other scientists have proposed that cetaceans with rough or damaged skin, such as the barnacle-covered skin of a gray whale, may be more susceptible to oil contamination and subsequent bacterial infection than smoother-skinned cetaceans (Albert 1981). Moore and Clarke (2002) reported that it is unclear whether gray whales can detect surface oil.

Gray whales could consume oil from fouled baleen, by engulfing tar balls, or by bottom feeding on contaminated sediments (Geraci 1990; Moore and Clarke 2002), though there are no reported cases of ingestion. Twenty-five whales stranded were after the Exxon Valdez spill; the whales had oil on their baleen, but not in their digestive tracts, suggesting that the baleen was fouled after death (Moore and Clarke 2002). Geraci and St. Aubin (1985) concluded that oil impact on baleen was slight and short term, based on laboratory tests where 70 percent of oil was flushed from baleen in 30 minutes, but Geraci (1990) proposed that baleen fibers could remain oiled if a whale was feeding in a highly oiled area where fouling outpaced the flushing rate. Moore and Clarke (2002) noted that oil and chemical dispersants, used to break up surface oil and cause it to sink, could contaminate benthic sediments. They proposed that any large-scale contamination of a primary feeding area could negatively affect the population.

Due to its proximity to Alaska's crude oil supply, Puget Sound is one of the leading petroleum refining centers in the United States, with about 15 billion gallons of crude oil and refined petroleum products transported through it annually (Puget Sound Action Team 2005). Inbound oil tankers carry crude oil to four major refineries in the sound, while outbound tankers move refined oil products to destinations along the United States west coast (Neel et al. 1997). In 2003, 746 oil tankers passed through Washington's waters bound for ports in Puget Sound, Canada, and along the Columbia River (Ecology 2004). This volume of shipping traffic puts the region at risk of having a catastrophic oil spill. The proposed removal of the current moratorium on oil and gas

exploration and development off the British Columbia coast may increase the danger of a major accident in the region. The possibility of a large spill is one of the most important short-term threats to coastal organisms in the northeastern Pacific (Krahn et al. 2002).

Neel et al. (1997) reported that shipping accidents were responsible for the largest volume (59 percent; 3.4 million gallons [12.9 million liters]) of oil discharged during major spills in Washington from 1970 to 1996. Other sources were refineries and associated production facilities (27 percent; 1.5 million gallons [5.7 million liters]) and pipelines (14 percent; 800,000 gallons [3.0 million liters]). Eight major oil tanker spills exceeding 100,000 gallons (378,500 liters) have occurred in the state's coastal waters and on the Columbia River since the 1960s, with the largest estimated at 2.3 million gallons (8.7 million liters). Grant and Ross (2002) did not report any major vessel spills from British Columbia during this same period, but at least one spill of 100,000 gallons (379,000 liters) is known to have occurred in Canadian waters at the mouth of the Strait of Juan de Fuca in 1991 (Neel et al. 1997). In addition to these incidents, numerous near accidents have resulted from vessel groundings, collisions, power loss, or poor vessel condition (Neel et al. 1997).

Puget Sound's four oil refineries are located on the coast at Anacortes (Shell Oil and Texaco), Ferndale (Mobil Oil), and Tacoma (United States Oil). Four major spills have occurred at two of these facilities, with each causing some discharge of petroleum into marine waters (NMFS 2005b). Pipelines connecting to refineries and oil terminals at ports represent another potential source of coastal spills. Pipeline leaks have caused several major spills in western Washington, but only the 1999 Olympic spill resulted in any discharge to marine waters (Neel et al. 1997).

During the late 1980s and early 1990s, Washington significantly upgraded its efforts to prevent oil spills in response to increased spills in the state and the *Exxon Valdez* accident in Alaska. A number of state, provincial, and federal agencies now work to reduce the likelihood of spills, as does the regional Oil Spill Task Force, which formed in 1989. National statutes enacted in the early 1990s, including the United State's Oil Pollution Act in 1990 and the Canada Shipping Act in 1993, have also been beneficial in creating spill prevention and response standards. Since 1999, Washington State has maintained a rescue tugboat at Neah Bay for approximately 225 days per year during the winter months to aid disabled vessels and thereby prevent oil spills. These measures appear to have helped reduce the number and size of spills since 1991, but continued vigilance is needed (Neel et al. 1997). In general, Washington's outer coast, the Strait of Juan de

Fuca, and areas near the state's major refineries are the locations most at risk of major spills (Neel et al. 1997). The area to be avoided was designated in the OCNMS to minimize the risk by routing large vessels away from dangerous and sensitive areas. An analysis by NOAA of the effectiveness of the voluntary area to be avoided restriction shows a decrease in the number of commercial vessels transiting the area following the designation. From July through September 1999, 511 vessels transited the area, down from 643 vessels for the same period in 1995, when the area to be avoided was established.

Chronic small-scale discharges of oil into marine waters from a variety of sources, including tanker ballast waters, ship bilge and fuel oil, and municipal and industrial waste, greatly exceed the volume released by major spills (Clark 1997) and are another potential impact to gray whales. Though chronic oil pollution has been documented in large numbers of seabird deaths (e.g., Wiese and Robertson 2004), less is known about its impact on gray whales and other marine mammals. The long-term effects of repeated ingestion of sub-lethal quantities of petroleum hydrocarbons on marine mammals are also unknown.

3.4.3.6.5 Offshore Activities and Underwater Noise

Anthropogenic activities in the ocean have increased over the past 50 years, resulting in more underwater noise (Hildebrand 2005). Underwater noise, associated with offshore oil and gas development, commercial fishing and vessel traffic, whale-watching, and scientific research, is often regarded as the primary source of disturbance to gray whales resulting from these activities (Moore and Clarke 2002). Noise specifically related to whale-watching and vessel disturbance is described directly below under the Whale-watching subheading. A broader discussion of noise (including both atmospheric and underwater noise) in the project area, is in Section 3.11, Noise, and its effects on wildlife other than gray whales is in Section 3.5, Other Wildlife Species. Gray whale reactions to offshore activities have been relatively well studied compared to those of other mysticetes (Moore and Clarke 2002). Researchers have noted short-term behavioral responses of gray whales to underwater noise. Malme et al. (1988) concluded there is a 50/50 chance that whales will change course to avoid the continuous broadband noise associated with aircraft, ships, and seismic explorations when sound levels exceed approximately 120 decibals (dB)[2] and to intermittent noise when levels exceed approximately 170dB. Moore and Clarke (2002) noted that, although these values provide some useful baseline information on the levels of industrial noise to which gray whales respond, the distance from the noise source at which these levels occur varies with geographic region and sea condition. In addition to altering swimming course and speed, gray whales exhibited abrupt behavioral changes in response to playback sounds and

airgun blasts, including switching from feeding to avoidance, with a resumption of feeding after exposure (Malme et al. 1984); and changing calling rates, call structure, and surface behavior, usually from traveling to milling (Dahlheim 1987).

Malme (1989) prepared a disturbance-ranking scheme for oil and gas noise sources off Alaska. Modeling indicated that gray whales have a high probability of being influenced by noise from oil and gas operations, including large tankers, dredges, and airgun arrays (Malme et al. 1988), but other studies indicated that the noisiest period of offshore oil and gas operations occurs during exploration and site establishment (Richardson et al. 1995). Production activities are generally quieter and require fewer support operations (Moore and Clarke 2002). Specific gray whale reactions to whale-watching include changing course and altering their swimming speed and respiratory patterns when followed by whale-watching boats (Bursk 1989), but Jones and Swartz (1984) documented that gray whales in the San Ignacio Lagoon of Baja California become less likely to flee as the season progresses. Cow-calf pairs of gray whales are considered more sensitive to disturbance by whale-watching vessels than other age or sex classes, for instance (Tilt 1985). Gray whales also preferentially avoid low frequency active transmissions conducted in a landward direction (Tyack and Clark 1998). Reported gray whale reactions to aircraft vary and seem related to ongoing whale behavior and aircraft altitude (Moore and Clarke 2002). Specific gray whale reactions to scientific research (tagging) include fluke-slapping and rapid swimming, but the whales returned to normal behavior shortly after tagging (Harvey and Mate 1984).

3.4.3.6.6 Vessel Interactions

Whale-watching for gray whales is an important recreational industry and activity along the west coast of North America, from the wintering grounds in the lagoons of Baja California to British Columbia, Canada, although most targeted gray whale whale-watching occurs in the winter range, where tourist boats offer trips to see (and sometimes pet) newly born gray whale calves and mothers. In Washington and British Columbia, killer whales easily surpass gray whales as the main target species of the commercial whale-watching industry (Hoyt 2001). The activity of commercial whale-watching vessels and private recreational boats has raised concerns about its effect on gray whales. In response to these concerns, regulations minimize disturbance by vessels in Mexico, the United States, and Canada.

In Mexico, the government has applied whale-watching regulations to commercial operators since 1997. There are currently regulations governing the numbers of boats and methods of approach for four specific whale-watching areas in the lagoons. There are no minimum approach distances,

but boats cannot chase whales. The northern two-thirds of San Ignacio lagoon closes to tourism and fishing activities during the breeding and calving season. In the southern third of San Ignacio lagoon (nearest the ocean), whale-watching tourism is closely regulated to allow access to only limited numbers of people (United Nations 1999). In Washington and British Columbia, NMFS and conservation organizations in the United States have teamed up with the Canadian government and conservation organizations to adopt 'Be Whale Wise' guidelines for vessels, kayaks, and other crafts watching whales. The guidelines, among other things, recommend that vessels keep a 100-yard (100-meter) buffer between the vessel and the whale, and recommend a slow approach speed of 7 knots within 400 yards (400 meters) of whales.

Whale-watching along the migration route is not heavily regulated and it has been suggested that this activity, in combination with commercial fishing and vessel operations, may cause gray whales to migrate further offshore (Wolfson 1977). Researchers conducted various studies on the reaction of gray whales to whale-watching vessels in winter on their wintering range and, to some extent, during migration (Urbán-Ramírez et al. 2003). Researchers have paid little attention to the northern portion of the summer range in the Bering Sea and adjacent Arctic Ocean because whale-watching is largely undeveloped in those areas (Richardson et al. 1995). One study reported on the reaction of gray whales feeding off Vancouver Island during summer to whale-watching vessels (Bass 2000). In general, scientists remain cautious about the effects of whale-watching on gray whales (e.g., Gard 1974; Rice 1975; Reeves 1977; Jones et al. 1994), but the response of gray whales to whale-watching vessels appears to be short term and temporary.

In the winter range, vessels in the lagoons can cause short-term escape reactions in gray whales, especially when boats move erratically or quickly (Reeves 1977; Swartz and Cummings 1978; Swartz and Jones 1978; Swartz and Jones 1981). Bursk (1989) reported that gray whales often changed speed and deviated from their course when near whale-watching vessels. Observers noted that gray whales have also displayed evasive behavior termed snorkeling, where whales came to an almost compete halt to breathe in an inconspicuous manner. Mosig (1998) reported an inverse relationship between the average number of whale-watching vessels and the average number of gray whales in Laguna San Ignacio in the winter of 1997, but she could not demonstrate any direct effect of vessels on whales. Jones and Swartz (1984 and 1986) found no evidence that gray whales abandoned the lagoons when whale-watching vessels were present; observers noted that some gray whales were attracted or showed no response to quiet, idling, slow-moving, or anchored vessels, especially late in winter (Norris et al. 1983; Dahlheim et al. 1984; Jones and Swartz 1984; Jones and Swartz 1986; Richardson et al. 1995). During the course

of all of these studies, there has been no evidence to demonstrate whale-watching vessels cause any more than a temporary effect on the behavior of gray whales and no apparent effect on the health of the population in the lagoons on the wintering grounds (Gard 1974; Jones et al. 1994).

Along the migration route, including the southern portion of the summer range, whale-watching vessels can also cause short-term reactions in gray whales. Migrating whales disturbed by vessels tended to exhale underwater and surface only long enough to inhale before resubmerging (Hubbs and Hubbs 1967). Observers noted that migrating gray whales also changed course more often with increasing numbers of whale-watching vessels (Bursk 1983; Bursk, in Atkins and Swartz 1988). Heckel et al. (2001) found substantial differences in both speed and direction of the transit of migrating gray whales with and without the presence of whale-watching vessels off Baja California. While these studies show migrating gray whales appear to react to whale-watching vessels, there is no evidence to suggest they have altered location of the migration route, migration timing, or the sequence of migration by sex and age groups. Whale-watching vessels regularly approach gray whales feeding in Clayoquot Sound, on the west coast of Vancouver Island, British Columbia, during summer. Whales responded to the vessels by changing their dive patterns, but the changes appeared to be temporary and not biologically significant (Bass 2000).

Harvey and Mate (1984) observed that gray whales sometimes responded to tagging by fluke slapping and rapid swimming, but usually returned to pre-tagging behavior shortly after the event. The response of gray whales to biopsy darts has not been described, but other mysticetes are observed having brief, sometimes dramatic, changes in behavior (Brown et al. 1991; Weinrich et al. 1991). Although the gray whale population is exposed to whale-watching vessels and other disturbances on the wintering grounds and along much of the migration route, it has demonstrated a tolerance and resiliency to whale-watching and other noisy human activities as reflected by the successful recovery of the population from over-exploitation (Cowles et al. 1981; Moore and Clarke 2002).

3.4.3.6.7 Activities Occurring in the Winter Range

Much of the coastal area surrounding the Baja lagoons and the gray whale wintering range is protected by law and limited access. In 1988, the Mexican government established El Vizcaino Biosphere Reserve, an area totaling 2,546,790 acres and encompassing Ojo de Liebre (Scammon's Lagoon), Guerreo Negro, and the San Ignacio Bay gray whale sanctuaries. Portions of the reserve, including San Ignacio and the Ojo de Liebre lagoons, were designated as United

Nations Educational, Scientific, and Cultural Organization world heritage sites in 1993 (Urbán-Ramírez et al. 2003). In 2005, the Bay of Loreto National Marine Park, in the northern area of the Sea of Cortez, joined the list. In May 2002, all Mexican territorial seas and the EEZ were declared as a refuge for the protection of large whales. See Urbán-Ramírez et al. (2003) for additional information on formal protection of gray whales in Mexico. Whale-watching is discussed above in further detail, but other activities in the winter range that have been identified as future environmental concerns by ParksWatch of Mexico are discussed below.

Mineral and Salt Mining

Mining for minerals (such as copper, manganese, gypsum, cobalt, silica, and phosphorus) peaked in the last century in places like Santa Rosalia, creating soil erosion, contamination, pollution, and litter in the ocean. Large mining companies have since abandoned these sites, and the town is in economic decline (ParksWatch 2004). The largest salt mine in the world is, however, still operating at Guerrero Negro, where approximately 7 million tons per year is extracted from the ocean through evaporation (ParksWatch 2004). The main threat posed by salt mining is the byproducts created by high salt concentrations (ParksWatch 2004).

In 1995, two large corporations proposed to expand industrial salt extraction by establishing a plant on the shores of San Ignacio Lagoon, Mexico. International and national concern arose as to whether the then-proposed salt plants would divert fresh water from pumping, produce and discharge toxic brine and other water-based pollutants into the lagoon waters, and spur further development, among other issues, potentially having adverse effects on the ecosystem and gray whales (e.g., Sullivan 2006). At the 52nd meeting of the IWC, Urbán-Ramírez (2000) reported the results of a study on the proposed saltworks project. In particular, he evaluated potential impacts on the gray whales that use this wintering area for breeding, calving, and calf rearing. According to his study results, the salt facility in San Ignacio would not harm gray whales. Nonetheless, on March 2, 2000, the government of Mexico cancelled the saltworks project. Conservation agreements negotiated between the Laguna San Ignacio Conservation Alliance and communal landowners have since placed 120,000 acres of land around the lagoon in a private land trust, and more agreements are anticipated (Sullivan 2006). Thus, while the local people fish and provide ecotourism and whale-watching, it is reasonable to assume that the area will remain a sanctuary for wintering gray whales (Sullivan 2006).

Shore-Based Commercial Development in Bahia Magdalena

The growth of gray whale tourism in the North Zone of Bahía Magdalena has led to a proposed Japanese-owned and financed tourist resort development at Bahía Magdalena (Dedina and Young 1995). Although NMFS identified this activity as a potential threat to the whales and their habitat in its 1999 gray whales status review (e.g., water quality degradation, increase in whale-watching tourism, etc.), there are currently no plans to proceed with this development (Rugh et al. 1999). Since 1999, the Mexican government (Fonatur, the national fund for the promotion of tourism) has planned to improve and promote the growth of various marinas around the Baja Peninsula, improve associated airports and airstrips, and pave a highway across the peninsula to improve yachting access and tourism. To date, the project has yet to be analyzed or implemented.

3.4.3.6.8 Ship Strikes

The nearshore migration route used by gray whales makes ship strikes a potential source of injury and mortality (Laist et al. 2001). Anecdotal data and strandings recorded by the Marine Mammal Stranding Network provide helpful, but incomplete, data on the occurrence, frequency, and significance of vessel-related whale deaths and injuries (Laist et al. 2001). From 1975 to 1980, there were reports of 12 collisions and 6 confirmed deaths of gray whales off the coast of southern California, and 7 of 489 gray whales stranded between Mexico and Alaska from 1975 to 1989 had apparent propeller injuries (Laist et al. 2001). Ferrero et al. (2000) reported five gray whale mortalities off California from ship strikes from 1993 to 1995, and one ship strike mortality occurred off Alaska in 1997. Between 1999 and 2003, the California marine mammal stranding network reported four serious injuries or mortalities of gray whales caused by ship strikes, one each in 1999, 2000, 2001, and 2003 (Angliss and Outlaw 2005). Based on the photo-id catalog maintained for gray whales in the winter range, Urbán-Ramírez et al. (2003) reported that an estimated 2 percent (then about 1,600) of the whales had injuries (scars) from impact with a large keel or propeller. Additional mortality from ship strikes probably goes unreported because the carcasses sink at sea (i.e., the whales do not strand), the beached carcasses do not show obvious signs of ship strikes, or the whales may not die when hit (Urbán-Ramírez et al. 2003). It is impossible to quantify the actual mortality of gray whales from this source, and an annual mortality rate of one or two gray whales per year from ship strikes represents a minimum estimate. Laist et al. (2001) suggests that most lethal or severe injuries are caused by large ships 80 meters (263 feet) or longer and by ships traveling 14 knots or faster.

3.4.3.6.9 Incidental Catch in Commercial Fisheries

The following information comes from NMFS' 2008 Stock Assessment Report (Angliss and Outlaw 2008). NMFS recognizes 22 commercial fisheries in Alaska that use trawl, longline, or pot gear and could have incidental serious injuries or mortalities of gray whales. No observed serious injuries or mortalities have occurred in any of those fisheries. NMFS observers monitored the Makah tribal set gillnet fishery from 1990 to 1998 and in 2000, reporting one gray whale taken in 1990 and one in 1995. One gray whale was entangled in a set gillnet during this fishery; it was released alive in 1996. NMFS observers also monitored the California/Oregon thresher shark/swordfish drift gillnet fishery from 1993 to 2003 and reported one mortality in 1998 and one in 1999. No serious injuries or mortalities have been reported in that fishery since 1999. The mean annual mortality rate from these monitored fisheries was 1.2 (the coefficient of variation is 0.85) gray whales per year. Additional information on gray whale mortalities from fisheries interactions comes from logbooks and stranding data. Angliss and Outlaw (2008) reported annual fishery mortality data from fisher logbooks (rounded up to one whale) and from stranding reports (rounded up to seven whales). Taken into account with the monitored fisheries, they estimated a total minimum annual mortality rate in commercial fisheries of approximately seven whales. Although there may be other unreported mortalities in commercial fisheries, Angliss and Outlaw (2005) concluded that fishery mortalities can be considered insignificant. Gray whales also migrate through Canada's exclusive economic zone and are subject to fisheries interactions there as well. Baird et al. (2002) estimated the annual mortality in Canadian fisheries to be around two whales.

3.4.3.6.10 Marine Energy Projects

Although not yet analyzed, approved, or implemented by the Federal Energy Regulatory Commission and various energy companies, 10 marine energy projects currently are proposed in Washington State. In its August 2006 report to the Washington Fish and Wildlife Commission, the WDFW stated that applications for licensing submitted to the Federal Energy Regulatory Commission cover the following project locations:

- San Juan Channel 116 turbines (60-foot rotors)
- Guemes Channel 166 turbines (30-foot rotors)
- Admiralty Inlet (1,010 turbines)
- Agate Pass 130 turbines (9-foot rotors)
- Speiden Channel (168 turbines)
- Rich Passage 62 turbines (30-foot rotors)

- Tacoma Narrows 60 turbines (60-foot rotors)
- Four to 20 turbines (30 to 60-foot rotors) (Snohomish County PUD) Deception Pass
- One hundred to 300 turbines (Washington Tidal Energy)
- Columbia River 50 to 150 turbines (25 to 50-foot rotors)

Generally, the concept for most of these proposed projects is to take wind turbines and place them under water to use the energy from tidal currents to generate electricity (WDFW 2006b). The actual impacts of these types of projects are unknown because very few exist in the world, but WDFW (2006b) has identified preliminary potential impacts to birds, fish, and marine mammals. They include, but are not limited to, direct mortality or injury from turbine blade strikes, interference with migratory patterns, measures to protect equipment from marine growth, direct habitat loss from equipment and infrastructure placement, impacts on currents, changes in water surface elevations, effects on commercial and recreational fishing areas and equipment, changes in sediment transport, and other issues not yet identified. The WDFW will design studies to assess effects on fish, birds, marine mammals, and their habitats (WDFW 2006b).

In December of 2007, the Federal Energy Regulatory Commission issued a license for a pilot wave energy project in Makah Bay, located in the Makah U&A, within the gray whale's migratory corridor (other applications are also proposed for siting in areas that some gray whales could potentially travel). Under the license, Finavera Renewables Ocean Energy Ltd., will place four buoys about 3.7 miles from shore in approximately 150 feet of water. Each buoy will be tethered by cables to four surface floats (approximately 4 feet in diameter) and each float will be connected by a cable to a subsurface anchor buoy just above the seafloor. All cables in the anchoring system will be under tension. A transmission cable will connect the buoys to a transmission station on land. This cable will lie along the ocean floor until it reaches a depth that is 10 to 30 feet below mean lower low tide, at which point it will be underground until it reaches the station. At this time the applicant has no definitive plans for future expansion of the project (AquaEnergy 2006). Finavera and FERC examined the environmental effects of the project and concluded there would be only minor or localized risks to gray whales. Impacts of the project to other resources are examined in Section 5.0, Cumulative Effects.

3.5 Other Wildlife Species

3.5.1 Introduction

Various marine mammals and birds inhabit the project area, with the highest use during late spring through early fall and the lowest use during winter (NOAA 1993). Twenty-nine species of marine mammals and 109 species of marine birds have been recorded in the project area (NOAA 1993). Of these species, eight mammal and four bird species are listed under ESA as threatened or endangered. Four federally listed reptiles (leatherback sea turtles, green sea turtles, loggerhead sea turtles, and olive ridley sea turtles) also could occur in the area. Species occurring in the project area and listed as threatened or endangered by Washington State, but not under the federal ESA, include one marine mammal (sea otter).

3.5.2 Regulatory Overview

Various federal, state, and local regulations address the protection of threatened, endangered, and sensitive wildlife in the project area. Table 3-10 provides regulations for wildlife. In most cases, city and county regulations reflect WDFW recommendations. For a detailed description of NMFS' management of marine mammals (including, but not limited to, gray whales), see Section 3.4.2.1, Marine Mammal Protection Act Management.

With regard to disturbance of marine wildlife, MMPA prohibits (with some exceptions) the harassment of marine mammals in United States waters. The 1994 amendments to the MMPA defined harassment (Level B) as any act of pursuit, torment, or annoyance that has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering. Loud, continued noises could be considered harassment to wildlife, particularly to marine mammals that use sound to communicate.

To protect nesting seabirds and marine mammals from noise and physical disturbance from low-flying aircraft, OCNMS prohibits flying motorized aircraft less than 2,000 feet over certain areas of the Sanctuary. These restrictions are described in greater detail in Section 3.1.1.1.2, Designation (of the OCNMS) and Regulatory Overview. Although codified as federal law, National Marine Sanctuary overflight regulations are not recognized by the Federal Aviation Administration. The Sanctuary, however, has made increasing voluntary compliance with this regulation a major priority (Galasso 2005). Notably, data collected by University of Washington researchers studying marine birds at Tatoosh Island were used to conduct an enforcement action against a helicopter pilot and contracting passenger (Parrish et al. 2005).

TABLE 3-10. FEDERAL, STATE, AND LOCAL REGULATIONS FOR PROTECTED WILDLIFE

REGULATION	OVERSEEING AGENCY	WILDLIFE SPECIES AND HABITATS ADDRESSED
Federal		
Marine Mammal Protection Act (MMPA)	NMFS and FWS	All marine mammal species.
Whaling Convention Act (WCA)	NMFS	All large cetacean species subject to aboriginal subsistence whaling.
Endangered Species Act (ESA)	FWS and NMFS	All federally listed threatened and endangered species and critical habitats. Federal agencies must ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat.
Migratory Bird Treaty Act and Executive Order 13186	FWS	Most migratory birds. The act provides that it is unlawful to pursue, hunt, take, capture, or kill these birds.
Bald Eagle Protection Act and Eagle Protection Act	FWS	Bald eagle (and golden eagle). The act prohibits the taking or possession of and commerce in bald and golden eagles, with limited exceptions.
Olympic Coast National Marine Sanctuary regulations, 15 CFR Part 922, Subpart O	NOAA National Ocean Science, National Marine Sanctuary Program	Sea turtles, seabirds, and their habitats. The regulations prohibit take of these wildlife, except as authorized by ESA, MMPA, Migratory Bird Treaty Act, or pursuant to any relevant Indian treaty, provided that the treaty is exercised in accordance with ESA, MMPA, and Migratory Bird Treaty Act, to the extent that they apply. These regulations prohibit flying motorized aircraft at less than 2,000 feet elevation both above the sanctuary and within 1 nautical mile of the Flattery Rocks National Wildlife Refuge or within 1 nautical mile seaward from the coastal boundary of the sanctuary, with limited exceptions.
State		
Washington State Endangered Species Act, Washington Administrative Code 232-12-297	WDFW	All state-listed threatened and endangered species. Associated recovery plans provide guidelines on management of these species.
Local		
Clallam County Critical Areas Ordinance No. 709, 2001	Clallam County	Habitat for threatened, endangered, and other sensitive species. Provides general guidance. Also provides specific buffers for bridge construction and other projects that are not relevant to the Makah EIS proposed action.

3.5.3 Existing Conditions

This following discussion is divided into three primary topics. It focuses on establishing a baseline of information for addressing EIS issues of concern including noise, disturbance, and other perturbations that may affect marine wildlife. Section 3.5.3.1 describes the marine mammal species that are known to occur in the project area. Section 3.5.3.2 provides an overview of other marine wildlife species in the project area. Both sections address ESA-listed species as well as other species in the project area. Section 3.5.3.3 discusses the sensitivity of marine mammals and other wildlife species to noise and other disturbance both above and below the surface of the water.

3.5.3.1 Marine Mammals

Table 3-11 lists 29 species of marine mammals that breed, rest within, or migrate through the waters off the Washington coast (NMFS 1992; NOAA 1993). Descriptions of the state and federal threatened or endangered species followed by common and then, to a lesser extent, uncommon species are provided below in this section. Full descriptions of these species are in Angliss and Outlaw (2005), Carretta et al. (2006), Forney et al. (2000), NMFS (1992), Ferrero et al. (2000), Haley (1986), Perrin et al. (2002), and Nowak et al. (2003), with specific information on their use off the Washington coast by Brueggeman et al. (1992), Calambokidis et al. (2004b), and Green et al. (1993).

TABLE 3-11. MARINE MAMMALS THAT OCCUR ALONG THE WASHINGTON COAST AND THEIR FEDERAL/STATE STATUS

SPECIES	*SCIENTIFIC NAME*	RELATIVE ABUNDANCE	PRIMARY HABITAT	PRIMARY PREY	SEASON(S) PRESENT	FEDERAL/ STATE STATUS
Harbor seal	*Phoca vitulina*	Common	Coastal/ continental	Fish	Year-round	
California sea lion	*Zalophus californianus*	Common	Coastal/shelf	Fish	Summer/ spring	
Steller sea lion	*Eumetopias jubatus*	Common	Coastal/shelf	Fish	Year-round	Federally/state threatened
Northern elephant seal	*Mirounga angustirostris*	Common	Shelf/slope	Fish/squid/ crab	Summer/fall	
Northern fur seal	*Callorhinus ursinus*	Common	Offshore/ slope	Fish/squid	Year-round	Federally depleted
Dall's porpoise	*Phocoenoides dalli*	Common	Shelf/slope/ offshore	Fish	Year-round	
Harbor porpoise	*Phocoena phocoena*	Common	Shelf	Fish/squid	Year-round	
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	Common	Slope/ offshore	Fish	Year-round	
Northern right whale dolphin	*Lissodelphis borealis*	Common	Slope/ offshore	Fish/squid	Year-round	
Common dolphin	*Delphinus delphis*	Uncommon	Offshore	Squid/fish	Unknown	

Species	Scientific Name	Relative Abundance	Primary Habitat	Primary Prey	Season(s) Present	Federal/ State Status
Striped dolphin	*Stenella coeruleoalba*	Uncommon	Shelf/offshore	Fish/squid/ zooplankton	Unknown	
Risso's dolphin	*Grampus griseus*	Common	Slope	Squid	Year-round	
Killer whale[1]	*Orcinus orca*	Common	Shelf/slope	Fish/marine mammals	Year-round	Federally/state endangered[1]
False killer whale	*Pseudorca crassidens*	Uncommon	Offshore	Fish	Unknown	
Pilot whale	*Globicephala macrorhynchus*	Uncommon	Shelf/offshore	Fish/ octopus	Unknown	
Pygmy sperm whale	*Kogia breviceps*	Uncommon	Offshore	Octopus/ fish/squid	Unknown	
Gray whale	*Eschrichtius robustus*	Common	Coastal/shelf	Crustaceans	Year-round	
Humpback whale	*Megaptera novaeangliae*	Uncommon	Shelf/slope	Zooplankton/ fish	Spring to fall	Federally/state endangered
Sperm whale	*Physeter macrocephalus*	Uncommon	Slope/ offshore	Squid/fish	Spring to fall	Federally/state endangered
Minke whale	*Balaenoptera acutorostrata*	Common	Shelf	Fish/squid	Year round	
Fin whale	*Balaenoptera physalus*	Uncommon	Slope/ offshore	Fish/ zooplankton	At least winter	Federally/state endangered
Blue whale	*Balaenoptera musculus*	Uncommon	Slope/ offshore	Zooplankton	Unknown	Federally/state endangered
Sei whales	*Balaenoptera borealis*	Uncommon	Offshore	Zooplankton	Unknown	Federally/state endangered
Right whale	*Balaena glacialis*	Rare	Shelf	Zooplankton	At least spring	Federally/state endangered
Baird's beaked whale	*Berardius bairdii*	Rare	Shelf/offshore	Squid/ octopus/fish	At least fall	
Curvier beaked whale	*Ziphius cavirostris*	Rare	Offshore	Squid/fish	Unknown	
Hubb's beaked whale	*Mesoplodon carlhubbsi*	Rare	Offshore	Squid/fish	Unknown	
Stejneger's beaked whale	*Mesoplodon stejnegeri*	Rare	Offshore	Squid/fish	Unknown	
Sea otter (Washington stock)	*Enhydra lutris kenyoni*	Common	Coastal	Invertebrates	Year round	State endangered

[1] NMFS recently listed the southern resident killer whale population as endangered. Transient and offshore killer whales are not listed under ESA, but occur in the project area.

Source: Haley 1986; Calambokidis et al. (2004b), Brueggeman et al. (1992); NMFS (1992); Green et al. (1993); Carretta et al. (2006), Anglis and Outlaw (2005), Ferrero et al. 2000; Forney et al. 2000.

3.5.3.1.1 ESA-Listed Marine Mammal Species

Steller Sea Lion

The eastern stock (identified as a distinct population segment) of Steller sea lions extends from California to 144° W longitude (at Cape Suckling, AK) at the northern end of southeast Alaska and includes Washington and Oregon. Based on extrapolations from pup surveys in 2002, the stock is estimated to be 44,996 animals with a PBR of 1,967 (Angliss and Outlaw 2005). This stock is listed as threatened under ESA (55 FR 12645, April 5, 1990). Overall the stock has been increasing at about 3.1 percent per year since the 1970s with the population more than doubling in size by 2002, principally in Southeast Alaska (Pitcher et al. *in press*).

The Steller sea lion occurs year around in Washington State, with peak numbers in late summer, fall, and winter (NMFS 1992). There are no rookeries in Washington State, but one or two pups infrequently are born at haulout sites on the Washington coast; it is unlikely that these pups survive (Gearin 2007). The closest rookeries are in northern British Columbia and central Oregon, where pupping occurs from late May to early July. Within Washington, Steller sea lions occur primarily in the nearshore zone and continental shelf zone, with smaller numbers in the inside waters of the Strait of Juan de Fuca and Puget Sound.

There are several commonly used haulout sites near the project area (Gearin and Scordino 1995), including near Neah Bay during all months of the year, but they are more commonly observed during late August through April. The west end of Tatoosh Island is a year-round haulout site with numbers peaking during fall and winter. To the south of Cape Alava, large numbers exceeding 1,000 Steller sea lions have been observed hauled out on the Bodelteh Islands and on Guano Rock (Figure 3-2). Farther to the south, large numbers also haul out on Carroll Island, along with California sea lions, and at the Split Rock complex north of Taholah.

Steller sea lions are opportunistic predators, feeding primarily on a wide variety of fish and cephalopods. Some of the more important prey in Washington include Pacific whiting, Pacific herring, spiny dogfish, skates, salmon, and smelts (Gearin et al. 1999). Steller sea lions have been known to prey infrequently on harbor seal, fur seal, ringed seal, and possibly sea otter pups (NMML 2007). Before 2005, Makah tribal regulations explicitly advised subsistence hunters to take care in hunting California sea lions to avoid Steller sea lions (Sepez 2001); since 2005, the Tribe has not authorized direct subsistence harvest of any marine mammals.

Killer Whale

There are three ecotypes of killer whales in the North Pacific Ocean: resident, transient, and offshore whales (Bigg et al. 1990; Ford et al. 2000). Resident killer whales congregate in relatively large groups in coastal areas where they forage primarily on fish. Transient killer whales, whose range extends over a broader area, primarily hunt marine mammals (Krahn et al. 2004; Baird et al. 1992). In a recent study by Wade et al. (2006), gray whales accounted for approximately 8 percent of 466 observed predation events by transient killer whales off the west coast of North America; calves and juvenile gray whales were taken preferentially over adults. Transient pods are usually smaller than resident pods, and they typically have different dorsal fin shapes and saddle patch pigmentation than resident pods. Little is known about offshore killer whales, but their groupings are large, they range from Mexico to Alaska, and their prey includes fish (Ford et al. 2000; Krahn et al. 2002, 2004). All three ecotypes of killer whales were seen each year during ship surveys from the summer of 1995 to 2002, including southern and northern residents (Calambokidis et al. 2004b). They reported 14 sightings of 124 animals; three of these sightings were of large groups between 20 and 35 animals, and the rest were fewer than 10. Killer whales were widely distributed across different habitats; animals were sighted both close to and far from shore and in fairly shallow and deep water.

As summarized by Carretta et al. (2006), most sightings of the Eastern North Pacific southern resident stock of killer whales have occurred in the summer in inland waters of Washington and southern British Columbia. Pods belonging to this stock have, however, also been sighted in coastal waters off southern Vancouver Island and Washington (Bigg et al. 1990; Ford et al. 2000). The complete winter range of this stock is uncertain. Of the three pods comprising this stock, one (J1) is commonly sighted in inshore waters in winter, while the other two (K1 and L1) apparently spend more time offshore (Ford et al. 2000). Pods K1 and L1 are often seen entering the inland waters of Vancouver Island from the north — through Johnstone Strait — in the spring (Ford et al. 2000), suggesting that they may spend time along the entire outer coast of Vancouver Island during the winter. In 1993, the three pods comprising this stock totaled 96 killer whales (Carretta et al. 2006). The population increased to 99 whales in 1995, then declined to 79 whales in 2001 before increasing slightly to 84 whales in 2004 (Ford et al. 2000; Center for Whale Research 2005). Ninety animals were documented in the J, K, and L pods in 2005 (Center for Whale Research 2005). The minimum population estimate for the eastern North Pacific southern resident stock of killer whales is 84 animals with a PBR of 0.8 whale per year. The southern residents primarily feed on salmon returning to rivers in Washington and southern British Columbia.

NMFS listed the southern resident killer whale distinct population segment as endangered in 2005 (70 FR 69903, November 18, 2005). Listing factors included reduced quantity and quality of prey, persistent pollutants that could cause immune or reproductive system dysfunction, oil spills, and noise and disturbance from vessel traffic. Additionally, the small size of this stock makes it potentially vulnerable to inbreeding that could cause a major population decline (70 FR 69903, November 18, 2005). In November 2006, NMFS designated critical habitat for the southern resident killer whales (71 FR 69054, November 29, 2006). This designation includes approximately 2,500 square miles of Puget Sound, including the entire Strait of Juan de Fuca in the project area. Areas with water less than 20 feet deep are not proposed. The primary constituent elements for the southern resident killer whale critical habitat are (1) water quality to support growth and development; (2) prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth; and (3) passage conditions to allow for migration, resting, and foraging.

Humpback Whale

The humpback whale is listed as endangered throughout its range (35 FR 8491, June 2, 1970). Three North Pacific Ocean populations of humpback whales are currently recognized, based on predominant migration patterns and destinations (there is no perfect correlation between the breeding and feeding areas): (1) the eastern North Pacific stock, which spends winter and spring in coastal Central America and Mexico, then migrates to the coast of California and to southern British Columbia in summer and fall; (2) the central North Pacific stock, which spends winter and spring off the Hawaiian Islands, then migrates to northern British Columbia/Southeast Alaska and Prince William Sound west to Kodiak in summer and fall; and (3) the western Pacific stock, which spends winter and spring off of Japan, then probably migrates to waters west of the Kodiak Archipelago in summer and fall (Carretta et al. 2006). Other humpbacks also spend winter and spring in the waters of Mexico's offshore islands, but the migratory destination of these whales is not well known. The eastern North Pacific population is the stock that most commonly occurs in the project area during summer and fall. Some individuals from the central North Pacific stock may also appear near or in the project area during the summer and fall; there is some overlap of this stock with the summer and fall distribution of the eastern North Pacific stock.

The minimum population estimate for humpback whales in the eastern North Pacific stock is based on 2002/2003 abundance estimates from line-transect and photo-identification mark-recapture studies (Calambokidis and Barlow 2004; Calambokidis et al. 2004b) and is

approximately 1,158 whales. The population is growing from approximately 6 to 7 percent, and the calculated PBR is 2.3 whales per year (Carretta et al. 2006).

Seventeen of 191 whales (9 percent) photo-identified by Calambokidis et al. (2004b) off northern Washington had also been photographed off California and Oregon. Interchange of whales seen off northern Washington and other feeding areas to the south decreased as distance among feeding areas increased. Approximately 10 percent of the whales that were identified off Oregon were also photographed off northern Washington (Calambokidis et al. 2004b).

Humpbacks are generally seen off the coast of Washington from May to November, although they have also been seen earlier in the spring and later in the winter (Shelden et al. 2000) with the highest numbers in June and July. Aerial surveys conducted by Brueggeman et al. (1992) off the coasts of Oregon and Washington recorded 36 groups of 68 humpbacks between May and November, and Green et al. (1993) reported 50 groups of 77 humpbacks between March and April. Humpbacks primarily occurred near the edge of the continental slope and deep submarine canyons (Astoria, Grays, and Nitinat Canyons) where upwelling concentrates zooplankton near the surface for feeding (Brueggeman et al. 1992). Brueggeman et al. (1992) observed that humpbacks were most abundant between May and September, but did not observe any during winter and did not sight any calves. Humpbacks typically are not sighted in winter, but Shelden et al. (2000) did observe some off the coast of Washington in late fall and winter 1998 and 1999; 5 humpback whales were sighted between Carroll Island and Cape Flattery in October, 26 humpbacks (in 12 groups) were sighted in November, and 18 humpbacks (10 groups) were sighted in December. Shelden et al. (2000) concluded that the late occurrence of humpbacks in Washington waters could be due to reoccupation of habitat subsequent to commercial whaling, or to abundance of prey available.

Calambokidis et al. (2004b) reported sightings of humpback whales during ship surveys conducted from 1995 to 2002 off the northern Washington coast within the boundaries of the Olympic Coast National Marine Sanctuary. Humpbacks were the most common species seen with 232 sightings of 402 animals and more than 191 unique individuals; the largest numbers were seen in 2002 when there were 79 sightings of 139 individuals. Group sizes ranged from one to eight animals. Only six calves were recorded from the ship surveys, probably because it was difficult to identify calves at the distance at which most sightings occurred. Sightings were concentrated between Juan de Fuca Canyon and the outer edge of the continental shelf, an area called the Prairie. A small area east of the mouth of Barkley Canyon and north of Nitnat Canyon

where the water was approximately 410 to 475 feet deep had numerous sightings in all years. Smaller numbers of humpback whales were also seen on Swiftsure Bank.

Sperm Whale

The sperm whale is listed as endangered throughout its range (35 FR 8491, June 2, 1970). Sperm whales are widely distributed in the pelagic regions of the North Pacific Ocean where they prey on deepwater squid (Gosho et al. 1984). Sperm whales breed in the lower latitudes (south of 40 degrees N) in winter and then migrate northward to summer feeding areas. Whaling records indicate that about eight sperm whales were harvested annually by whalers at the Bay City, Washington, whaling station during its 15 years of operation in the early 1900s, suggesting that sperm whales were consistently present off the coast at that time. Ship surveys by Calambokidis et al. (2004b) from 1995 to 2002 recorded no sperm whales. However, in surveys Brueggeman et al. (1992) conducted, 24 groups of 36 sperm whales were recorded off the Oregon and Washington coasts. Most were encountered in the deeper offshore waters, except for a relatively small number found in continental slope waters. Brueggeman et al. (1992) observed sperm whales during spring through fall, but not in winter. The highest single-day count was 13 sperm whales in September 1990. Green et al. (1993) reported seven sperm whales in five groups off the Oregon and Washington coasts between March and May. The most recent estimate of abundance is 1,233 sperm whales reported by Barlow (2003) for California, Oregon, and Washington; the minimum population estimate is 885 animals with a PBR of 1.8 whales per year (Carretta et al. 2006). Population trends for the California-Oregon-Washington population are uncertain, though the larger eastern North Pacific population appears to be increasing slightly. The information indicates that relatively small numbers of sperm whales are present in the deep waters off the Washington coast from spring through fall.

Fin Whale

The fin whale is listed as endangered throughout its range (35 FR 8491, June 2, 1970). Three stocks are generally recognized off the United States west coast: (1) the California/Oregon/ Washington stock; (2) the Hawaii stock; and (3) the Alaska stock (Carretta et al. 2006). Fin whales of the California/Oregon/Washington stock are year-round residents off the coast of California; they summer off the Oregon coast and may pass by the Washington coast. They are a pelagic species, seldom found in waters shallower than 656 feet. Ship surveys by Calambokidis et al. (2004b) from 1995 to 2002 indicated no fin whales. Aerial surveys Brueggeman et al. (1992) conducted off the Oregon and Washington coasts indicated 13 groups of 27 fin whales between

June and January. All of the fin whales were observed off the Oregon coast, with all but five whales in waters on the continental slope (656 to 6,562 feet deep). The whales that were not observed in continental slope waters included two seen about 124 miles offshore in November and three viewed on the continental shelf just south of the Columbia River in January. The former group was traveling south, suggesting they were migrating back to the wintering grounds. Except for these two groups of whales, all the other whales were observed during June and July. No calves were observed with any of the whales. Green et al. (1993) reported sighting two fin whales during aerial surveys off the coast of Oregon and Washington between March and May in 1992, but did not report the location. An estimated 3,270 fin whales occur off the coasts of California, Oregon, and Washington during summer and fall, based on shipboard surveys in 1996 by Barlow and Taylor (2001) and in 2001 by Barlow (2003). The minimum population estimate from the 1996 and 2001 surveys was 2,541 with a PBR of 15 whales per year (Carretta et al. 2006). Fin whales can be distinguished from other mysticetes (baleen whales, such as gray, humpback, sei, bowhead, and fin whales) by distinct coloration on the head. The pigmentation differs on the left side and right side, as well as on the dorsal and ventral surface. On the left side, both the dorsal and ventral surfaces are dark slate. On the right side, the dorsal surface is gray and the ventral surface is white (Aguilar 2002). Fin whales in the northern hemisphere typically feed on small schooling fish, planktonic crustaceans, small squid, and zooplankton (Aguilar 2002; Nowak 2003). Based on the Oregon sightings near Washington, it is possible that relatively small numbers of fin whales pass through Washington during winter while migrating south.

Blue Whale

Blue whales are the largest animal, with recorded lengths of from 104 to 107 feet. Females are typically larger than males, and southern hemisphere whales are larger than those of the northern hemisphere (the largest recorded was 92 feet) (Sears 2002). The species is listed as endangered under the ESA (35 FR 8491, June 2, 1970) throughout the range. Three stocks of blue whales inhabit United States waters: the western North Atlantic stock, the Hawaiian stock, and the eastern North Pacific stock. The eastern North Pacific stock feeds in California waters in summer and fall (from June to November) and migrates south to productive areas off Mexico and as far south as the Costa Rica Dome in winter and spring (Angliss and Outlaw 2005; Carretta et al. 2006). Blue whales are very rarely seen off the Oregon coast, and there have been no recent sightings of blue whales off the Washington coast (Calambokidis and Barlow 2004; Calambokidis et al. 2004b; Carretta et al. 2006). Blue whales are found in coastal and deep offshore waters, but also occur on the continental shelf. Blue whales appear to feed almost

exclusively on krill (which are relatively large euphausiid crustaceans) worldwide in areas of cold current upwelling (Nowak 2003; Sears 2002). Some other prey species, including fish and copepods, have been reported as being consumed by blue whales, but these prey are unlikely to contribute substantially to the diet of blue whales (NOAA Fisheries Office of Protected Resources 2006). The best estimate of the eastern North Pacific blue whale stock is 1,744 individuals (Calambokidis and Barlow 2004; Carretta et al. 2006). The minimum population size is 1,384 with a PBR of 1.4 whales per year (Carretta et al. 2006). There is some indication that blue whales increased in abundance in California coastal waters between 1979/1980 and 1991 and between 1991 and 1996. Population estimates in 2000/2001 suggest a decline when compared to previous years. Due to the small sample sizes used in these estimates, the accuracy of this apparent decline is uncertain. Blue whales would not be expected to occur in the project area.

Sei Whale

The sei whale is listed as endangered throughout its range under the ESA (35 FR 8491, June 2, 1970). Sei whales are uncommon off California, Oregon, and Washington (Carretta et al. 2006). Two sei whales were tagged off California in 1962 and 1965 and later commercially taken off the Washington coast in 1969 and British Columbia in 1966 (Rice 1974). No sei whales were observed during aerial surveys Brueggeman et al. (1992) conducted off the coast of Oregon or Washington in 1991 or in 1992, during surveys Green et al. (1993) conducted, or during ship surveys Calambokidis et al. (2004b) conducted from 1995 to 2002. Sei whales are primarily found offshore in deeper water and are not associated with coastal waters. Sei whales primarily prey on copepods and amphipods, but also take euphausiids and small fish (Nowak 2003). The most recent abundance estimate for sei whales off California, Oregon, and Washington out to 300 nautical miles from the coast is 56 whales based on shipboard surveys in 1996 and 2001 (Barlow 2003). Consequently, sei whales would not be expected in the project area.

Right Whale

The North Pacific right whale is listed as an endangered species under the ESA (35 FR 8491, June 2, 1970). It is the least abundant of all large whale species and most marine mammal species. Right whales are found in three general regions: the North Atlantic, the North Pacific, and the Southern Hemisphere. The North Pacific stock has two populations: a Sea of Okhotsk stock and an eastern North Pacific stock. The range of the latter population is thought to include the west coast from Mexico to Alaska (Brownell et al. 2001; Clapham et al. 2004), although few

have been observed off the Washington coast. A group of eight right whales was reported off Destruction Island, Washington, in April 1959 (Fiscus and Niggol 1965). The most recent sighting of a single whale off Cape Elizabeth occurred on May 24, 1992 (Rowlett et al. 1994). Recent extensive ship surveys in western Alaska indicated no sightings of right whales (Zerbini et al. 2006), nor were any seen off Washington during ship surveys from 1995 to 2002 (Calambokidis et al. 2004b). Right whales generally feed on zooplankton, including copepods, near the coast and continental shelf edge. Reliable estimates of population size and trends are not known (Angliss and Outlaw 2005), but observers believe that the North Pacific stock numbers 100 to 200 animals, a small fraction of the pre-whaling abundance (Nowak 2003). This information suggests that a small number of right whales could occur off the Washington coast; however, the probability is low (Carretta et al. 2006).

3.5.3.1.2 Common Species off Washington Coast

Harbor seals, California sea lions, northern fur seals, northern elephant seals, Dall's porpoises, harbor porpoises, Pacific white-sided dolphins, Risso's dolphins, northern right whale dolphins, and minke whales are common in the project area. A short description of these species is provided below. These species could occur in the project area during the proposed whale hunt.

Harbor Seal

For management purposes, three harbor seal stocks are recognized along the west coast of the continental United States, including the California stock, outer coast of Oregon and Washington, and Washington inland waters stock (Carretta et al. 2006) Harbor seals from the last two stocks occur within the project area. Both occur principally in the nearshore zone and are the most common marine mammal in Washington (NMFS 1992). Recent counts show 10,430 seals off the Washington coast and 5,735 in Oregon, totaling 16,165 harbor seals for the outer coast of Oregon and Washington stock; the minimum population is estimated at 22,380 (Carretta et al. 2006; Jeffries et al. 2003). The mean number of seals in the Washington inland waters stock was estimated to be 9,550 in 1999 with a minimum population size of 12,844 seals; more recent estimates are not available (Carretta et al. 2006) The combined PBR for the coastal (1,343) and inland stocks (771) is 2,114 harbor seals. The species occurs year-round in Washington. Harbor seals give birth on shore and nurse their pups for 4 to 5 weeks. After the pups are weaned, they disperse widely in search of food. Pupping along the outer coast of Washington and the Strait of Juan de Fuca occurs in May through July, and additionally in August in the strait. Breeding occurs in the water shortly after the pups are weaned. The Makah U&A contains at least

32 harbor seal haulout sites (Gearin and Scordino 1995). This area is subdivided for convenience into three areas (western Strait of Juan de Fuca complex, Cape Flattery Complex, and the Cape Alava Complex) with variable harbor seal densities within each complex. The western Strait of Juan de Fuca complex has the lowest density (number of seals per nautical mile); the Cape Alava area has the highest density and number of pups (Gearin and Scordino 1995; Jefferies et al. 2000). Common prey include sole, flounder, sculpin, hake, cod, herring, squid, octopus, and, to a lesser degree, salmon (Jeffries and Newby 1986; Orr et al. 2004). Before 2005, the Makah Tribal Council promulgated regulations allowing tribal members to exercise treaty rights for subsistence harvest of harbor seals. An estimated 5 to 15 seals may have been taken for subsistence per year by northwest tribes (Carretta et al. 2006).

California Sea Lion

The California sea lion includes three subspecies of which *Z. c. californianus* (found from southern Mexico to southwestern Canada) occurs in the project area. California sea lions breed on islands in three geographic regions that are used to separate this subspecies into three stocks: (1) the United States stock, which begins at the United States/Mexico border and extends northward into Canada; (2) the Western Baja California stock, which extends from the United States/Mexico border to the southern tip of the Baja California Peninsula; and (3) the Gulf of California stock, which includes the Gulf of California from the southern tip of the Baja California peninsula (Carretta et al. 2006). California sea lions occur seasonally in Washington waters (NMFS 1992). Based on extrapolations from pup counts, the population is estimated between 237,000 and 244,000 sea lions, and it is growing at 5.4 to 6.1 percent per year (Carretta et al. 2006). The minimum population estimate is 138,881 sea lions with a PBR of 8,333 per year (Carretta et al. 2006). Males migrate northward along the coast following the summer breeding season in California. Beginning in August, male California sea lions appear along the outer Washington coast principally in the nearshore and continental shelf zones. Some move into Puget Sound and British Columbia. California sea lions remain in Washington waters through the winter and early spring before returning to California in May and June (Gearin and Scordino 1995; Jeffries et al. 2000). The migration can be characterized as a feeding migration consisting primarily of adult and sub-adult males. California sea lion females and younger animals less than four to five years old tend to remain near the home rookeries throughout the year, or move only as far north as central California. California sea lions are common around Neah Bay during fall, winter, and spring. They are also common inside Neah Bay in April and May; a group of 5 to 10 sea lions feeds on fish scraps around the harbor, and groups of 50 to 100 animals reside on the

west end of Tatoosh Island. Within the project area, small numbers of California sea lions are often sighted in Makah Bay and to the south at Cape Alava where larger numbers haul out at west Bodelteh Island during migration (Gearin and Scordino 1995; Jeffries et al. 2000). As many as 4,000 to 5,000 California sea lions have been observed on the Bodelteh Islands during the fall. Farther south on Carroll Island, 200 to 300 sea lions may haul out during the migration peak. Little is known of their diet on the Washington coast, but in Puget Sound they feed primarily on Pacific whiting, Pacific herring, salmonids, dogfish sharks, and squid (Gearin and Scordino 1995). Before 2005, the Makah Tribe promulgated regulations allowing Tribe members to exercise treaty rights for subsistence harvest of sea lions. Up to two sea lions were taken for subsistence each year (Carretta et al. 2006).

Northern Elephant Seal

Northern elephant seals, estimated to number 101,000 animals, breed off Mexico and California during winter and move northward to feed from Baja California to northern Vancouver Island and far offshore of the Gulf of Alaska and Aleutian Islands (Nowak 2003; Carretta et al. 2006). Populations of northern elephant seals in the United States and Mexico all originally derived from a few tens or a few hundreds of individuals surviving in Mexico after they were nearly hunted to extinction. The California breeding population is now demographically isolated from the Baja California population and is considered a separate stock for management purposes (Carretta et al. 2006). Elephant seals occur off the Washington coast primarily during summer and early fall (Brueggeman et al. 1992) and were the second most common pinniped sighted during summer during ship surveys off the Washington coast from 1995 to 2002 (Calambokidis et al. 2004b). In contrast, all the elephant seals Brueggeman et al. (1992) observed from mid-fall through spring were off the Oregon coast. Most of the elephant seals they encountered were over the continental shelf and slope, at a mean distance of almost 40 miles from the coast. No haulout sites occur in Washington. Elephant seals prey on deepwater and bottom-dwelling organisms, including fish, squid, crab, and octopus (Nowak 2003).

Northern Fur Seal

The eastern Pacific stock of the northern fur seal is estimated to number 688,028 animals; the minimum population estimate is 676,540 with a PBR of 14,546. Based on significant declines in abundance during the 1960s and 1970s, the Pribilof Islands population was listed as depleted under the MMPA in 1984 because population levels had declined to levels lower than 50 percent of those observed in the 1950s (1.8 million animals; 53 FR 17888 18 May 1988) (Angliss and

Outlaw 2005). Causes of decline and current threats are uncertain but may include climate change, vessel and human presence, depletion of prey species, predation, and environmental contamination (NMFS 2007c).

Fur seals are a seasonal migrant off the Washington coast, and they do not breed or haul out (although individuals may infrequently be seen on land mixed with sea lions) in Washington (Angliss and Outlaw 2005). The closest rookeries are in the Bering Sea (Pribilof Islands and Bogoslof Island) and the Channel Islands (San Miguel Island) of California. During the July-August breeding season, most of the population is found on the Pribilof Islands. Females and juveniles of both sexes migrate south in fall into waters over the continental shelf and slope of the eastern North Pacific Ocean, while adult males generally stay in Alaska waters (Gentry 2002). The migration ranges as far south as 30 to 32 degrees north latitude off southern California and northern Baja, Mexico. Fur seals begin the return migration northward in mid-spring; by early summer, most have returned to their breeding islands (Gentry 2002; Nowak 2003).

In Washington, Brueggeman et al. (1992) reported that northern fur seals primarily inhabited the deep offshore waters, but they also used the continental shelf and slope waters. They were observed off the Washington coast year-round, but most individuals (more than 90 percent) were encountered from January through May. Sightings of northern fur seals in the Strait of Juan de Fuca or Puget Sound are rare, but they do occur occasionally (Gearin and Scordino 1995). They feed on walleye pollock, Pacific herring, capelin, squid, and small schooling fishes (Kajimura 1984). Pribilof Islands Aleut Natives take approximately 600 to 800 subadult male fur seals/year for subsistence use (Angliss and Outlaw 2005). Makah Tribe hunters took fur seals from canoes in the open ocean in the late 1800s and into the 1900s, but they do not currently hunt them, nor have they recently been taken incidental to the Makah set net fisheries (Swan 1883; Swan 1887; Sepez 2001; Pamplin 2005a).

Northern Sea Otter

Sea otters occurred historically along the outer coast of Washington; the population was severely over-hunted in the late mid-1700s to 1800s and extirpated in the Pacific Northwest by 1920 (NMFS 1992; Jameson 1995). The last known native sea otters in Washington were taken in Willapa Bay in 1910 (Scheffer 1940). In 1969 and 1970, 59 northern sea otters were transplanted to Washington from Amchitka Island, Alaska (Lance et al. 2004). Although the otters off Washington State are descended from the Amchitka Island sea otters and are, thus, related to the southwest Alaska distinct vertebrate population segment recently listed as threatened under ESA

(70 FR 46366, August 9, 2005), they are geographically isolated from the southwest Alaska population by hundreds of kilometers and are not included in the listing. Sea otters off the Washington coast have been listed as a Washington State endangered species since 1981, due to small population size, restricted distribution, and vulnerability (Lance et al. 2004).

The FWS has conducted cooperative sea otter surveys with WDFW since 1985. In 1985, 65 sea otters were counted, increasing to 276 sea otters in 1991, 814 sea otters in 2005, and 790 sea otters in 2006 (Jameson and Jeffries 2005; Jameson and Jeffries 2006). Laidre et al. (2002) estimated the carrying capacity of sea otters at 1,836 individuals (95 percent confidence interval from 1,386 to 2,286), based on an assumption that sea otters will reoccupy most of their historic habitat along the outer Washington coast (excluding reoccupation of the Columbia River, Willapa Bay, and Grays Harbor estuaries due to significant human alterations and use) and eastward into the Strait of Juan de Fuca as far as Protection Island. The FWS and WDFW uses these estimates in stock assessment reports and recovery plans.

The current sea otter population range extends as far south as Cape Elizabeth on the outer Olympic Peninsula Coast to as far north as Pillar Point, with concentrations near Duk Point, Cape Alava, Sand Point, Cape Johnson, Perkins Reef, and Destruction Island (Figure 3-2). More than half of the population occurs south of La Push, with the single largest concentration of otters located at Destruction Island (Jameson and Jefferies 2005). Sea otters occur nearshore throughout the project area and are being seen more consistently, in lower numbers, in the Strait of Juan de Fuca as far inland as Port Townsend. A large group of males moved into the Strait of Juan de Fuca during winter in the 1990s (Lance et al. 2004), but have not done so since 2000. Sea otters generally inhabit shallow coastal waters less than 1 mile from shore, but small numbers of sea otters have been found out to at least 3 miles from the Cape Alava area. In Washington, sea otters generally stay in relatively shallow waters and forage on a variety of marine invertebrates, including sea urchins, throughout the entire depth range from intertidal areas out to at least 20 fathoms (120 feet) (Lance et al. 2004). Sea otters pup in late winter and early spring, and the pups are weaned in late summer and early fall. Reproduction occurs throughout the area (Lance et al. 2004). Post-weaning mortality is higher for males than females and increases as resources become limited (Estes and Bodkin 2002). Low levels of mortality occur in adult females as a result of injury by males during copulation (Estes and Bodkin 2002). Sea otters are preyed upon by white sharks, killer whales, and, infrequently, Steller sea lions. Of the marine mammals within the project area, they (and northern fur seals) are most susceptible to mortality caused by oil spills due to the importance of their fur in regulating metabolism (Ballachey et al.

1994). The expanding sea otter population has had a substantial impact on the Makah Tribe's sea urchin fishery (Pamplin 2005a). Two sea otters were taken incidental to the Makah set net fisheries in 2004, and none were taken in 2005 (Pamplin 2005a).

Harbor Porpoise

Two harbor porpoises stocks are recognized within the project area, the Washington inland waters stock and the coastal Oregon/Washington stock. Extensive interchange is likely between the two stocks. The former is estimated at 3,509 animals with a minimum population estimate of 2,545 and a PBR of 20 porpoises per year (Carretta et al. 2006). The coastal Oregon/Washington stock is estimated to number 39,586 animals with a minimum population estimate of 28,967 and a PBR of 290 per year (Carretta et al. 2006). This stock is present year-round off the Washington coast, and those in the inland stock are present throughout most of the year in inland waters (Carretta et al. 2006). Numbers of harbor porpoises are particularly high in the fall and winter, low in the summer, and intermediate in the spring (Brueggeman et al. 1992; Carretta et al. 2006). They are widespread throughout the inland and coastal waters of Washington with the exception of southern Puget Sound (NMFS 1992). Scheffer and Slipp (1948) provide a historical account of this species in Washington.

Harbor porpoises are known to calve and breed in Washington, and they generally give birth in summer from May through July. Calves remain dependent for at least six months (Leatherwood et al. 1982). Harbor porpoise are usually shy and avoid vessels; thus, they are difficult to approach. The species frequents inshore areas, shallow bays, estuaries, and harbors. Harbor porpoises are found almost exclusively shoreward of the 100-fathom (600-foot) contour line along the Pacific coast, with the vast majority found inside the 25-fathom (150-foot) curve (Gearin and Scordino 1995; Green et al. 1992). The primary prey of harbor porpoise are small fish and squid typically found in shallow waters. Bottom-dwelling fishes and small pelagic schooling fishes with high lipid content, including herring and anchovy, are common prey (Bjorge and Tolley 2002; Leatherwood and Reeves 1986). Small numbers of harbor porpoise have recently been taken incidentally in Makah set net fisheries, including two individuals in 2004 and none in 2005 (Gearin et al. 2000; Carretta et al. 2006; Pamplin 2005a).

Dall's Porpoise

Dall's porpoises are common off the Washington coast, but their distribution and abundance are variable and likely linked to variable oceanographic conditions (Carretta et al. 2006). They are probably the most widely distributed cetacean in the temperate and subarctic regions of the North

Pacific and Bering Sea (Leatherwood et al. 1982). An estimated 99,517 Dall's porpoises occur in the California, Oregon, and Washington stock with a minimum population estimate of 75,915 and a PBR of 729 animals per year (Carretta et al. 2006). They were the most common small cetacean observed in ship surveys off the Washington coast from 1995 to 2002 with 115 sightings of 406 animals (Calambokidis et al. 2004b). Brueggeman et al. (1992) reported 152 groups containing 341 Dall's porpoise, including four calves, during surveys off the coast of Oregon and Washington. Porpoises were most common during fall, least common during winter, and intermediate in occurrence during spring and summer, although encounter rates were not substantially different among seasons, suggesting that a resident population occurs off the coast of Oregon and Washington. Encounter rates were highest over the continental slope, lowest on the continental shelf, and intermediate in offshore waters. They rarely occurred in shallow coastal waters. Dall's porpoises were observed in small groups, which are consistent with observations reported in other studies, although aggregations of at least 200 individuals have been reported. They occur only rarely in groups of mixed species, although they are sometimes seen in the company of harbor porpoises and gray whales (Klinowska 1991; Reeves and Leatherwood 1994). Dall's porpoises apparently feed at night. They depend, to some degree, on the deep scattering ocean layer, through which fauna travel upwards each night from the deeper parts of the ocean's water column. Prey species, as determined from stomach contents, include squid and schooling fishes (Jefferson 2002; Klinowska 1991; Reeves and Leatherwood 1994). Killer whales and sharks are believed to be the primary natural predators of Dall's porpoises.

Pacific White-Sided Dolphin

The Pacific white-sided dolphin numbers an estimated 59,274 animals in the California, Oregon, and Washington stock, and it is one of the most abundant dolphins occurring year around off the coast of Washington (Brueggeman et al. 1992; Green et al. 1993; Carretta et al. 2006). The estimated minimum population level is 39,822 with a PBR at 382 dolphins per year (Carretta et al. 2006). Calambokidis et al. (2004b) recorded 28 sightings of 1,133 individuals in offshore waters during ship surveys off the Washington coast from 1995 to 2002. Some seasonal shifts occur off the coast of Oregon and Washington where dolphins are more common in offshore waters during spring. Their distribution shifts to continental slope waters during summer and fall, in rough synchrony with the movements of prey (VanWaerebeek 2002). Pacific white-sided dolphins may also move north to south seasonally (Forney and Barlow 1998). Peak abundances off the Oregon and Washington coast have been reported during May (Brueggeman et al. 1992; Buckland et al. 1993). Pacific white-sided dolphins consume a wide variety of fishes and

cephalopods. Off the coast of British Columbia, herring was the most commonly occurring prey species, followed by salmon, cod, shrimp, and capelin (Heise 1997). Pacific white-sided dolphins have been known to occur in association with other marine mammals, including Dall's porpoise, Risso's dolphin, northern right whale dolphin, humpback whale, and gray whale (Brueggeman et al. 1992).

Risso's Dolphin

Risso's dolphins are distributed world-wide in warm-temperate and tropical waters along the continental shelf and slope edge. They are estimated to number 16,066 animals in the California, Oregon, and Washington area with a minimum population level of 12,748 and a PBR of 115 per year (Carretta et al. 2006). Risso's dolphins are common off the coast of Washington, where they are present year-round (Brueggeman et al. 1992). Nine sightings of 79 individuals were reported off the Washington coast during ship surveys from 1995 to 2002 (Calambokidis et al. 2004b). They are most common during spring and summer, least common in winter, and intermediate in occurrence during the fall (Brueggeman et al. 1992). Calves have been observed off the coast of Oregon and Washington during May, July, and November. Risso's dolphins primarily inhabit continental slope waters, but they also occur in lower numbers near the edge of the continental shelf. Risso's dolphins are consistently found on the continental slope and in shelf-edge waters throughout the year, suggesting there is no inshore to offshore movement pattern. However, there may be some seasonal north to south movement of Risso's dolphins between Oregon/Washington and California, based on the shifts in abundance between the two regions, possibly related to prey movements. Principal prey include cephalopods and fish, and limited behavioral research suggests that they feed primarily at night (Baird 2002; Nowak 2003). Risso's dolphins have been known to occur in association with other marine mammals, including Pacific white-sided and northern right whale dolphins (Brueggeman et al. 1992). No habitat issues are known to be of concern for this species, and human-caused mortality from commercial fishing and other sources is low (Carretta et al. 2006).

Northern Right Whale Dolphin

The California, Oregon, and Washington stock of the northern right whale dolphin is estimated at 20,362 animals with a minimum population estimate of 16,417 and a PBR of 164 dolphins per year (Carretta et al. 2006). The species is relatively common off the coast of Washington, which is toward the northern end of its range in the eastern North Pacific Ocean (Brueggeman et al. 1992). The northern right whale dolphin has been reported in Washington waters during all seasons except

winter (Calambokidis et al. 2004b; Brueggeman et al. 1992). Numbers are highest in the fall and lowest during spring and summer. Use of the continental slope waters is considerably higher than the offshore water. Few dolphins occur in continental shelf waters. While northern right whale dolphins show a seasonal abundance pattern off the Washington coast that is somewhat opposite of the California pattern, it is not clear whether they move between the two areas. They are gregarious animals, often traveling in groups of 2,000 to 3,000 animals. The primary prey for this species include lanternfish, Pacific whiting, saury, mesopelagic fish, and squid (Lipsky 2002). The northern right whale dolphin has been frequently reported in association with Pacific white-sided dolphins (Leatherwood and Walker 1979; Brueggeman et al. 1992).

Minke Whale

There is no population estimate for minke whales in the North Pacific Ocean. The number off the coast of California, Oregon, and Washington is, however, estimated to be 1,015 whales based on vessel surveys between 1996 and 2001, with a minimum population size of 585 whales and a PBR of 5.8 whales per year (Carretta et al. 2006). Minke whales reside off the Washington coast year-round (Carretta et al. 2006). They typically occur as single animals, rather than in groups. Calambokidis et al. (2004b) reported four sighting of four individuals during ship surveys off the Washington coast from 1995 to 2002. Brueggeman et al. (1992) encountered four single minke whales, including three off the Oregon coast and one off the Washington coast. Most were on the continental shelf. Minke whales are also known to enter shallow bays and estuaries (Nowak 2003). Green et al. (1993) reported 10 groups of 12 minke whales off the Oregon and Washington coasts between March and May, but did not give their locations or indicate the distributions between the two states. Minke whales in the North Pacific typically prey on euphausiids, Japanese anchovy, Pacific saury, walleye pollock, small fish, and squid (Perrin and Brownell 2002; Nowak 2003).

3.5.3.1.3 Uncommon Marine Mammal Species off Washington Coast

Nine other uncommon marine mammals are occasionally sighted off the Washington coast. They include common dolphin, striped dolphin, false killer whale, pilot whale, pygmy sperm whale, Baird's beaked whale, Curvier beaked whale, Hubb's beaked whale, and Stejneger's beaked whale (Table 3-11). Most of these species would be expected to occur seasonally in low numbers in deeper offshore waters. Brueggeman et al. (1992) observed a small number of false killer whales in the spring and beaked whales in the fall off the Washington coast. Five groups of 21 Baird's beaked whales were also observed, but all were off the Oregon coast during spring and

summer, suggesting low occurrence by this species in Washington waters. While there is some limited information on this group of uncommon marine mammals, little is known about their use of waters off the Washington coast. Summary information for each species can be found in Carretta et al. (2004), Angliss and Outlaw (2005), and Perrin et al. (2002).

3.5.3.2 Other Marine Wildlife

In addition to several species that are listed as threatened or endangered under ESA, the project area provides breeding and wintering habitat for numerous species of seabirds. The following sections provide descriptions of ESA-listed species and other seabird species. The latter discussion is organized by the habitat types with which the species are associated.

3.5.3.2.1 ESA-Listed Species

FWS (2004) identified the following ESA-listed marine wildlife species as occurring in the project area: brown pelican, bald eagle, and marbled murrelet. The agency also indicated that short-tailed albatross, leatherback sea turtles, green sea turtles, loggerhead sea turtles, and olive ridley sea turtles could occur in the area. Each of these species is described further below.

Brown Pelican

Brown pelicans are federally listed as endangered under ESA (35 FR 8491, June 2, 1970). In the project area, brown pelicans occur as non-breeding individuals, where they are present from June to October (Seattle Audubon Society 2005). They forage in marine waters, particularly in shallow areas, including bays and estuaries, and near offshore islands, spits, breakwaters, and open sand beaches. The birds rarely forage more than 40 miles from shore (FWS 2005b). Their diet consists of schooling anchovies, herring, Pacific mackerel, minnow, and sardines (Monterey Bay Aquarium 2003). Brown pelicans roost on offshore islands in the project area (Seattle Audubon Society 2005).

Marbled Murrelet

The marbled murrelet is federally listed as threatened under the ESA (57 FR 45328, October 1, 1992). This species nests in mature and old-growth forests and forages in marine waters. Nearshore marine waters within 1.2 miles are considered essential to the recovery of the species (FWS 1997). Newer information indicates murrelets occur out to 5 miles from shore with the highest mean densities closer to shore (Raphael et al. 2007). Critical marine foraging habitat includes “proximity of old-growth forests, distribution of rocky shoreline/substrate versus sand shoreline/substrate, and abundance of kelp” (Thompson 1996, as cited in FWS 1997). Key prey species include Pacific sand lance, Pacific herring, northern anchovy, smelt, and possibly sardines, although the birds will forage on a variety of other small fish and macrozooplankton.

In the project area, marbled murrelets occur throughout the year in the nearshore marine waters and bays, and must select areas which provide adequate prey resources within swimming distance for about two months during the flightless molting period (July to December)(Carter and Stein 1995). As indicated in a study by Thompson (1999), marbled murrelets are more abundant closer to shore. In Thompson's study (1996, as cited in FWS 1997), murrelet density declined with increasing distance from the coastline. Survey data collected under the auspices of the Northwest Forest Plan effectiveness monitoring indicate that murrelet densities in the project area begin to decline 1.9 miles from shore (Lynch 2006 pers. comm.) and Huff et al. (2006) reported that only a small proportion of the population (generally less than 5 percent) is found beyond 1.86 miles from shore. The density of marbled murrelets is known to be higher in the Strait of Juan de Fuca (Huff et al. 2006). Survey results also indicated that marbled murrelet density from 2000 to 2004 in the project area vicinity (specifically along the outer Washington Coast from Cape Flattery to Point Grenville) ranged from 0.4 birds per square mile (in 2000) to 0.9 birds per square mile (in 2004) (Lance and Pearson 2005).

Short-tailed Albatross

The short-tailed albatross, which is federally listed as endangered under ESA, is an extremely rare bird off Washington's coastline (65 FR 46643, July 31, 2001). According to the Seattle Audubon Society's BirdWeb, there were only a few valid records of the short-tailed albatross on the west coast south of Alaska between 1940 and 1990, with most seen between April and August (Seattle Audubon Society 2005). Since the early 1990s, sightings have increased, and a few birds are reported off the west coast annually. Sightings of these pelagic birds are generally more than 20 miles from the coastline. Short-tailed albatross feed primarily on squid (Seattle Audubon Society 2005).

Sea Turtles

Four species of sea turtles occur off Washington's outer coast: the leatherback turtle, green turtle, loggerhead turtle, and olive ridley turtle. Leatherback sea turtles are federally listed as endangered under ESA, while the three other sea turtles are federally listed as threatened in the Washington area (35 FR 8491, June 2, 1970; 43 FR 32800, July 28, 1978). Leatherback sea turtles are associated with pelagic habitats and occur with some regularity in the deep waters off the coast of Washington (Bowlby et al. 1994). In addition, these turtles occasionally have been sighted in bays and estuaries, although bays and estuaries are not their preferred habitat (Brown et al. 1995). Leatherback sea turtles' diet consists almost exclusively of jellyfish (Sea Turtle, Inc. 2005). The species does not nest in Washington State.

The other three sea turtle species (green, loggerhead, and olive ridley) are strictly warmer water species, and they occur infrequently off the coast of Washington during the summer (Brown et al. 1995). Higher occurrences of the sea turtles coincide with El Niño years that are characterized by warmer currents in the area. Diet of the three species varies. The green sea turtle is mostly herbivorous and feeds on a variety of sea grasses and marine algae; the loggerhead is primarily carnivorous and feeds on a variety of crabs, jellyfish, shellfish, and sponges; and the olive ridley is omnivorous and feeds primarily on crustaceans, mollusks, and tunicates (Sea Turtle, Inc. 2005). None of these sea turtles nests in Washington State.

3.5.3.2.2 Non-Listed Birds and Their Associated Habitats

The project area provides important habitat for bald eagles and some of the largest seabird colonies in the continental United States. The area also provides wintering and other non-breeding habitat for marine birds. Considering all seasonal uses, more than 100 marine bird species use the marine waters, associated beaches, and offshore islands within the project area, with 20 of these species known to nest in the project area (Table 3-12).

The bald eagle was removed from the ESA list of threatened species on July 9, 2007 (72 FR 37346). These birds are present in Washington State year-round, although individual birds may be present for only a portion of the year (e.g., the wintering period). Bald eagles nest in large, superdominant trees, generally away from intense human activity, and they forage in nearby waters with abundant fish, waterfowl, and seabird prey (Stinson et al. 2001). Perch sites generally consist of large trees along shorelines. Roost sites are typically large trees within forested stands that are located within 0.67 mile of foraging areas (Stinson et al. 2001).

Bald eagle nest sites occur throughout the proposed action area coastline. Most of the Washington State bald eagle wintering population occurs along major salmon rivers (e.g., Skagit, Nooksack, and Columbia Rivers), but the birds also winter along the state's outer coastline and along the Strait of Juan de Fuca, including portions of the project area (Stinson et al. 2001).

The marine environments used by marine birds in the project area can be divided into six habitat types: (1) coastal beaches, bays, and estuaries; (2) coastal headlands and islands; (3) nearshore marine waters; (4) inland marine deeper waters; (5) marine shelf; and (6) oceanic waters. Habitat types for marine birds are based on Buchanan et al. (2001), but were modified slightly for consistency with marine fish habitat types (NMFS 2005a) and marine mammal habitats. This section describes these habitats and their associated bird species.

TABLE 3-12. MARINE BIRD SPECIES PRESENT IN THE MAKAH U&A

Common Name	*Scientific Name*
LOONS AND GREBES	***GAVIIDAE AND PODICIPEDIDAE***
Common loon	*Gavia immer*
Pacific loon	*Gavia pacifica*
Red-throated loon	*Gavia stellata*
Yellow-billed loon	*Gavia adamsii*
Horned grebe	*Podiceps auritus*
Red-necked grebe	*Podiceps grisegena*
Western grebe	*Aechmophorus occidentalis*
Eared grebe	*Podiceps nigricollis*
TUBENOSES	***PROCELLARIIFORMES (DIOMEDEIDAE, PROCELLARIIDAE AND HYDROBATIDAE)***
Black-footed albatross	*Diomedea nigripes*
Short-tailed albatross	*Phoebastria albatrus*
Laysan albatross	*Diomedea immutabilis*
Buller's shearwater	*Puffinus bulleri*
Flesh-footed shearwater	*Puffinus carneipes*
Pink-footed shearwater	*Puffinus creatopus*
Short-tailed shearwater	*Puffinus tenuirostris*
Sooty shearwater	*Puffinus griseus*
Northern fulmar	*Fulmaris glacialis*
Fork-tailed storm petrel*	*Oceanodroma furcata*
Leach's storm petrel*	*Oceanodroma leuchorhoa*
PELICANS AND CORMORANTS	***PELECANIDAE AND PHALOCROCORACIDAE***
Brown pelican	*Pelecanus occidentalis*
Brandt's cormorant*	*Phalacrocorax penicillatus*
Double-crested cormorant*	*Phalacrocorax auritis*
Pelagic cormorant*	*Phalacrocorax pelagicus*
SWANS, GEESE, AND DUCKS	***ANATIDAE***
Trumpeter swan	*Cygnus buccinator*
Tundra swan	*Cygnus columbianus*

Common Name	*Scientific Name*
Aleutian Canada goose	*Branta canadensis leucopareia*
Brant	*Branta bernicla*
Black scoter	*Melanitta nigra*
Surf scoter	*Melanitta perspicillata*
White-winged scoter	*Melanitta fusca*
Harlequin duck	*Histrionicus histrionicus*
Oldsquaw	*Clangula hyemalis*
Bufflehead	*Bucephala albeola*
Common goldeneye	*Bucephala clangula*
Barrow's goldeneye	*Bucephala islandica*
Greater scaup	*Aythya marila*
Lesser scaup	*Aythya affinis*
Canvasback	*Aythya valisineria*
Red-breasted merganser	*Mergus serrator*
Common merganser	*Mergus merganser*
Hooded merganser	*Lophodytes cucullatus*
Gadwall	*Anas strepera*
Eurasian widgeon	*Anas penelope*
American widgeon	*Anas americana*
Mallard	*Anas platyrhynchos*
Green-winged teal	*Anas crecca*
Blue-winged teal	*Anas discors*
Northern shoveler	*Anas clypeata*
Northern pintail	*Anas acuta*
Ruddy duck	*Oxyura jamaicensis*
RAILS, GALLINULES, AND COOTS	***RALLIDAE***
American coot	*Fulica americana*
EAGLES, OSPREYS AND FALCONS	***FALCONIFORMES***
Bald eagle*	*Haliaeetus leucocephalus*
Osprey*	*Pandion haliaetus*
Peregrine falcon*	*Falco peregrinus*

Common Name	*Scientific Name*
OYSTERCATCHERS	***HAEMATOPODIDAE***
Black oystercatcher*	*Haematopus bachmani*
PLOVERS	***CHARADRIIDAE***
Killdeer*	*Charadrius vociferous*
Semipalmated plover	*Charadruis semipalmatus*
American golden plover	*Pluvialis dominicus*
Black-bellied plover	*Pluvialis squatarola*
SANDPIPERS, TURNSTONES, SURFBIRDS, AND PHALAROPES	***SCOLAPACIDAE***
Black turnstone	*Arenaria melanocephala*
Ruddy turnstone	*Arenaria interpres*
Surfbird	*Aphriza virgata*
Marbled godwit	*Limosa fedoa*
Greater yellowlegs	*Tringa melanoleuca*
Lesser yellowlegs	*Tringa flavipes*
Spotted sandpiper*	*Actitis macularia*
Whimbrel	*Numenius phaeopus*
Wandering tattler	*Heteroscelus incanus*
Long-billed dowitcher	*Limnodromus scolopaceus*
Short-billed dowitcher	*Limnodromus griseus*
Rock sandpiper	*Calidris ptilocnemis*
Baird's sandpiper	*Calidris bairdii*
Dunlin	*Calidris alpina*
Least sandpiper	*Calidris minutilla*
Sanderling	*Calidris alba*
Western sandpiper	*Calidris mauri*
Red phalarope	*Phalaropus fulicaria*
Red-necked phalarope	*Phalaropus lobatus*
Northern phalarope	*Lobipes lobatus*
JAEGERS AND SKUAS	***STERCORARIINAE***
Long-tailed jaeger	*Stercorarius longicaudus*

Common Name	*Scientific Name*
Parasitic jaeger	*Stercorarius parasiticus*
Pomarine jaeger	*Stercorarius pomarinus*
South polar skua	*Catharacta mccormicki*
GULLS AND TERNS	***LARIDAE***
Bonaparte's gull	*Larus philadelphia*
California gull	*Larus californicus*
Glaucous-winged gull*	*Larus glaucescens*
Heerman's gull	*Larus heermanni*
Herring gull	*Larus argentatus*
Mew gull	*Larus brachyrhynchos*
Ring-billed gull	*Larus delawarensis*
Sabine's gull	*Xema sabini*
Thayer's gull	*Larus thayeri*
Western gull*	*Larus occidentalis*
Black-legged kittiwake	*Rissa tridactyla*
Caspian tern	*Sterna caspia*
Common tern	*Sterna hirundo*
Forster's tern	*Sterna forsteri*
Arctic tern	*Sterna paradisaea*
ALCIDS	***ALCIDAE***
Ancient murrelet	*Synthliboramphus antiquum*
Cassin's auklet*	*Ptychoramphus aleutica*
Common murre*	*Uria aalge*
Marbled murrelet	*Brachyramphus marmoratus*
Pigeon guillemot*	*Cepphus columbia*
Rhinoceros auklet*	*Cerorhinca monocerata*
Tufted puffin*	*Lunda cirrhata*
KINGFISHERS AND HERONS	***ALCEDINIDAE AND ARDEIDAE***
Belted kingfisher*	*Ceryle alcyon*
Great blue heron*	*Ardea herodias*
Green heron	*Butorides striatus*

Common Name	*Scientific Name*
American bittern	*Botaurus lentiginosus*

Sources: Speich and Wahl 1989; Peterson 1990; Buchanan et al. 2001; FWS 2005c.

* = species known to nest in the area.

Coastal Beaches, Bays, and Estuaries

The project area includes several beaches, bays, and estuaries (Figure 3-2). Bays and estuaries provide concentrations of nutrients and forage for marine birds and shorebirds such as loons, grebes, mergansers, scoters, dunlins, plovers, and sandpipers. Beaches, particularly those with fine-grained sand, provide forage areas for several shorebird species, including sanderlings, dunlins, and killdeer. Human-made structures, such as jetties, pilings, and buoys, provide important roosting habitat for cormorants, gulls, and other birds. Approximately 49 marine bird species in Washington State are closely associated with beaches, bays, and estuaries; 37 marine bird species are generally associated; and another 16 marine bird species occasionally use beaches, bays, and estuaries (Table 3-13). Bird densities along the beaches and in the bays and estuaries are particularly high during spring and fall migration during winter.

TABLE 3-13. MARINE BIRD SPECIES RICHNESS IN MARINE HABITATS BASED ON HABITAT ASSOCIATION

	HABITAT USE (RECORDED AS NUMBER OF SPECIES)			
HABITAT TYPE	CLOSELY ASSOCIATED[1]	GENERALLY ASSOCIATED[2]	OCCASIONAL USE[3]	TOTAL
Beaches, bays, and estuaries	49	37	16	102
Headlands and islands	22	14	2	38
Nearshore marine	31	26	10	67
Inland marine	21	17	9	47
Marine shelf	28	15	9	52
Oceanic	18	7	3	28

[1] Closely associated: A species is widely known to depend on a habitat for part or all of its life-history requirements.

[2] Generally associated: A species exhibits a high degree of adaptability and may be supported by a number of habitats. These habitats play a supportive role for the species' maintenance and viability.

[3] Occasional use: A species demonstrates occasional use of a habitat. The habitat provides marginal support to the species for its maintenance and viability.

Source: Table adapted and modified from Buchanan et al. (2001). Because some species are associated with more than one habitat type, totals within columns are not additive.

Coastal Headlands and Islands

This habitat type includes coastal headlands and bluffs, rocky cliffs, and offshore rocks and islands. In the project area, steep headlands, bluffs, and cliffs are used by ledge-nesting birds,

including peregrine falcons, pelagic cormorants, and common murres. Offshore islands and rocks support large breeding colonies of seabirds (Speich and Wahl 1989; Buchanan et al. 2001; FWS 2005c).

Comprehensive information on seabird colony breeding densities in Washington is available from Speich and Wahl (1989). These researchers summarized seabird colony data from surveys conducted from 1978 to 1982. In the Cape Flattery survey region, which extends along the outer Washington coast from Cape Flattery to Carroll Island and inland along the Strait of Juan de Fuca to Sail Rock, surveyors documented 13 breeding seabird species, the most common of which were Cassin's auklets, Leach's storm-petrels, and tufted puffins (Table 3-14). Sites with the highest recorded abundance of seabird colonies (all species combined) in this region include Carroll Island (18,876 breeding seabirds), Bodelteh Island (11,618 breeding seabirds), and the Tatoosh Islands (3,528 breeding seabirds). In addition to the survey sites from the Cape Flattery survey region, the Speich and Wahl report includes data from Jagged Island, near the southern boundary of the Makah U&A. The surveyors recorded 37,057 breeding seabirds on Jagged Island, including 20,000 Leach's storm-petrels, 7,800 tufted puffins, and 8,000 Cassin's auklets (Speich and Wahl 1989).

TABLE 3-14. BREEDING SEABIRD SPECIES AND ABUNDANCE IN THE VICINITY OF CAPE FLATTERY

SPECIES	APPROXIMATE NUMBER OF BREEDING BIRDS
Cassin's auklet	24,000
Leach's storm-petrel	11,000
Tufted puffin	8,700
Glaucous-winged or western gulls	4,400
Fork-tailed storm-petrel	3,700
Common murre	900
Pelagic cormorant	900
Rhinoceros auklet	200
Double-crested cormorant	150
Pigeon guillemot	150
American black oystercatcher	60
Brandt's cormorant	10

Source: Speich and Wahl (1989)

A variety of shorebirds (such as plovers, oystercatchers, sanderlings, and sandpipers) uses offshore rocks and islands and their associated tidal areas for foraging and roosting. The larger islands (including Ozette Island and the Bodelteh Islands) are used by several raptors (such as peregrine falcons) for foraging and occasionally nesting. Passerines (such as swallows and

sparrows) use these islands for nesting, foraging, and migration resting areas (FWS 1985). Nesting great blue herons have also been documented on the larger islands (FWS 1985). The island vicinities are also used by migrating and wintering marine birds (such as gulls, loons, grebes, and scoters). Buchanan et al. (2001) indicate that 22 marine bird species in Washington are closely associated with headlands and offshore islands (Table 3-13).

Nearshore Marine Zone

The nearshore marine habitat zone includes those marine waters along shorelines that are not significantly affected by freshwater inputs (i.e., excludes bays and estuaries) (Buchanan et al. 2001). Nearshore marine habitat includes both nearshore marine waters and inland marine deeper waters. Nearshore marine waters extend from the high tide line to a depth of approximately 66 feet (Buchanan et al. 2001). Typical birds that forage in nearshore marine waters include common murres, sooty shearwaters, western grebes, Brandt's cormorants, and rhinoceros auklets. Species richness and bird densities are greatest in winter, although common murres, rhinoceros auklets, and sooty shearwaters may concentrate in large numbers during the summer (Buchanan et al. 2001). A variety of common marine birds (e.g., phalaropes, other shorebirds, and waterfowl) also uses nearshore marine habitats as migration corridors (Buchanan et al. 2001). Buchanan et al. (2001) indicate that 31 bird species in Washington are closely associated with nearshore marine waters (Table 3-13).

Within the project area, inland marine deeper waters include waters ranging from 66 feet deep within the western portion of the Strait of Juan de Fuca up to 120 feet deep. Species richness is relatively low in this area, with richness and bird densities higher in winter than summer (Table 3-13) (Buchanan et al. 2001). Common wintering birds in the area include western grebes, common murres, scoters, phalaropes, mergansers, buffleheads, and goldeneyes (Buchanan et al. 2001; Nysewander et al. 2004). Murres are also common in summer, along with cormorants and auklets.

Continental Shelf

Along the outer coast of Washington, the continental shelf habitat includes those marine waters from approximately 120 to 600 feet deep (Buchanan et al. 2001; as modified by NMFS 2005a). As with the nearshore marine habitat, the continental shelf provides foraging habitat and a migration route for a variety of marine birds. In Washington, 28 birds are highly associated with continental shelf habitat (Table 3-13). Typical birds that forage in the shallower portions of the continental shelf are common murres, rhinoceros auklets, tufted puffins, and sooty shearwaters. Typical birds in the outer, deeper portions of the continental shelf include albatrosses, fulmars,

storm-petrels, and shearwaters (in addition to the sooty shearwater). Species use varies by season, with the most species during winter and the fewest species during summer (Buchanan et al. 2001). Bird densities are greatest in summer and early fall, when both summer residents and migrant phalaropes, jaegers, terns, and alcids are present (Buchanan et al. 2001).

Continental Slope

Oceanic waters include the marine slope (waters from 600 to 4,200 feet deep) and offshore areas (waters greater than 1.25 miles deep) (Buchanan et al. 2001; as modified by NMFS 2005a). Species richness and bird densities in oceanic waters are diminished compared to the other marine habitats, presumably due to the lower abundance of food in oceanic waters (Table 3-13; Buchanan et al. 2001). As with the continental shelf, bird densities in oceanic waters are greatest in late summer to early fall, when both summer residents and fall migrants are present. Characteristic bird species of the continental shelf include the black-footed albatross, fork-tailed storm-petrel, northern fulmar, herring gull, and black-legged kittiwake.

3.5.3.3 Sensitivity of Wildlife to Noise and Other Disturbance

This section describes the sensitivity of marine wildlife species to noise and other disturbance. Anthropogenic noise can be either transient or continuous and can result in a variety of effects with consequences ranging from none to severe (Würsig and Richardson 2002). Examples of transient noise include helicopters, planes, and explosions; examples of continuous noise include ships underway and dredging activities. The discussion that follows focuses on wildlife sensitivity to noise potentially generated from activities associated with a Makah whale hunt, including aircraft overflights, boat traffic, and use of gunfire or explosives. See Section 3.11, Noise, for a discussion of key concepts related to noise, as well as existing noise levels in the project area.

Marine mammals may respond to noise and other disturbance in many ways, including changes in behavior, avoidance reactions, masking, hearing impairment, and nonauditory physiological effects and stress (Würsiig and Richardson 2002). For marine mammals that rely on sound for communication, finding prey, avoiding predators, and probably navigation, perturbations involving noise could have negative impacts on fitness or survival.

Effects of disturbance on marine birds can range from temporary minor behavioral changes, such as indicating an alert response, to nest abandonment. Bird responses depend on a variety of factors as described further in the sections below (Carney and Sydeman 1999; PRBO 2005). Colonial nesting birds are particularly vulnerable to disturbance due to their high nesting densities

and group behavior; when one bird responds to a given disturbance (e.g., flushing from its nest), other birds often follow (Rodgers and Smith 1995).

3.5.3.3.1 Aircraft Overflights

Based on a review of studies of response of species found in west coast National Marine Sanctuaries, Moore (1997) concluded that aircraft overflights "can and do disturb wildlife." Disturbance varies by species and the specifics of the situation, however. Reactions among some bird species may range from increased vigilance and attentiveness (including scanning by head-turning) to flushing from a nest or perch (Brown 1990; Stalmaster and Kaiser 1997; Giese and Riddle 1999; Ward et al. 1999). In similar circumstances, other species may not react at all (Parrish et al. 2005). In their review of overflight and wildlife disturbance, the National Park Service (1995) indicated mixed results, with some species exhibiting response to overflights, but other species showing minimal or no response. At least one study (peregrine falcons) indicated no apparent change in parental behavior from low (less than 500 feet) military overflights, while another study (waterfowl) found minimal disturbance caused by military overflights (Parrish et al. 2005). With increasing numbers of overflights, some wildlife may habituate to aircraft noise (e.g., black ducks), whereas other species do not (e.g. wood ducks, black brant, emperor, and Canada geese) (Conomy et al. 1998; Ward and Stein 1989).

In general, conclusions based on responses of one species are not necessarily applicable to another species (Manci et al. 1988); similarly, responses to one aircraft type may differ from responses to other types, even within a single species (National Park Service 1995; Ward et al. 1999). In a field study using playback of recordings of overflights to measure effects on seabirds, Brown (1990) found that the level of response increases with increasing noise. This is notable because not all aircraft produce the same amount of noise; thus, a quieter closer aircraft may cause less disturbance than a noisier aircraft farther away (Parrish et al. 2005). In a study of nesting osprey, Trimper et al. (1998) found that adult osprey did not appear to be disturbed by military overflights at various distances, approximately 2 miles from the nest, but reacted strongly to float planes approaching within 4.8 miles. Parrish et al. (2005) noted that helicopters typically cause more disturbance than other aircraft types.

Based on observations of marine birds and aircraft overflights at Tatoosh Island, Parrish et al. (2005) drew the following general conclusions:

1. Aircraft type has a substantial effect on disturbance level, independent of altitude, with louder aircraft having a greater effect.

2. Immediate geomorphology has an effect on disturbance level, as concave surfaces (bowls) concentrate sound whereas convex surfaces dispel sound.
3. The timing of the disturbance event within the breeding season has an effect on disturbance level; earlier in the season (before egg laying), birds are more likely to exhibit signs of disturbance (culminating in temporary evacuation of nesting or loafing sites), whereas later in the season (when pairs have eggs or chicks), birds may remain on nests even during elevated levels of disturbance.
4. Not all species respond equally. Disturbance varies by species and the specifics of the situation such that even related species differ in their responses. Disturbance may also not occur or be minimal. The lateral distance of the aircraft also strongly affects whether wildlife are disturbed. The correlation between distance and increased disturbance may result from increasing noise levels. The sudden appearance of aircraft, especially in the case of infrequent overflights, may also disturb wildlife.
5. Based on observed disturbance caused by overflights, several authors conclude that aircraft altitude restrictions should be developed or maintained, with recommendations for the distance aircraft should stay from wildlife ranging from 500 to 5,000 feet, depending on the species under consideration (Giese and Riddle 1999; Grubb and Bowerman 1997; Stalmaster and Kaiser 1997).
6. For any particular aircraft type, flying at lower altitudes generally increases the level of disturbance.

Few studies have documented the response of marine mammals to overflights (Parrish et al. 2005). Studies measuring the response of marine animals to noise were summarized by Myrberg (1990), who noted numerous reports of marine mammal disturbance caused by man-made sources, including offshore oil drilling and shipping. In a study of bowhead and beluga whales, Patenaude et al. (2002) found that helicopters cause more disturbance than other types of aircraft. Insley (1993) used sound recordings, sound pressure measurements, and video recordings to study the effect of aircraft overflights on northern fur seal behavior at St. George Island, Alaska. He found that if pilots followed the prescribed flight path and altitude and did not pass over the seal rookeries there was no discernable impact on the seals.

Response to aircraft may also depend on overflight frequency. With increasing numbers of overflights, some wildlife may habituate to aircraft noise, whereas other species will not

(Conomy et al. 1998). Conversely, sensitization may also occur. For example, the response of harbor seals increased with greater overflight occurrence (Johnson 1977 in Moore 1997).

Some specific study results relevant to the Makah proposal are as follows:

1. In a review paper of marbled murrelets, Nelson (1997) stated that aircraft flying at low altitudes are known to cause marbled murrelets to dive, although the specific altitude was not mentioned.

2. Pilots are asked to stay more than 2,000 feet above ground level when flying over the OCNMS and to follow Federal Aviation Administration guidelines as indicated on navigational charts. These charts advise pilots that overflights below this altitude may disturb wildlife, resulting in a violation of federal law (Parrish et al. 2005).

3. Several studies have documented effects of aircraft on foraging and nesting eagles. In a study of nesting eagles in Michigan, average eagle flushing distance was approximately 0.5 mile for jets, 0.75 mile for light planes, and 0.4 mile for helicopters (Grubb et al. 1992). In a study on the effects of helicopters on nesting eagles in northwestern Washington, Watson (1993) reported that 53 percent of nesting eagles were disturbed (i.e., alert and flush behavior) when helicopters approached within 1,500 feet of eagle nests. In a study of wintering bald eagle response to military activities at Fort Lewis, Washington, investigators reported that most eagles flushed when helicopters approached within 1,000 feet (Stalmaster and Kaiser 1997). In their Draft National Bald Eagle Management Guidelines (2006), FWS recommends that aircraft maintain a distance of at least 1,000 feet from eagle nests during the nesting season, except where eagles have demonstrated tolerance for such activity.

4. In a study of the effects of low-level jet aircraft overflights along the Naskaupi River, Labrador, Canada, nesting osprey behavior did not differ significantly between pre- and post-overflight periods, and adult osprey did not appear agitated or startled when overflown by jet aircraft (at overflights as low as 100 feet aboveground) (Trimper et al 1998). Osprey were attentive to and occasionally flushed from nests when float planes entered their territories.

5. At a mixed cliff-nesting colony of fulmars, shags, herring gulls, kittiwakes, guillemots, razorbills, and puffins on the Aberdeenshire coast of Scotland, aircraft flying at heights

about 300 feet above the cliff-top did not affect the attendance of incubating and brooding birds (Dunnet 1977).

3.5.3.3.2 Boat Traffic

A study on the Pribilof Islands in summer 1990 measured the effect of direct noise (airplanes, land vehicles, ships, and construction activities) on northern fur seal behavior at rookeries on St. Paul Island (Insley 1992). Noise levels were measured on land near the rookeries as ships moved toward and away from the island during all hours of the day. Ship noise at the rookeries averaged approximately 82 dB in a frequency range between 60 and 300 hertz (Hz). No effect from ship noise was observed in fur seal behavior during this study. In contrast, Insley et al. (2003) found that fur seals foraging at sea changed their direction of movement when commercial trawl vessels were nearby. As summarized by Würsig and Richardson (2002) the strongest components of sound from many of the major anthropogenic sources are below 1,000 Hz; the sounds from outboard motors operating at high speed ranges.

Marine birds can also be sensitive to disturbance from boat traffic. Bird responses to boat traffic range from changing body position to abandoning a foraging attempt to flushing from a nest (Burger 1998; Carey and Sydeman 1999; PRBO 2005). Responses of birds depend on a variety of factors, including the time of year; type, speed, and distance of boats from the birds; frequency of disturbance; bird species; and bird activity (foraging, roosting, or nesting) (Burger 1998; Ronconi and St. Clair 2002; Rodgers and Schwikert 2002). In general, mobile birds (e.g., foraging birds) move away from areas with high boat traffic, while nesting birds show behavioral, growth, or reproductive effects, with varying degrees of habituation (Kuletz 1996; Burger 1998).

Some specific study results relevant to the Makah proposal are as follows:

1. Of the hundreds of murrelets that researchers encountered with their skiff each day in Alaska's Auke Bay and Fritz Cove, most of the birds reacted to the skiff by paddling away; only a few of the birds reacted by flying away (Speckman et al. 2004). However, on eight separate occasions, murrelets that were holding fish crosswise in their bills swallowed the fish on approach of the skiff, generally when the skiff was within 15 to 130 feet of the bird. The birds holding fish were presumed to be parents about to make food deliveries to their chicks (as consistent with other alcids). Consequently, skiff disturbance represented a loss in food for the chicks. The researchers concluded that such disturbance could be detrimental to murrelets in areas where prey are relatively scarce,

where birds' inland nests are far from marine foraging areas, or where boat traffic is concentrated in waters immediately adjacent to nesting areas.

2. Observers conducting boat surveys for marbled murrelets noted that the birds dove more often than flew when a boat approached. If approached slowly and from an angle, however, the birds paddled away from the boat Neatherlin, WDFW, personal communication. 2003, as cited in FWS 2003).

3. In a study in Finland, boat disturbance (at levels of 3.5 to 8.5 disturbances per day) lengthened the swimming distances of velvet scoter ducklings and reduced the time used for feeding (Mikola et al. 1994). The birds showed a response to the boats when the boats were within 100 feet of the ducks. Birds disturbed more frequently than average were smaller than birds disturbed less frequently. The frequency of predatory gull attack on the ducks was 3.5 times higher in disturbed areas than undisturbed areas.

4. In a study in Florida, researchers investigated the flushing distance of 23 waterbird species to personal watercraft and outboard-powered boats (Rodgers and Schwikert 2002). Flushing distance for foraging and loafing birds varied by species and individual and boat type. Average flush distance by species ranged from 77 feet (Forster's tern) to 190 feet (osprey) of outboard-powered boats and 64 feet (least tern) to 162 feet (osprey) for personal watercraft. Based on their study results, the researchers suggested buffer zones of 590 feet for wading birds, 490 feet for osprey, 460 feet for terns and gulls, and 330 feet for plovers and sandpipers to minimize disturbance at foraging and loafing sites.

5. Several studies have documented effects of boats on foraging and nesting eagles. In a study of nesting eagles in Michigan, average eagle flushing distance was 360 feet for power boats and about 1,000 feet for canoes/kayaks (Grubb et al. 1992). Foraging eagles on the Columbia River maintained an average distance of 1,300 feet from stationary boats. In the presence of boats, the birds reduced their feeding time and number of foraging attempts (McGarigal et al. 1991). In a study of wintering bald eagle response to military activities at Fort Lewis, Washington, investigators reported that most eagles flushed when boats approached within 330 feet (Stalmaster and Kaiser 1997). In a study of wintering eagles along the Nooksack and Skagit Rivers in Washington, researchers reported that average distance for perched eagles flushed by a canoe was approximately 500 to 550 feet, and average flush distance for eagles standing or feeding on the ground was approximately 750 to 900 feet, although more sensitive eagles flushed at distances

out to approximately 1,150 feet (Knight 1984). In their Draft National Bald Eagle Management Guidelines (2006), FWS recommends that within 300 feet of eagle nests during the nesting season (1) concentrations of noisy vessels (e.g., commercial fishing boats and tour boats) should be avoided, except where eagles have demonstrated tolerance for such activity; and (2) other motorized boat traffic should attempt to minimize trips and avoid stopping in the areas where feasible, particularly where eagles are unaccustomed to boat traffic.

Marine birds may be sensitive to underwater noise when they are diving to catch fish. Effects can range from behavioral changes (e.g., delayed or aborted foraging attempts, avoidance of potential foraging areas) to physical injury (FWS 2003). Based on a review of studies of the effects of noise on animals in underwater environments, FWS (2003) estimated that peak sound pressure levels greater than 180 dB have the potential to cause physical injury. A recent study of noise levels from small powerboats found peak levels of 145 to 150 dB, primarily in the 350- to 1,200 Hz frequency range (Bartlett and Wilson 2002). Similarly, Hildebrand (2005) reported peak noise levels of 140 dB for small fishing vessels. Higher noise levels are associated with larger vessels; Richardson et al. (1995) provided estimates of 171 dB for a tug and barge and 181 dB for a large supply ship.

3.5.3.3.3 Gunfire and Explosives

Studies on the effects of non-lethal gunfire on marine birds are rare. Investigators did study the effect of military shooting ranges on the birds of the Wadden Sea, although effects may have been confounded by aircraft effects (Kuesters and Van Raden 1998). The investigators stated that the reactions of the birds to bombing and shooting air-to-ground missiles and machine guns from low-flying planes varied from continuing feeding to alert behavior to spontaneous flight. Reaction intensity depended on the sequence in which the weapons were fired (i.e., birds were more likely to become habituated if the shooting started with low-noise weapons) and particularly on the tide, with higher tides (and associated concentrations of birds on their high-tide roosts) eliciting stronger responses. In a study of wintering bald eagle response to military activities at Fort Lewis, Washington, investigators reported that most eagles were not “overly disturbed” by artillery and small arms fire (Stalmaster and Kaiser 1997). In a study of nesting eagles in Michigan, average eagle flushing distance was approximately 1,600 feet for gunfire and 5,000 feet for artillery fire (Grubb et al. 1992).

Indirect evidence of the effects of gunfire on birds can be obtained from results of bird hazing activities at aquaculture facilities, hydroelectric facilities, agricultural sites, and oil spills. In general, gunfire and other pyrotechnics initially cause foraging birds to flush, but the birds usually become habituated to the gunfire over time (Bomford and O'Brien 1990; Salmon and Marsh 1991; Bechard and Marquez-Reyes 2003). The intermittent use of weapons during a Makah whale hunt would not be expected to result in birds habituating to the gunfire.

3.5.3.3.4 Marine Mammals and Underwater Noise

Within animals, hearing characteristics vary among individuals, sex and age classes, populations, and species. Hearing capabilities of marine mammals have been studied for just over 20 of approximately 125 species (Richardson et al. 1995; Wartzok and Ketten 1999; Würsig and Richardson 2002). The species studied are limited to those small enough to be held in captivity. Traditionally, direct hearing measurements have involved trained responses; more recently, electrophysiological methods have been used to measure neural activity in animals presented with sound. For larger or rare species, hearing must be estimated from mathematical models based on anatomy, inferred from the sounds they produce, or from reactions to sounds in their environment.

Of the cetaceans, baleen whales are thought to be most sensitive to low-frequency sounds (approximately 10 to 5,000 Hz) based on characteristics of their auditory morphology, behavioral responses, and sound production (Wartzok and Ketten 1999). See Section 3.4.3.6.5, Known and Potential Anthropogenic Impacts, Offshore Activities and Underwater Noise, for more information about gray whales and marine noise. No direct empirical data exist on the hearing of baleen whales. Most odontocetes (toothed cetaceans, such as killer whales, other dolphins and porpoises, and sperm whales) have functional hearing across a broader range of mid to high frequencies (from 200 to 100,000 Hz) (Johnson 1967; Hall and Johnson 1972; Erbe and Farmer 1998; Tremel et al. 1998; Szymanski et al. 1999). A few odontocetes, including harbor porpoises and river dolphins, hear relatively similarly in this broad range, but appear to be specialized for hearing sounds at very high frequencies (approximately 4,000 to 150,000 Hz or higher) (Wartzok and Ketten 1999).

Pinnipeds (seals, sea lions, and walrus) are fundamentally different from other marine mammals, because they are amphibious mammals performing important life functions both above and below water. Consequently, they have a number of auditory adaptations enabling fairly sensitive hearing across wide frequency ranges both in air and water (Richardson et al. 1995; Kastak and

Schusterman 1998). Pinnipeds can be segregated into two functional groups based on their underwater hearing capabilities: (1) otariids (sea lions and fur seals), which have been shown to be sensitive to a fairly wide range of mid frequencies (approximately 1,000 to 30,000 Hz); and (2) phocids (true seals) and walruses, which generally are capable of hearing across a wide range of low to mid frequencies (approximately 200 Hz to 50,000 Hz). The differences in hearing bandwidth in air are less striking between the phocids and otariids; in both taxa, functional bandwidth is narrower in air than in water.

Ketten (1998) reported that there are no conventional audiometric data available for sea otters, but research on river otters indicates a functional hearing range in air of approximately 450 to 35,000 Hz and a peak sensitivity of 16,000 Hz.

Noise and Marine Mammal Hearing

Noise exposure may result in a range of effects on auditory and non-auditory systems. Noise may be detectable, but have no effect on a mammal's hearing or physiology. The presence of noise may mask signals of interest (such as calls of other animals) (Bain and Dahlheim 1994; Erbe 2002; Southall et al. 2003). Intense or prolonged exposure may result in either temporary or permanent changes in hearing sensitivity (Malme et al. 1983; Malme et al. 1984; Malme et al. 1988; Ljungblad et al. 1988; Tyack and Clark 1998; Schlundt et al. 2000). Sound exposure may also induce physical trauma to non-auditory structures (Jepson et al. 2004; Fernandez et al. 2005), although much remains uncertain regarding the exact mechanisms. Because marine mammals in the project area rely on underwater sounds for various purposes, any strong anthropogenic sounds at relevant frequencies might have an effect.

Noise and Marine Mammal Behavior

Most studies of the effects of noise on marine mammal behavior are observational rather than experimental. Behavioral responses may take many forms, including subtle changes in surfacing and breathing patterns, cessation of vocalization, or active avoidance or escape from the vicinity of the noise source. Bowhead whales have been observed altering their diving and blowing behavior in response to human noises (Richardson et al. 1986). Many whale species have been seen to cease vocalizing in response to human noises. These include right whales (Watkins 1986), bowheads (Wartzok et al. 1989), sperm whales (Watkins and Schevill 1975; Bowles et al. 1994), and pilot whales (Bowles et al. 1994). Other responses include humpback whales lengthening their song cycles (Miller et al. 2000) and moving away from mid-frequency sonar (Maybaum 1993), beluga whales adjusting their echolocation clicks to higher frequencies (Au et al. 1985),

and gray whales avoiding air gun noise (Malme et al. 1984). In contrast, some observers (e.g., Tyack and Clark 1998; Fristrup et al. 2003) have reported instances in which whales did not respond to human sounds. Responses may vary depending on age and sex. For example, cow-calf pairs of gray whales are considered more sensitive to disturbance by whale-watching vessels than other age or sex classes (Tilt 1985). Responses also appear to be affected by the location of the source relative to the animal, the motion of the source, and the onset and repetition of the sound (Hildebrand 2005).

In a study that used acoustic tags and controlled exposure experiments with north Atlantic right whales, Nowacek et al. (2004) examined the effects of shipping noise on marine mammal behavior. Five of six individual whales responded strongly (interrupted dive pattern and rapid ascent to the surface) to the presence of an artificial alarm stimulus (series of constant frequency and frequency modulated tones and sweeps), but ignored playbacks of vessel noise. More information about the effects of noise on gray whale behavior can be found in Section 3.4.3.6.5, Known and Potential Anthropogenic Impacts, Offshore Activities and Underwater Noise.

3.6 Economics

3.6.1 Introduction

This section describes current conditions and recent trends in economic activity within Clallam County and on the Makah Reservation, including Neah Bay. Information presented in this section includes the following:

- Countywide employment, personal income, and tourism statistics
- Commercial shipping information
- Makah tribal employment and personal income statistics
- Local economic conditions related to tourism
- County and tribal income generated by tourism
- Ocean sport and commercial fishing statistics
- Summary of economic effects of media coverage of the 1998, 1999, and 2000 Makah Tribe gray whale hunts

3.6.2 Regulatory Overview

No federal, state, or local regulations, statutes, or policies pertain specifically to the establishment or maintenance of the economic resources in the project area, other than those addressing wildlife management and hunting activities discussed in other sections of this chapter (Section 3.3.2, Regulatory Overview (Marine Habitat and Species), Section 3.4.2, Regulatory Overview (ENP Gray Whale, Section 3.5.2, Regulatory Overview (Other Wildlife Species).

3.6.3 Existing Conditions

3.6.3.1 Countywide Conditions (Clallam County)

3.6.3.1.1 <u>Employment, Unemployment, and Labor Force</u>

In addition to tourism and fishing, Clallam County's economic base is largely anchored by lumber and wood products, including the production of paper and related materials. Although the lumber and wood products industry has been adversely affected by several national recessions since the early 1970s, industries built around lumber, plywood, log exports, pulp and paper, and shakes and shingles continue to provide most of the goods-producing jobs in Clallam County. The Olympic Peninsula's climate and topography provide favorable growing conditions for forests, which produce more than 165 cubic feet of wood per acre per year. The markets for lumber and wood products, however, remain volatile. Invariably, factors such as interest rates, trading of the United States dollar, and government policies will continue to affect the industry. Protection of endangered species, specifically the spotted owl, also will continue to impact

forestry activity (Washington State Employment Security Department, Labor Market and Economic Analysis Branch 2001).

Clallam County is becoming a retirement center of some note. In recent years, the number of retirees coming to the area has increased. A mild climate, particularly around the Sequim area, coupled with a relatively low cost of living, is attractive to retirees (Washington State Employment Security Department, Labor Market and Economic Analysis Branch 2001).

Since 2000, annual average wage and salary employment in Clallam County has increased by more than 15 percent, with employment growing by 3,160 jobs. Most of the job growth has occurred in service industries, where 1,040 jobs were added between 2000 and 2006. Employment growth also has been strong in the government sector, with 770 new jobs, and the retail trade sector, with 440 additional jobs (Washington State Employment Security Department, Labor Market and Economic Analysis Branch 2007a).

In 2006, an average of 23,780 wage and salary workers were employed in Clallam County. Goods-producing industries, including those involved in natural resources, mining, construction, and manufacturing, accounted for 16 percent of countywide employment, about the same as the 17 percent share of these industries' jobs statewide. Government employment generated nearly 28 percent of the county's jobs, compared to 18 percent statewide. Trade, service, transportation, warehousing, and utility industries accounted for the remaining wage and salary jobs, generating 56 percent of countywide employment opportunities, compared to 65 percent statewide (Washington State Employment Security Department, Labor Market and Economic Analysis Branch 2007a).

In addition to wage and salary employment, employment related to business ownership and self-employment is important to the economy of Clallam County. For example, in 2000, proprietors' employment produced nearly 9,500 jobs, in addition to contributing to countywide wages and salaries (Bureau of Economic Analysis 2005).

Clallam County's resident civilian labor force averaged 29,500 persons in 2006, reflecting labor force growth of 14 percent since 2000. This growth rate was substantially higher than the statewide labor force increase of 9 percent over the same period. Unemployment in the county in 2006 averaged 5.6 percent, higher than the statewide unemployment rate of 4.9 percent. Since 2000, growth in the employment of Clallam County's residents has outstripped growth of the county's resident labor force, resulting in an unemployment rate falling from 6.9 percent in 2000 to its current level. Over the same period, the statewide unemployment rate decreased slightly

from 5.0 to 4.9 percent (Washington State Employment Security Department, Labor Market and Economic Analysis Branch 2007b).

3.6.3.1.2 Personal Income

Personal income is generally seen as a key indicator of a region's economic vitality. Personal income, as presented here, captures all forms of income: wages, salaries, government transfer payments, retirement income, farm income, self-employment income, proprietors' income, interest, dividends, and rent, but it does not include contributions toward social insurance. Social insurance payments are those made for certain government programs, including health, disability, unemployment, retirement, life insurance, and workers' compensation insurance programs. Nominal (not adjusted for inflation) total personal income for Clallam County increased from $995 million in 1990 to $1.9 billion in 2004, ranking the county fifteenth among Washington's 39 counties in total income in 2004 (Table 3-15). This 96 percent increase equates to an average 4.0 percent annual growth rate, very close to the state's 8.8 percent annual income growth over this period (Washington State Employment Security Department, Labor Market and Economic Analysis Branch 2007c).

Per capita income, which relates an area's total income to its population level, provides an indicator of the economic well-being of the residents of an area. In 2004, per capita income in Clallam County was $23,454, compared to $35,041 statewide, ranking the county thirteenth among the state's 39 counties (Washington State Employment Security Department, Labor Market and Economic Analysis Branch 2001). Between 1999 and 2004, per capita income in Clallam County increased by nearly 63 percent, growing from $17,605 to $28,664 (Table 3-15).

TABLE 3-15. POPULATION AND PERSONAL INCOME IN CLALLAM COUNTY IN 1990 AND 2004

CATEGORY	1990	2004	PERCENT CHANGE 1990-2004 (%)
Population	56,525	67,991	20.3
Total personal income ($1,000s)	995,115	1,948,883	95.8
Per capita income ($1,000s)	17,605	28,664	62.8

Source: Bureau of Economic Analysis 2005. ; Washington State Employment Security Department, Labor Market and Economic Analysis Branch 2007c.

3.6.3.1.3 Tourism

Tourism is an important component of Clallam County's economy. The rugged, pristine environment and variety of habitats found along the Olympic Coast and the Strait of Juan de Fuca provide recreational opportunities for both residents and tourists. Additionally, Olympic National Park, which has attracted an average of 3.2 million recreation visitors per year since 1990 (National Park Service 2008), generates visitation to Clallam County, including its visitor centers in Port Angeles, Forks, Sequim, and Neah Bay (North Olympic Peninsula Visitor and Convention Bureau 2005a). Much of the land in Clallam County, including a large segment of its Pacific coastline, is within the Olympic National Park and Olympic National Forest. The OCNMS, which provides opportunities for wildlife viewing, also attracts visitors to the county's outer coastline. Additional information concerning Olympic National Park and the OCNMS is presented in Section 3.12.3.2, Vantage Points and Visual Opportunities in the Project Area.

According to a recent study of visitors to the Olympic Peninsula (Jim Lillstrom and Associates 2003), visitors to Clallam County participate in an array of sightseeing and recreation activities. General sightseeing, hiking, wildlife viewing, and visiting historical and cultural sites are among the most popular activities of visitors to the county (Table 3-16). In addition to hiking, other popular recreational activities include boating and water sports, biking, backpacking, rafting and kayaking, and fishing.

Tourism is a relatively large industry in Clallam County. According to a recent study of travel-related economic impacts, visitors spent $139.6 million at destinations in Clallam County in 2003 (Table 3-17), accounting for 1.5 percent of statewide travel spending. Spending occurs in several sectors of the county's economy, but is greatest in the food and beverages services sector (28 percent of total visitor spending) and accommodations sector (19 percent). Additionally, approximately 16 percent of visitor spending occurs in both the retail sales sector and the arts, entertainment, and recreation sector (Dean Runyan Associates 2004).

TABLE 3-16. PERCENTAGE OF VISITORS TO CLALLAM COUNTY PARTICIPATING IN SPECIFIC ACTIVITIES DURING THEIR VISITS

ACTIVITY	PERCENT OF DAY VISITORS (%)	PERCENT OF OVERNIGHT VISITORS (%)
Sightseeing/driving tour	53	75
Hiking	46	63
Wildlife viewing	36	58
Visiting historic/cultural site	35	56
Shopping	44	47
Visiting Native American site	21	43
Participating in a family event	26	20
Visiting a gallery	17	31
Boating/water sports	21	18
Biking	20	11
Backpacking	13	17
Attending a festival/event	16	14
Wine tasting	15	13
Rafting/kayaking	13	13
Fishing	16	10
Visiting a garden/farm	10	14
Antiquing	11	13
Golfing	10	5
Going to a casino	8	6

Source: Jim Lillstrom & Associates 2003.

TABLE 3-17. TRAVEL SPENDING IN CLALLAM COUNTY IN 2003

COMMODITY PURCHASED	TRAVEL SPENDING (MILLIONS $)	PERCENT OF TOTAL TRAVEL SPENDING (%)
Accommodations	26.2	18.8
Food and beverage services	39.7	28.4
Food stores	10.7	7.7
Ground transportation and motor fuel	16.9	12.1
Arts, entertainment, and recreation	22.8	16.3
Retail sales	23.2	16.6
Air transportation	0.1	0.1
TOTAL SPENDING	**139.6**	**100.0**

Note: Includes spending (in nominal dollars) at a destination in Clallam County related to all types of travel, including business and pleasure travel. Expenditures at a destination where a traveler stays overnight or at a destination more than 50 miles from a traveler's home are included.

Source: Dean Runyan Associates 2004.

Between 1991 and 2003, travel-related spending at destinations in Clallam County grew at an average annual rate of 3.6 percent, compared to 4.9 percent statewide (Table 3-18). Spending in the county increased in every year of the period except in 1994, when spending decreased by 1.9 percent, and in 1999, when spending decreased by 0.3 percent. The average annual growth rate of travel-related spending in Clallam County slowed after 1999, declining from an average of 4.1 percent between 1991 and 1998 to 3.6 percent between 1999 and 2003 (Table 3-18). The statewide growth rate of travel-related spending also slowed after 1999, with the statewide slowdown similar to the change in Clallam County (Table 3-18).

TABLE 3-18. TRAVEL SPENDING IN CLALLAM COUNTY AND WASHINGTON STATE, 1991 TO 2003

	Clallam County		Washington State	
Year	Travel Spending (millions $)	Change from Previous Year (%)	Travel Spending (millions $)	Change from Previous Year (%)
1991	97.8	NA	6,830.0	NA
1992	106.6	9.0	7,070.2	3.5
1993	107.3	0.7	7,306.4	3.3
1994	105.3	-1.9	7,490.0	2.5
1995	112.9	7.2	7,825.2	4.5
1996	114.2	1.2	8,323.7	6.4
1997	118.7	3.9	8,750.2	5.1
1998	126.0	6.1	9,063.0	3.6
1999	125.6	-0.3	9,599.0	5.9
2000	130.5	3.9	10,495	9.3
2001	135.2	3.6	10,472	-0.2
2002	135.8	0.4	10,356	-1.1
2003	140.1	3.2	10,845	4.7
Average annual percentage change 1991-1998	3.7	NA	4.1	NA
Average annual percentage change 1999-2003	2.8	NA	3.1	NA
Average annual percentage change 1991-2003	3.3	NA	4.3	NA

Note: Table includes spending (in nominal dollars) at a destination related to all types of travel, including business and pleasure travel. Expenditures at a destination where a traveler stays overnight or one more than 50 miles from a traveler's home are included. Unlike the 2003 spending shown in Table 3-17, spending in this table includes expenditures by county or state residents for air travel and travel agency services for trips to destinations outside of Clallam County or Washington State.

NA = not applicable.

Source: Dean Runyan Associates 2004.

Travel-related spending by visitors to Clallam County generates earnings and employment in visitor-serving industries. Earnings generated by travel spending totaled an estimated $41.8 million in 2003, including $25.2 million in the accommodations and food service sectors and $10.3 million in the arts, entertainment, and recreation sector (Table 3-19). Employment generated by travel-related spending in Clallam County totaled an estimated 2,920 jobs in 2003 (Table 3-19), accounting for 12.5 percent of Clallam County's wage and salary jobs and 8.7 percent of all jobs (including proprietors' employment) (Dean Runyan Associates 2004).

TABLE 3-19. ESTIMATED TRAVEL-RELATED ECONOMIC IMPACTS BY SECTOR IN CLALLAM COUNTY IN 2003

SECTOR	INDUSTRY EARNINGS GENERATED BY TRAVEL SPENDING (MILLIONS $)	JOBS GENERATED BY TRAVEL SPENDING
Accommodations and food service	25.2	1,540
Arts, entertainment, and recreation	10.3	1,080
Retail and gasoline	5.1	250
Auto rental and other ground transportation	0.9	40
Air transportation	0.1	Less than 5
Other travel	0.3	10
TOTAL	**41.8**	**2,920**

Source: Dean Runyan Associates 2004.

3.6.3.1.4 Commercial Shipping

Next to fishing, the predominant use of waters off the Olympic Coast is commodities transportation to and from port facilities in Puget Sound. In 2004 Puget Sound ports handled $63 billion worth of international trade (Washington Joint Transportation Committee 2007). Included in the commercial shipping traffic are tug boats with barges carrying hydrocarbon products along the coast. The entrance to the Strait of Juan de Fuca is highly congested by oil tankers, freighters, tugs and barges, and fishing vessels (NOAA 1993). Management of commercial vessel traffic near the project area and marine vessel traffic regulations adopted during the Makah Tribe's previous whale hunt are discussed in Section 3.13, Transportation. Similarly, data on transits into Washington State waters through the Strait of Juan de Fuca by large cargo and passenger vessels, tank ships, barges, and commercial fishing vessels are presented and discussed in Section 3.13, Transportation.

Commercial shipping routes in the Strait of Juan de Fuca and nearby waters, including Haro Strait, Boundary Pass, Rosario Strait, and the Strait of Georgia, are managed jointly by the United States and Canadian Coast Guards, primarily through the Cooperative Traffic System. This system allows for management of vessel traffic in a waterway segment without regard to the

international boundary that separates the waters of the United States and Canada. A vessel separation scheme, similar to a divider median on a highway, is used to maintain a safe distance between opposing vessel traffic (United States Coast Guard 2002).

The Strait of Juan de Fuca traffic separation scheme encompasses five sets of traffic lanes, including the western and southwestern approaches to and from the Pacific Ocean, the western lanes in the Strait, the southern lanes to Port Angeles, and the northern lanes to Victoria. Each set of lanes consists of inbound and outbound traffic lanes with separation zones (NOAA 2005). The traffic lanes encompassed by the Strait of Juan de Fuca traffic separation scheme generally run through the center of the Strait of Juan de Fuca, near the boundary line separating the waters of the United States and Canada. The southern boundary of the traffic separation scheme generally lies about 4 nautical-miles offshore of Clallam County along the Strait of Juan de Fuca and extends further away from the coast as it leaves the Strait of Juan de Fuca and enters ocean waters. The Makah Tribe's U&A (Figure 3-1) overlaps the traffic separation scheme near the international boundary line in the Strait and encompasses the commercial traffic lanes that provide a southwestern approach to and from the Pacific Ocean near the mouth of the Strait.

Commercial traffic largely honors the OCNMS area to be avoided (Figure 3-1), discussed in more detail in Section 3.1.1.1.3, Current Issues (OCNMS), and Section 3.13, Transportation. The Coast Guard RNA, which was established to enforce vessel activities near any Makah whale hunt, falls within the area to be avoided, except for the portion of the RNA that wraps around Cape Flattery and Tatoosh Island (Figure 3-1). The commercial shipping traffic lanes appear to avoid the regulated navigation area, indicating that most commercial traffic avoids this area.

3.6.3.2 Local Conditions on the Makah Reservation, including Neah Bay

Demographic data presented in the Employment and Personal Income parts of this section differ from employment and personal income data that will be presented in Section 3.7, Environmental Justice. The data in this section apply to all (non-native and Native American) residents of the Makah Reservation, whereas the data presented in the Environmental Justice section apply only to Native American residents of the Makah Reservation; therefore, the data do not match.

3.6.3.2.1 General Description of the Local Economy

The Makah Reservation, which includes the community of Neah Bay, is relatively isolated. The reservation has been accessible by road only since 1931 and is an approximately 70-mile drive from the closest commercial center in Port Angeles (Sepez 2001). The economy in the coastal region that includes the Makah Reservation is inextricably linked to its natural resources, based

primarily on seafood, timber harvesting, pulp and paper production, and tourism (NOAA 1993). Neah Bay, the Makah Reservation's central town, is primarily a commercial fishing and timber community, as well as a tourist and sport fishing destination.

Similar to other locations on the Olympic Peninsula that depend on resource-based industries, the Makah Reservation and Neah Bay have experienced economic difficulties since the late 1980s due to salmon harvest restrictions and controversies surrounding timber practices that have led to reductions in harvest. In addition, the 1989 deactivation of the United States Air Force Base operating on the Makah Reservation resulted in the loss of approximately 200 local jobs, further reducing job opportunities in the local area. Both of these changes, combined with normal fluctuations in the reservation's commercial fishing, sport fishing, and tourism industries, have impaired the Makah Tribe's ability to ensure reliable incomes and subsistence sources for its members (Renker 2002).

Most reservation residents live in Neah Bay, the location of the public school, post office, health clinic, and other services (Renker 2002). Commercial activity on the Makah Reservation includes the businesses shown in Table 3-20, which mainly are located in Neah Bay. Tribal artisans also produce carvings, jewelry, and silk screen designs for sale in local shops and regional galleries (Sepez 2001). Most businesses on the reservation are owned by the Makah Tribal Council or by tribal members. Exceptions include Washburn's General Store, High Tides Seafood, Tommycod Charters, and the Cape Motel and RV Park (Arnold 2005).

3.6.3.2.2 Employment

In 2000, the labor force residing on the Makah Reservation totaled 613 persons, including 464 Native Americans (primarily Makah tribal members), representing 67 percent of the reservation's population 16 years old or older (United States Census Bureau 2002). Unemployment trends and industrial employment data specifically for the Native American population residing on the Makah Reservation are presented and discussed in Section 3.7, Environmental Justice.

TABLE 3-20. BUSINESSES ON THE MAKAH RESERVATION

Accommodations	Restaurants
Cape Motel and RV Park[1]	Warmhouse Restaurant
Hobuck Beach RV, Cabins, Campground & Resort	Beebe's Café
Tyee Motel and RV Park	Natalie's Pizza
Retail Goods/Services and Fuel	**Fishing Charter Businesses**
Big Salmon Resort (fuel)	Big Salmon Resort (bookings only)
Kim Brown's Take-Home Fish	Tommycod Charters[1]
Makah Mini-Mart (includes fuel and smoke shop)	
Raven's Corner Indian Art	
Washburn's General Store[1]	
Johnson's Beauty Shop	
Rose's Interior Decorators	
Cedar Shack Espresso Stand	
Makah Maiden Pantry	
Other Businesses	**Individual Tribal Member Fishing Vessels**
Bunn Construction Co., Inc.	40 longline – troll and gill net
Burley's Construction	10 small (coastal) trawlers
Cape Flattery Fishermen's Coop	5 large (whiting) trawlers
High Tide Seafoods[1]	5 gill net (salmon)
Makah Marina	12 small combination vessels (e.g., crab, trollers, longline)
Makah Rock and Gravel	
Makah Housing Authority	
Makah Cultural and Research Center	21 Individual (tribal members) registered fish buyers
Makah Forestry Enterprise	30 individual (tribal members) river fishermen (salmon)
Makah Fisheries Development Foundation	
Makah Bingo	
Ocean Gold Seafood	
Patsy Bain Fish Company	

[1] Indicates non-tribal owned businesses. All other businesses are owned by the Makah Tribe or by tribal members. Businesses are primarily located in Neah Bay.

Sources: Amazon.com 2005; Forks Web 2005; Makah Tribe 2005c; Pamplin 2005b; Manual 2007; Svec 2007, pers.comm.

According to the 2000 United States Census, 468 of the 613 Makah Reservation residents (non-native and Native American together) in the labor force were employed in 2000. Of the 468 Makah Reservation residents with jobs in 2000, 64 percent were employed by government entities, 13 percent were self-employed, and 23 percent were employed by private businesses (United States Census Bureau 2002). This employment distribution points to the importance of the government sector to the economy of the Makah Reservation and Neah Bay. In addition to state and federal employment, the Makah Tribe, which is the largest employer on the reservation, employs approximately 170 persons (Makah Tribe 2005b). Management and professional occupations, many probably related to government employment, accounted for 38 percent of the jobs held by reservation residents in 2000 (Table 3-21). Service, sales, and office occupations together

accounted for an additional 34 percent of total jobs. Farming, fishing, and forestry occupations related to the area's natural resources provided jobs for 13 percent of the reservation's employed labor force. The United States Census data may undercount the reservation's employment associated with fishing occupations. According to the Makah Tribe (Svec 2007, pers.comm.), tribal members held approximately 250 commercial fishing jobs in 2006. Other employers on the Makah Reservation include the Indian Health Service medical and dental clinics, with 22 employees, and the Cape Flattery Public Schools, with 61 employees (Makah Tribe 2005b).

TABLE 3-21. EMPLOYMENT BY OCCUPATION OF MAKAH RESERVATION RESIDENTS IN 2000

OCCUPATION	NUMBER	PERCENT (%)
Management, professional, and related occupations	178	38.0
Service occupations	80	17.1
Sales and office occupations	80	17.1
Farming, fishing, and forestry occupations	60	12.8
Construction, extraction, and maintenance occupations	26	5.6
Production, transportation, and material moving occupations	44	9.4
TOTAL	**468**	**100.0**

Note: The table includes both non-native and Native American residents of the Makah Reservation.
Source: United States Census Bureau 2002.

The distribution of employment by industry for residents (non-native and Native American together) of the Makah Reservation in 2000 is presented in Table 3-22.

TABLE 3-22. EMPLOYMENT BY INDUSTRY OF MAKAH RESERVATION RESIDENTS IN 2000

INDUSTRY	NUMBER	PERCENT
Agriculture, forestry, fishing, hunting, and mining	90	19.2
Construction	27	5.8
Manufacturing	3	0.6
Wholesale trade	4	0.9
Retail trade	15	3.2
Transportation, warehousing, and utilities	12	2.6
Information	0	0.0
Finance, insurance, real estate, and rental and leasing	4	0.9
Professional, scientific, management, administrative, and waste management services	13	2.8
Educational, health, and social services	110	23.5
Arts, entertainment, recreation, accommodation, and food services	31	6.6
Other services (except public administration)	9	1.9
Public administration	150	32.1
TOTAL	**468**	**100.0**

Note: The table includes both non-native and Native American residents of the Makah Reservation.
Source: United States Census Bureau 2002.

3.6.3.2.3 Personal Income

Personal income levels of Makah Reservation residents (non-native and Native American together) lag behind those of residents throughout Clallam County. According to the United States Census Bureau (2002), the median income of reservation households was $24,100 in 1999, representing only 66 percent of the median countywide household income of $36,450.

In 1999, the per capita income of all reservation residents was also below the countywide level. Based on United States Census Bureau estimates of per capita income, the $11,000 per capita income of Makah Reservation residents was 56 percent of countywide per capita income.

Because Neah Bay is isolated, most of the earnings of local residents come from the wage and salary payments of local businesses. Based on a recent informal survey of businesses in Neah Bay, local businesses generate an estimated annual total payroll of about $21 million (Arnold 2005).

3.6.3.2.4 Contribution of Tourism to the Local Economy

Tourism is one of the key elements of the economy of Neah Bay and the Makah Reservation. Visitors are attracted to Neah Bay and the reservation by several activities associated with the area's cultural, scenic, and recreational offerings.

In the village of Neah Bay, the Makah Cultural and Research Center houses the Makah Museum, which includes permanent exhibits featuring artifacts from the Ozette archeological site. Ozette was an ancient Native American whaling village discovered in 1970 on the Pacific Coast side of the reservation. The museum, which houses the nation's largest collection of Native American artifacts, is connected to a gift shop that offers visitors carvings, basketry, and jewelry made by Makah artists. The Makah Cultural and Research Center also houses the Makah language program, which is designed to preserve and teach the Makah language (Makah Tribe 2005c).

Neah Bay also offers visitors opportunities for sport fishing charters and guided tours. Several visitor-dependent businesses are located in Neah Bay, including five businesses providing accommodations, three restaurants, several retail shops providing fuel and supplies, and three sport fishing charter businesses (Table 3-20). Although none of the charter boat operators based in Neah Bay advertises whale-watching trips, at least one operation will charter whale-watching if requested (Pamplin 2005b).

Several other tourist and recreation activities are available elsewhere on the Makah Reservation, including vehicle sightseeing tours along forested State Route 113 and the irregular Strait of Juan de Fuca coastline accessed by State Route 112. Many people travel to the coast to watch the

annual migration of California gray whales (NOAA 1993). As discussed previously, most whale-watching on and near the Makah Reservation is from land-based locations, with few businesses offering whale-watching tours or charters. Beach activities are available to reservation visitors at sandy beaches near Neah Bay and along Hobuck Beach Road on the outer coast side of the reservation. Camping is available at Hobuck Beach, as well as at the Cape Resort and Silver Salmon Resort in Neah Bay.

Hiking is a popular activity for recreationists visiting the reservation. Popular trails include the 0.75-mile Cape Flattery Trail and the 3.3-mile Shi Shi Trail. The Cape Flattery Trail, with observation decks for viewing the OCNMS, Tatoosh Island, and the Pacific Ocean, is popular with ecotourists and those interested in wildlife viewing opportunities (Makah Tribe 2005c). Wildlife viewing also is available at Flattery Rocks National Wildlife Refuge and the Olympic Coast National Marine Sanctuary. Additionally, the public can view migrating salmon at the Makah National Fish Hatchery, located on the Sooes River on the west side of the reservation (North Olympic Peninsula Visitor and Convention Bureau 2005a).

Sport fisheries and other tourist attractions draw approximately 130,000 visitors annually to the Makah Reservation (Makah Tribe 2005b). The following statistics provide an indication of recent visitation activity.

- The Makah Cultural and Research Center, which includes the Makah Museum, accommodated the following number of non-Makah visitors between 2000 and 2006 (Makah Cultural and Research Center 2005; Makah Cultural and Research Center 2007):
  - 2000: 13,605 people
  - 2001: visitor data not available
  - 2002: 12,272 people
  - 2003: 13,503 people
  - 2004: 11,928 people
  - 2005: 11,907 people
  - 2006: 9,807 people
- The Olympic National Park visitor's center in Neah Bay attracted 10,130 visitors in 2004 (North Olympic Peninsula Visitor and Convention Bureau 2005b).
- The Makah Tribe sold 7,592 recreational permits to non-tribal members visiting the reservation in 2006 (R. Bowechop 2008, pers. comm.). Permit sales from 2002 to 2005 ranged from 7,880 to 9,130 and averaged 8,243 permits sold per year. Sales of permits peak during summer months and are lowest during the winter. Recreation permits are

required for non-tribal persons on the reservation. Permits are sold on a per vehicle basis and are good for a calendar year; this number of permits does not capture the total number of non-tribal persons visiting the reservation in a calendar year, nor does it capture the length of a visit and the number of visits an individual may make to the reservation under a single permit (Peterson 2005).

- The Makah Tribe sold 616 annual recreation fishing permits in 2004 ($12,330 total revenue), 533 in 2005 ($10,672 total revenue), and an estimated 460 in 2006 (approximately $9,210 total revenue) (Sones 2007). The permits, which are sold on an individual basis, allow visitors to fish on rivers within the reservation (Sones 2005).

Persons visiting the Makah Reservation for tourism and recreational purposes generate revenues for businesses in Neah Bay, most of which are owned by tribal members, including the Makah Mini-Mart, the Makah Marina, a tackle shop, two motels and a hostel, 30 recreational vehicle sites, a campground, a general store, two restaurants, and two espresso shops (Makah Tribe 2005b). However, the amount of revenues annually generated by reservation tourism and recreation, as well as the number of jobs and amount of personal income that depend on visitor spending, is not known. According to the United States Census, 46 reservation residents were employed in the retail trade sector and the arts, entertainment, recreation, accommodation, and food services sector, two sectors that depend directly on tourism (Table 3-22). These jobs account for 10 percent of the employment in the local area. Many other local jobs likely are either directly or indirectly supported by tourist spending.

3.6.3.2.5 Contribution of Ocean Sport Fishing to the Local Economy

The diversity and abundance of fish species along the coast are important recreational and commercial resources. Salmon and groundfish (including halibut) fisheries are the primary recreational fisheries within the project area, including the Makah U&A, the OCNMS area to be avoided, and the Coast Guard RNA (Figure 3-1). Recreational fishing for groundfish is concentrated primarily seaward of the entrance to the Strait of Juan de Fuca. The ocean recreational fishery for salmon, which operates out of both Neah Bay and La Push, occurs primarily in the protected waters of the Strait of Juan de Fuca (Beattie 2005).

Ocean sport fishing seasons vary according to species, with seasons adjusted from year to year based on fishery management considerations. The recreational salmon fishery from Cape Alava (near Ozette) north to the United States/Canada border and for the Strait of Juan de Fuca near Neah Bay is generally open from early July until mid-November each year (Pacific Fishery Management Council 2005b). The recreational groundfish season is generally open year-round,

although the season is limited for certain species. For example, the halibut season is generally open from mid-May until mid-June, whereas the bottomfish season, including fishing for rockfish, is open year-round (WDFW 2005b). Periodic openings and closing for specific species may occur during the normal fishing season period.

Several fishing derbies and tournaments also draw visitors to Clallam County's sport fisheries each year. Based on information from a search of internet-based websites, annual derbies and tournaments in Clallam County include the Sekiu Salmon Derby in early April, the Port Angeles Halibut Derby over Memorial Day weekend in May, the Sekiu Halibut Derby in early June, the Sekiu Salmon Derby "No Fin, You Win" Derby in mid-September, and the La Push Last Chance Salmon Derby in late September or early October.

Sport fishing facilities located in Neah Bay include the relatively new Makah Marina, which is managed by the Makah Tribal Council. The marina provides permanent moorage slips for about 200 commercial and sport fishing vessels and pleasure craft. The marina also provides utility hookups, restrooms and showers, and a pump-out facility for boats. Boat launching ramps and trailer parking facilities also are available at Big Salmon Resort and West Wind Resort in Neah Bay (Office of the Interagency Committee 2005).

Currently, three sport fishing charter businesses operate in Neah Bay, but charter businesses based elsewhere also fish in Neah Bay and adjacent waters. An estimated five sport fishing charter companies that are open all year operate in and near Neah Bay, but up to approximately 15 charter boats may operate in the Neah Bay area at times (Arnold 2005).

Between 1995 and 2004, the annual number of recreational salmon angler trips originating from Neah Bay ranged from 4,800 trips in 1997 to 26,100 trips in 2004; salmon trips originating from La Push ranged from 600 to 4,600 trips (Table 3-23). The annual number of angler trips targeting groundfish, halibut, and albacore tuna that originated from Neah Bay ranged from 29,000 trips in 1998 to 18,700 trips in 2004 (Pacific Fishery Management Council 2005b).

Based on previous studies of sport fishing in marine (and fresh) waters in the Pacific Northwest (The Research Group 1991; Gentner et al. 2001), spending by anglers who sport fish for salmon and steelhead in marine waters of the Puget Sound is estimated to average approximately $50 per angler day for fishing from private boats and $150 per angler day for fishing from charter boats (in 2000 dollars). Based on data from the Pacific Fishery Management Council (2005b), private boats account for approximately 95 percent of the salmon angler trips originating from Neah Bay, and charter boats account for approximately 5 percent of the trips. Based on these proportions and

estimates of average spending per angler trip, sport fishing for salmon originating from Neah Bay between 1995 and 2004 generated trip-related spending ranging from about $264,000 to $1.4 million annually. Using similar assumptions and estimates of average spending per angler day, trips originating from Neah Bay that targeted groundfish, halibut, and albacore tuna generated local spending ranging from about $1.0 million to $1.6 million annually. Washington-resident anglers account for most of this spending.

3.6.3.2.6 Contribution of Ocean Commercial Fishing to the Local Economy

High levels of commercial fishing occur throughout the Strait of Juan de Fuca and near the approach to the strait over Swiftsure Bank and La Perouse Bank (commonly referred to as the Plains). Additionally, pink shrimp trawling occurs between the 100-fathom isobaths of the outer coast. Fish harvested by commercial vessels include five species of salmon, bottomfish, and shellfish (Dungeness crab and pink shrimp). Salmon fisheries, particularly the ocean troll fisheries for Chinook and coho salmon, are managed to safeguard against over-harvest of the least viable individual stocks. Salmon harvest restrictions have severely constrained harvest levels in some years.

In addition to the reservation nearshore and river areas, the Makah Tribe's U&A entirely overlaps the Coast Guard RNA and portions of the OCNMS area to be avoided, and includes the area north of 48° 02' 15" N (Norwegian Memorial) and west of 123° 42' 30" W (Tongue Point) and east of 125 ° 44' 0" W, all within the United States EEZ. Makah tribal commercial fisheries include 20 different fisheries based on species, gear types, and seasons:

- Mid-water (Pacific whiting, yellowtail rock fish)
- Bottom trawl (cod, flatfish)
- Longline (halibut, black cod/sablefish)
- Ocean troll
    - Summer Strait
    - Winter Strait
    - Gill net - sockeye, chum, pink, Coho
    - Set net - Chinook
- Dive fisheries (shell fish, sea cucumbers, sea urchin)
- Dungeness crab (ocean and Strait)

TABLE 3-23. SPORT FISHING ANGLER TRIPS BY SPECIES, 1995 TO 2004

PORT LOCATION/SPECIES GROUP	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Neah Bay										
- Salmon	9,500	10,900	4,800	6,400	8,100	11,400	18,100	13,700	20,400	26,100
- Groundfish, halibut, and albacore tuna	23,300	25,800	27,700	29,000	24,900	24,600	21,200	19,700	26,600	18,700
La Push										
- Salmon	1,500	1,300	900	600	2,900	2,000	3,400	3,400	4,400	4,600
- Groundfish, halibut, and albacore tuna	1,600	1,600	2,200	1,200	1,100	1,500	1,200	1,600	3,600	2,100
All ocean port areas north of Cape Falcon, Oregon[1]										
- Salmon	93,600	69,300	91,700	52,500	108,900	132,200	275,700	191,600	232,600	201,200
- Groundfish, halibut, and albacore tuna	52,000	53,400	54,900	56,200	46,300	46,000	41,600	40,200	52,200	40,800

[1] These data include the ocean port areas of Columbia River and Buoy 10, Westport, La Push, and Neah Bay.

Source: Pacific Fishery Management Council 2005b.

- River set net/hook and line (salmon)
- Tuna
- Sardines (in development)

Commercial ocean fishing seasons vary according to species, with seasons adjusted from year to year based on fishery management. The non-tribal commercial salmon troll fishery from Cape Falcon (near the Oregon/Washington border) north to the United States/Canada border generally is open from early May until late June for all salmon species except coho. Additionally, during some years, the fishery is open for all salmon species from early July until early-to-mid-September. For tribal commercial fishing, including the Makah Tribe, salmon fishing is generally open from early May until mid to late June, and then again from early July until mid-September. Commercial groundfishing is generally open year-round for some species, with seasonal limits imposed on certain species. During the course of any year, periodic openings and closing for specific species may occur during the normal fishing season (Pacific Fishery Management Council 2005b).

The tribes are comanagers of the fisheries resources and are involved in management plan development, monitoring, licensing, and enforcement. Based on the Boldt decision (*United States v. State of Washington* 1974), the management plan allocates a portion of the salmon and steelhead among tribal and non-tribal fishers by region of origin. Additionally, the tribes have recognized treaty rights to other species. Since 1986, the tribes have received a direct halibut allocation from the International Pacific Halibut Commission. Since approximately 1994, the Washington State coastal tribes have received an allocation of black cod (sablefish) from the Pacific Fishery Management Council. That tribal allocation of both halibut and black cod subsequently is divided among the tribes by intertribal agreement. Pacific whiting, rockfish, and groundfish tribal harvest allocations are established on a year-to-year basis by the Pacific Fishery Management Council (Bryant 2007). See Section 3.1.2.1, Makah Tribal Departments and Agencies, and Section 3.1.2.2.2, Makah Fisheries Management Programs, for more information on tribal fisheries management programs.

Commercial fishing is one of the mainstays of the Makah Reservation economy. The Makah Tribe conducts a marine gillnet fishery along the shore near Cape Flattery and in the Strait of Juan de Fuca for Chinook and sockeye salmon. The Makah also participate in a variety of groundfish fisheries. Rockfish, sablefish, Pacific halibut, and whiting are the targeted species and are taken by trawl and longline gear. These fisheries occur year-round, and are centered off the north coast of the Olympic Peninsula.

Currently, 75 commercial vessels, all operated by Makah tribal members, are based out of Neah Bay. Tribal employment related to commercial fishing includes 75 vessel skippers, 145 deckhands, and 30 river fishermen (net setters), for a total of 250 jobs (Svec 2007, pers. comm..).

Commercial landings have varied widely over the last 20 years. Based on data derived from the WDFW commercial catch database, the value of commercial fish landings at the Port of Neah Bay since 2000 has ranged from $4.0 to $5.7 million annually; the tribal (mainly Makah Tribe) share accounts for between 50 and 80 percent of the total landings (Table 3-24). Between 2000 and 2004, groundfish comprised from 65 to 85 percent of the total harvest value of commercial fish landings at Neah Bay (Table 3-24).

The Makah Tribe also participates in the Pacific whiting fishery. Annual allocations to the Tribe have ranged from approximately 16,500 to 38,500 metric tons, with the value of whiting per ton averaging $100. This fishery usually opens around the middle of May and closes at the end of December. Most of whiting caught in the tribal fishery is processed at sea on a processing vessel. Smaller portions of the allocation are delivered to a shoreside processing facility in Westport, Washington. Because virtually no whiting is landed and sold at the port of Neah Bay by tribal or non-tribal fishers, the value of this fishery is not reflected in WDFW's catch database.

The value of all commercial fish landed within the Makah's U&A (including fish landed in both tribal and non-tribal fisheries) is 300 to 400 percent greater than the value of commercial fish landed and processed at the port of Neah Bay (Table 3-24), suggesting that most of the fish caught in the U&A are processed at other ports. Most of the commercial catch of salmon from these catch areas is believed to be landed and processed at Port Angeles (Beattie 2005).

TABLE 3-24. VALUE OF COMMERCIAL FISHING LANDINGS BY SPECIES, 2000 TO 2004 (IN MILLIONS OF NOMINAL DOLLARS)

LANDING LOCATION	2000			2001			2002			2003			2004		
	NON-TRIBAL	TRIBAL	TOTAL	NON-TRIBAL	TRIBAL	TOTAL	NON-TRIBAL	TRIBAL	TOTAL	NON-TRIBAL	TRIBAL	TOTAL	NON-TRIBAL	TRIBAL	TOTAL
Catch Reporting Areas for the Project Area															
Groundfish	6,202.0	1,736.1	7,938.1	6,137.2	1879.9	8,017.1	5,819.3	1,830.5	7,649.8	6,095.3	3,622.8	9,718.1	6,464.7	3,782.4	10,247.1
Salmon	175.7	219.4	395.2	140.6	432.6	573.2	297.8	415.2	713.0	594.0	492.6	1,086.6	696.8	1,225.9	1,922.7
Shellfish	6,423.7	0.4	6,424.1	2,836.8	1.2	2,838.0	2,638.5	--	2,638.5	8,173.3	--	8,173.3	3,525.4	11.8	3,537.2
Other	392.1	10.5	402.6	377.9	23.1	401.0	597.5	30.5	628.0	393.9	28.8	422.7	345.1	35.0	380.1
TOTAL	**13,193.0**	**1,966.5**	**15,160.0**	**9,492.5**	**2,336.7**	**11,829.0**	**9,353.1**	**2,276.1**	**11,629**	**15,256.0**	**4,144.2**	**19,400**	**11,032.0**	**5,055.1**	**16,087.0**
Port of Neah Bay															
Groundfish	1,725.3	1,711.3	3,436.6	1,248.6	1,891.4	3,134.0	1,732.8	1,882.0	3,614.9	1,328.0	3,078.4	4,406.3	565.3	2,486.3	3,051.5
Salmon	62.9	52.2	115.1	46.0	22.4	68.4	77.6	30.2	107.8	68.4	28.3	96.8	13.2	18.6	31.8
Shellfish	125.1	368.5	493.6	86.4	698.7	785.1	227.3	464.6	691.8	483.6	518.6	1,002.2	296.4	1,296.3	1,592.7
Other	--	--	--	--	--	--	1.3	4.1	5.4	250.7	--	250.7	--	8.6	8.6
TOTAL	**1,913.3**	**2,132.0**	**4,045.4**	**1,381.0**	**2,612.5**	**3,993.5**	**2,038.9**	**2,380.9**	**4,419.8**	**2,130.8**	**3,625.3**	**5,756.1**	**874.9**	**3,809.7**	**4,684.7**
All Washington Ports															
Groundfish	6,290.2	1,790.3	8,080.5	6,239.0	1,919.6	8,158.6	5,973.5	1,894.8	7,868.2	6,167.6	3,673.3	9,840.9	6,542.3	3,827.9	10,370.2
Salmon	585.1	248.1	833.2	651.9	113.9	765.9	770.2	145.0	915.2	470.9	69.8	540.7	462.0	65.6	527.6
Shellfish	239.3	549.2	788.4	380.9	772.6	1,153.5	751.3	692.3	1,143.6	985.7	713.0	1,698.7	1,181.3	1,840.2	3,021.5
Other	6,433.1	9.7	6,442.7	2,851.0	26.4	2,877.4	2,651.4	23.6	2,675.0	8,208.7	17.1	8,225.8	4,284.9	26.8	4,311.7
TOTAL	**13,548.0**	**2,597.3**	**16,144.0**	**10,123.0**	**2,832.5**	**12,955.0**	**10,146**	**2,755.7**	**12,902**	**15,832.0**	**4,473.3**	**20,306**	**12,470.0**	**5,760.5**	**18,231.0**

[1] Catch reporting areas vary by species and do not correspond very closely with the U&A for the Makah Tribe. Refer to Figure 1-1 for a graphical depiction of the geographic correspondence.

Note: Totals are subject to rounding.

Source: WDFW, commercial catch database.

3.6.3.3 Gray Whale Economic Values

3.6.3.3.1 Summary of Economic Effects of the Makah Gray Whale Hunts

No quantitative information is available concerning the economic effects of the Makah Tribe's practice whale hunt exercises in late 1998, or their whale hunting in the spring of 1999 and of 2000, but anecdotal information from media coverage of the hunts on protest and media activity and subsequent tourism-related effects provides some indication of the impacts on the local economy.

As described in more detail in Section 3.13, Transportation, news accounts indicate that protests and media coverage of the practice whale hunt exercises in 1998 and the hunts in 1999 and 2000 temporarily generated an increase in the number of people potentially seeking accommodations and services in the communities of Neah Bay, Clallam Bay, and Sekiu. The change in local economic activity during these periods is, however, difficult to assess based on available information. For example, based on one account (Sullivan 2000), rooms at the Cape Motel and all other motels in Neah Bay were booked by television stations and newspaper staff during the attempted whale hunts in October 1998. In an article published in the *Seattle Times* on October 8, 1998 (Mapes 1998a), however, it was noted that, "One of the biggest surprises of this hunt has been the small turnout of protesters," although the article may have been referring to the demand for accommodations in and near Neah Bay rather than the actual number of protesters near the hunt. According to the article, which noted that protesters were primarily staying in Sekiu, "Campgrounds are empty, and some motels still have vacancies." The same article reported that about 40 media representatives from all over the world were in the Neah Bay area covering the possible whale hunt during October 1998. During the May 1999 whale hunt, which occurred on four days of one week, the journalists who took up temporary residence on the reservation hired a boat to transport them to the hunting grounds (Sepez 2001). Protesters again arrived in the Neah Bay area during whale hunts in spring 2000 (Oldham 2003). Comparing the spring 1999 and 2000 hunts, the number of protesters decreased from a peak of 50 people during the 1999 whale hunt to a core group of less than 24 people (Welch 2000). Groups of protesters (numbering up to 40 people) staged weekly protests near the Makah Reservation boundary, sometimes temporarily blocking State Route 112, the only paved route to the Makah Reservation, during the 1999 and 2000 hunts (Mapes and Solomon 1999a; United States Coast Guard 1999b; *Seattle Post-Intelligencer* 2000).

In addition to onsite protests, the Makah whale hunts generated calls for boycotts of Makah tribal enterprises and Washington State products by some groups and individuals opposing the hunts. For example, as early as 1997, members of the Sea Shepherd Conservation Society, a leading opponent of the hunts, reportedly suggested calling for a boycott of tourism on the Olympic peninsula (Westneat 1997). Again, in 1998, it was reported that some activists threatened to organize a boycott of Olympic Peninsula tourism (Simon 1998), although organized boycotts apparently never materialized. In March 1999, an Australian-based animal-rights group called Australians for Animals launched an international boycott of apples produced in Washington State to protest the Makah Tribe's whale hunts, with the group's president claiming that over 1 million people had signed onto the boycott; however, the boycott apparently had no immediate effect on sales of Washington apples (Mapes 1999). Additionally, the Makah Nation was reportedly listed as the target of a boycott by Co-Op America, an economic action group that teaches individuals how to invest in environmentally responsible ways (Glass 2000). No information is available to determine whether any of the individual or group calls for boycotts had any effect on Makah tribal enterprises, Olympic Peninsula tourism, or Washington State commerce.

Anecdotal information suggests that any economic effects on tourism may have been minor, as reported in a *Seattle Times* article in August 1999 (Associated Press 1999). Gordon Bentler, the owner of the Cape Motel in Neah Bay, was quoted in the article as saying, "I've noticed no drop. In fact, I think we're probably up this year over last." Also quoted in the article was Rick Hert, executive director of the North Olympic Peninsula Visitor and Convention Bureau, who indicated that room-tax figures from Clallam County hotels and motels appeared relatively flat during the summer of 1999. Last, Bob Buckingham, manager of the marina in Neah Bay, was quoted as saying, "We haven't seen any sign of that [the hunt] affecting us out here. Our actual marina revenue is up from last year so far. We're getting quite a bit of tourism up here."

3.6.3.3.2 Commercial Value of Whales

In the past, whales were valued worldwide as a commercial resource, primarily to satisfy the global demand for whale oil, but also for human and animal foods, fertilizer, leather, and pharmaceuticals (Freeman and Kreuter 1994). Commercial whaling resulted in widespread depletion of many whale species, so governments began to develop regulations and policies to sustain and conserve the whale resource (Section 3.4.3.2.2, Protection and Recovery after Commercial Exploitation, for more information about the development of legal protections). Though a moratorium on commercial harvest of gray whales and right whales had been in place since 1937 and was reaffirmed in the 1946 ICRW, commercial harvests of other whale species

occurred as late as the 1970s and early 1980s. In December 1971, the United States banned all commercial whaling by United States nationals and sought an international moratorium on the commercial killing of all whales in the IWC arena starting in 1972 (16 USC 916 note, Public Law 96-60, August 15, 1979). As noted in Section 3.12, Aesthetics, Congress found that "whales are a unique marine resource of great aesthetic and scientific interest to mankind" and declared that "the protection and conservation of whales are of particular interest to citizens of the United States" (16 USC 916 note, Public Law 96-60, August 15, 1979). Congress also found that "marine mammals have proven themselves to be resources of great international significance, aesthetic and recreational as well as economic" (16 USC 1361(6)). The IWC adopted the commercial whaling moratorium in 1982, and implemented it in 1986. Some commercial whaling does exist today; Norway conducts commercial whaling under an objection to the ICRW's commercial whaling moratorium (see information about Article V.3 objections in Section 1.2.4.1.1, Functions and Operating Procedures of the IWC). Iceland and Japan conduct scientific whaling under Article VIII of the ICRW, but not for gray whales.

More recently, whales have become a commercial resource for the whale-watching industry, a fast-growing tourist activity in several regions of the world (Freeman and Kreuter 1994). In 1994, Kalland reported that participants at a marine mammal conference in 1980 estimated the non-lethal commercial value of cetaceans to be about $100 million dollars, approximately the same value as commercial whaling industries of the day (Kalland 1994). He noted that commercial whaling had largely ceased, and the non-lethal commercial value of whales had increased. About a decade later, Hoyt (2001) reported that whale-watching (including vessel-based whale-watching and whale-based tourism out of 'dolphinaria,' where some places market swimming with whales) was still on the rise. The number of whale watchers worldwide more than doubled between 1991 and 1998, from 4 to 9 million people per year, and the total expenditures increased from $504 million in 1994 to $1 billion in 1998 (Hoyt 2001). Since 1994, the United States has claimed more than a million whale watchers, and other countries, including Canada, joined the 'million whale watch club' around 2001 (Hoyt 2001).

Some people who commented during public scoping expressed their concerns that a gray whale hunt would affect revenues of the local, regional, and west-coast-wide whale-watching industries by causing whales to avoid boats. Although whale-watching was not one of the activities included in the Lillstrom and Associates (2003) study (Section 3.6.3.1.3, Tourism), it is among the attractions that draw visitors to Clallam County (NOAA 1993). Much of the whale-watching in Clallam County is done from land-based locations along its seashore. Few operators in Clallam

County advertise whale-watching tours or charters, although whale-watching charters are available through one resort in Sekiu and may be available through some sport fishing boat operators. Whale-watching is also possible from the two passenger ferries that run between Port Angeles and Victoria.

Whale-watching primarily occurs during autumn and spring, corresponding with the annual southern and northern migrations of the gray whale. Poor weather conditions often make viewing difficult during the fall/winter southward migration. During the spring/summer northward migration, land-based whale-watching opportunities are good from several locations, including Cape Flattery on the Makah Reservation; Shi Shi Bluffs, south of the Makah Reservation; Cape Alava, near the Ozette Indian Reservation on the outer coast; and at La Push on the outer coast (Great Pacific Recreation & Travel Maps 2000).

Outside of Clallam County, whale-watching is an important tourist activity off Westport, located on Washington's Pacific coastline at Grays Harbor, approximately 80 miles south of the Makah U&A. Whale-watching trips originating from Westport occur from March to May, when gray whales can be viewed just off the coast during their annual migration to northern feeding grounds. Most of Westport's 11 charter boat businesses offer whale-watching trips during this period, along with halibut, bottomfish, salmon, and tuna fishing charter trips at various times throughout the year (WestportWa.com 2006). Whale-watching trips range from $20 to $30 per person and generally last 2.5 hours, with many of the charter operators guaranteeing that clients will see a gray whale during their trip (WestportWa.com 2006).

Whale-watching is also an important tourist activity off Vancouver Island. On southern Vancouver Island, whale-watching operators are largely based in Victoria, Vancouver Island's largest city, but a few operators are also based in smaller communities, including Port Renfrew, at the mouth of the Strait of Juan de Fuca, and Sidney and Duncan, on Vancouver Island's southeast shore north of Victoria. Whale-watching operators also reside in Tofino and Ucluelet, located on Vancouver Island's southwest shore.

On southern Vancouver Island, 16 businesses are known to offer whale-watching tours or charters operating out of Victoria, two businesses operating out of Sidney, and one business operating out of both Port Renfrew and Duncan. Several of these operators provide saltwater fishing charters, as well as whale-watching. Tours and charters primarily occur in nearby waters, including the Strait of Juan de Fuca, waters off the Gulf and San Juan Islands, and waters offshore of the city of Vancouver. The whale-watching tours and charters provided by operators focus largely on

opportunities for viewing orcas (also called killer whales) that are part of three orca pods, known as the southern resident pods. The high season for whale-watching operators is mid-April through mid-October, when the orcas are most visible and the seas are calmer. In addition to offering orca viewing opportunities, most operators also advertise opportunities for viewing other wildlife, including gray whales, humpback whales, Minke whales, porpoises, seals, sea lions, and otters (BritishColumbia.com 2005; Whale Watch Operators Association Northwest 2005).

On southwest Vancouver Island, 12 businesses are known to offer whale tours operating out of Tofino and Ucluelet (tofino-bc.com 2007). Tours out of Tofino generally operate in the waters of Clayoquot Sound, while tours out of Ucluelet generally operate in the waters of Barkley Sound. Some tours also include the waters off the western coast of Vancouver Island; none of the operators describes tours that include the Strait of Juan de Fuca, which is 50 miles southeast of Ucluelet. Most tour operators primarily offer opportunities to view gray whales, in addition to opportunities to view orcas and humpback whales. The tours focusing on migrating gray whales typically are offered in March and April. Tours to see locally feeding gray whales during the summer feeding period are available from April until October or November. In addition to whale-watching trips, several operators in Tofino and Ucluelot offer tours to view other wildlife, including sea lions, seals, sea otters, and birds. Some operators also offer bear-watching tours and fishing charters.

3.7 Environmental Justice

3.7.1 Introduction

The primary issue of concern addressed in this section is the extent to which the proposed action would disproportionately affect minority and low-income populations. United States Census data from 2000 are used to describe existing conditions for population, employment, personal income, and poverty characteristics of minority and low-income populations in Clallam County, with particular focus on tribal communities within the county. Makah Tribe (Makah Tribe 2005b) data on employment, personal income, and poverty supplements the United States Census material. These data form the basis for identifying minority and low-income populations, as well as assessing the relative severity of the proposed action's potential impacts on these communities and economies regarding changes in income, employment, net economic value, and direct and indirect sociological impacts. Unlike Section 3.6, Economics, the information and data provided in this section on Environmental Justice excludes non-native persons residing on reservations. Thus, the data provided in the two sections are not directly comparable.

3.7.2 Regulatory Overview

Executive Order 12898, *Environmental Justice*, requires that federal agencies "identify and address the . . . disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." Based on assessment of the demographic data presented later in this section and preliminary analysis of the type and location of effects potentially resulting from the proposed action, the environmental justice analysis for the proposed action focuses on Clallam County's Native American population.

The EPA Office of Civil Rights and Environmental Justice developed guidance for all federal agencies conducting environmental justice analyses. This environmental justice analysis follows the EPA guidelines. The EPA environmental justice guidelines offer a range of categories to indicate the presence or absence of environmental justice effects (EPA 1998). Consequently, this indicator-based assessment draws topically from the range of indicator categories EPA (1998) outlined, from information provided in other sections of this environmental impact statement, and from other information relevant to the circumstances of the tribal communities.

3.7.3 Existing Conditions

Existing conditions for the environmental justice analysis are based on information on minority populations in Clallam County. This includes information on demographics, employment, personal income, and poverty characteristics of these populations.

3.7.3.1 Minority Populations

The following sections provide information on the size and demographic characteristics of minority populations in Clallam County, including Native American populations and the Makah Tribe.

3.7.3.1.1 Clallam County

In 2000, Clallam County's population totaled approximately 64,500 residents, with 40 percent of the population residing in the county's unincorporated areas. Among the county's incorporated communities, the largest is Port Angeles, with 18,400 residents, followed by Sequim and Forks, with populations of 4,300 and 3,100 people, respectively (United States Census Bureau 2002).

The population of Clallam County is largely white, with whites accounting for 89.1 percent of the county's residents in 2000 (Table 3-25). American Indians and Alaska Natives (hereafter referred to as Native Americans) are the only other relatively large racial group in the county. The 3,303 Native Americans residing in Clallam County in 2000 accounted for 5.1 percent of the countywide population. Together, all other racial groups accounted for only 5.8 percent of the population. Hispanics, who can be categorized as members of other racial groups for the purposes of the United States Census, accounted for 3.4 percent of the county's population in 2000.

TABLE 3-25. RACIAL DISTRIBUTION OF CLALLAM COUNTY POPULATION IN 2000

RACE	NUMBER	PERCENT (%)
White	57,505	89.1
Native American[1]	3,303	5.1
Asian[1]	731	1.1
Black[1]	545	0.8
Native Hawaiian and other Pacific Islander[1]	104	0.2
Some other race[1]	761	1.2
Two or more races	1,576	2.5
Total	64,525	100.0
Hispanic or Latino[2]	2,203	3.4

[1] This includes persons reporting only one race.

[2] For purposes of the United States Census, Hispanics or Latinos may be of any race, so they are already included in other applicable race categories in the table.

Source: United States Census Bureau 2002

3.7.3.1.2 County Tribal Demographics

Four Native American reservations are located in Clallam County: the Makah Reservation, encompassing Neah Bay; the Jamestown S'Klallam Reservation and off-reservation trust lands at Blyn near Sequim; the Lower Elwha Reservation and off-reservation trust lands west of Port Angeles; and the Quileute Reservation at La Push. Additionally, the Hoh Tribe maintains a business committee office in Forks, although the Tribe's reservation is located near Oil City in Jefferson County. The Quinault Tribe, whose reservation is in Grays Harbor County, also has an administrative office in Forks.

Together, the population of Clallam County's four reservations totaled 2,058 persons, including 1,640 persons of Native American ancestry alone, in 2000 (Table 3-26). Non-tribal members also live on reservation properties, including those married to tribal members and those with jobs on the reservation. According to United States Census data, an additional 1,663 Native Americans in Clallam County lived outside of reservation and trust land properties in 2000. Among the four reservations in the county, Native American populations ranged from 2 people on the Jamestown S'Klallam Reservation to 1,083 people on the Makah Reservation.

TABLE 3-26. POPULATION OF AMERICAN INDIAN RESERVATIONS AND TRUST LANDS IN CLALLAM COUNTY IN 2000

RESERVATION	TOTAL POPULATION	AMERICAN INDIAN[2]
Makah	1,356	1,083
Quileute	371	307
Lower Elwha[1]	315	248
Jamestown S'Klallam[1]	16	2
TOTAL	**2,058**	**1,640**

[1] This includes the population on off-reservation trust lands.
[2] This includes Native Americans reporting only one race.
Source: United States Census Bureau 2002

Table 3-27 contains selected demographics for Native Americans residing on the four reservations in Clallam County. The most notable characteristic of reservation demographics is the youthful nature of their populations. With the exception of the Jamestown S'Klallam Reservation, which had only two Native American residents in 2000, the median age of the Native American populations was well below the median age of 43.8 years for all residents in Clallam County in 2000. The median age of reservation populations ranged from 20.6 years for the Lower Elwha Reservation to 26.3 years for the Quileute Reservation (Table 3-27).

Differences also exist in the average household and family sizes of the reservation populations, which were higher than the countywide averages of 2.31 persons per household and 2.78 persons per family in 2000. Excluding the Jamestown S'Klallam Reservation, average household size ranged from 2.84 on the Quileute Reservation to 3.67 on the Lower Elwha Reservation. Average family sizes ranged from 3.34 on the Quileute Reservation to 3.97 on the Lower Elwha Reservation (Table 3-27).

TABLE 3-27. SELECTED DEMOGRAPHICS OF NATIVE AMERICANS RESIDING ON RESERVATION AND TRUST LANDS IN CLALLAM COUNTY IN 2000

CATEGORY	MAKAH RESERVATION[1]	QUILEUTE RESERVATION[1]	LOWER ELWHA RESERVATION AND TRUST LANDS[1]	JAMESTOWN S'KLALLAM RESERVATION AND TRUST LANDS[2]
Male	54.1%	55.3%	45.3%	50.0%
Female	45.9%	44.7%	54.7%	50.0%
Median age (years)	24.7	26.3	20.6	43.0
Under 18 years of age	37.9%	38.7%	46.1%	25%
Over 65 year and over	4.7%	6.0%	2.3%	25%
Average household size (persons)	2.95	2.84	3.67	2.29
Average family size (persons)	3.44	3.34	3.97	2.60
Owner-occupied housing units	69.9%	89.7%	94.7%	71.4%
Renter-occupied housing units	30.1%	10.3%	5.3%	28.6%

[1] Data represent Native Americans reporting only one race. Non-native residents living on reservations are excluded in this state.
[2] Because of the small size of the Native American population residing on the Jamestown S'Klallam Reservation and trust lands, the data represent the entire population of the reservation and trust lands, rather than Native Americans alone.
Source: United States Census Bureau 2002

3.7.3.1.3 Makah Tribe

The United States Census Bureau (2002) reported that 1,083 Native Americans lived on the Makah Reservation in 2000, compared to 940 Native Americans in 1990 and 803 Native Americans in 1980. An additional 273 non-tribal persons lived on the reservation in 2000, including those married to tribal members and others who work for government agencies. Not all members of the Makah Tribe live on the Makah Reservation. Tribal enrollment, which includes the total number of tribal enrollees certified as being tribal members by the Tribe's leader or designee, was 2,389 members in January 2001, including about 1,200 tribal members who lived off the reservation (Makah Tribe 2005b). Table 3-27 shows selected demographics for American Indians living on the Makah Reservation.

Neah Bay, an isolated fishing and timber community of 794 persons, is the population center of the Makah Reservation, accounting for nearly 60 percent of the reservation's population in 2000 (United States Census Bureau 2002). Most of the Makah residing on the reservation live in Neah Bay, though some live in the reservation's hilly regions and along the road that runs south along the Pacific Ocean side of the reservation (Sullivan 2000).

3.7.3.2 Minority Employment

The sections below provide information regarding minority employment potentially affected by the Makah's proposed gray whale hunts.

3.7.3.2.1 Clallam County

In 2000, Clallam County's minority civilian labor force totaled 2,643 persons (Table 3-28), representing 10 percent of the county's civilian labor force. Hispanics, who, for the purposes of the United States Census, may be categorized as members of other racial groups, had 810 persons in the labor force, accounting for 3.1 percent of the county's total labor force.

Unemployment for minorities in Clallam County is generally higher than for those in the overall countywide population. In 2000, the county's minority population had an unemployment rate of 14.0 percent at the time of the United States Census, compared to a countywide unemployment rate of 7.7 percent. Hispanics, who can be categorized as members of other racial groups for the purposes of the United States Census, have lower unemployment figures than other minorities, at 12.3 percent.

TABLE 3-28. LABOR FORCE, EMPLOYMENT, AND UNEMPLOYMENT FOR CLALLAM COUNTY MINORITY AND NATIVE AMERICAN POPULATIONS IN 2000

	Clallam County					
Category	All Minority Persons[1]	Hispanics or Latinos[2]	Makah[3]	Quileute[3]	Lower Elwha[3]	Jamestown S'Klallam[4]
In civilian labor force	2,643	810	464	122	96	13
Employed	2,266	710	336	95	78	13
Unemployed	385	100	128	27	18	0
Unemployment rate (%)	14.6	12.3	27.6	22.1	18.8	0.0

[1] This includes Blacks, Native Americans, Asians, Native Hawaiian and other Pacific Islanders, persons of some other race, and persons of two or more races.

[2] For purposes of the United States Census, Hispanics or Latinos may be of any race, so they are already included in other applicable race categories in the table.

[3] Data represent Native Americans on reservations reporting only one race. Non-native residents on reservations are excluded from this table.

[4] Because of the small size of the Native American population residing on the Jamestown S'Klallam Reservation and trust lands, the data represent the entire population of the reservation and trust lands, rather than Native Americans alone.

Source: United States Census Bureau 2002

3.7.3.2.2 County Tribal Employment

Native Americans residing on the reservations of Clallam County's four tribes had a labor force of 695 persons in 2000, with 522 of these persons employed (Table 3-28). About two-thirds of the tribal labor force resided on the Makah Reservation, with virtually all of the remaining tribal labor force living on the Quileute and Lower Elwha Reservations. Together, Native Americans on the four reservations had an unemployment rate of 24.9 percent in 2000, much higher than the 7.7 percent rate countywide and the 14.6 percent rate for all minority groups combined in Clallam County. The difference in unemployment rates between Native Americans and the general population in the county may be higher than that reported by the United States Census, because some tribal members may have been available for work, but dropped out of the labor force because of the lack of nearby employment opportunities.

Government employment is important to Native Americans living on the county's four reservations (

Table 3-29). Two industrial sectors linked to government, the public administration sector and the educational, health, and social services sector, generated more than half of all jobs for reservation tribal members in 2000, including 55 percent of the jobs for the Makah Reservation, 46 percent of the jobs for the Lower Elwha Reservation, and 44 percent of the jobs for the Quileute Reservation. Industries related to agriculture, forestry, fishing, hunting, and mining are also important to the reservations, accounting for 19 percent of all job opportunities in 2000.

3.7.3.2.3 Makah Tribe

In 2000, the labor force of Native Americans (primarily Makah and excluding non-native residents) on the Makah Reservation totaled 464 persons, representing 66 percent of the population 16 years old or older (United States Census Bureau 2002). This labor force participation rate was about the same as the rate in 1990 and 1980 (United States Census Bureau in Northwest Area Foundation 2005).

As Table 3-28 shows, 336 Native Americans on the Makah Reservation had jobs in 2000. The census data indicate that 27.6 percent of the tribal labor force was unemployed that year, an unemployment rate substantially higher than the 7.7 percent rate countywide. While relatively high, the tribal unemployment rate suggested by the census data is much lower than unemployment rates reported by the Makah Tribe and the Bureau of Indian Affairs for recent years. Based on the Tribe's estimates of how many of its residents were available for work, but were unemployed, tribal unemployment rates have ranged from an estimated 48 percent in 1991

to 70 percent in 2001 (Bureau of Indian Affairs, Office of Tribal Services, in Northwest Area Foundation 2005).

TABLE 3-29. EMPLOYMENT BY INDUSTRY OF NATIVE AMERICAN RESIDENTS AT CLALLAM COUNTY IN 2000

	MAKAH RESERVATION[1]		QUILEUTE RESERVATION[1]		LOWER ELWHA RESERVATION[1]		JAMESTOWN S'KLALLAM RESERVATION[2]	
INDUSTRY	NUMBER	PERCENT (%)	NUMBER	PERCENT (%)	NUMBER	PERCENT (%)	NUMBER	PERCENT (%)
Agriculture, forestry, fishing, hunting, and mining	80	23.8	13	13.7	6	7.7	0	0.0
Construction	16	4.8	0	0.0	4	5.1	0	0.0
Manufacturing	0	0.0	5	5.3	3	3.8	1	7.7
Wholesale trade	2	0.6	1	1.1	6	7.7	0	0.0
Retail trade	11	3.3	9	9.5	0	0.0	0	0.0
Transportation, warehousing, and utilities	5	1.5	3	3.2	4	5.1	0	0.0
Information	0	0.0	0	0.0	2	2.6	0	0.0
Finance, insurance, real estate, and rental and leasing	4	1.2	0	0.0	0	0.0	3	23.1
Professional, scientific, management, administrative, and waste management services	7	2.1	4	4.2	6	7.7	0	0.0
Educational, health, and social services	67	19.9	25	26.3	12	15.4	2	15.4
Arts, entertainment, recreation, accommodation, and food services	20	6.0	10	10.5	8	10.3	3	23.1
Other services (except public administration)	6	1.8	8	8.4	3	3.8	2	15.4
Public administration	118	35.1	17	17.9	24	30.8	2	15.4
TOTAL	**336**	**100.0**	**95**	**100.0**	**78**	**100.0**	**13**	**100**

[1] Data represent Native Americans on reservations reporting only one race. Non-native residents on reservations are excluded from this table.

[2] Because of the small size of the Native American population residing on the Jamestown S'Klallam Reservation and trust lands, the data represent the entire population of the reservation and trust lands, rather than Native Americans alone.

Source: United States Census Bureau 2002

Due to the seasonal nature of the reservation's tourist and fishing industries, unemployment is generally much higher during winter months than during the summer (Sullivan 2000).

According to the 2000 United States Census, three industrial sectors of the local economy provided three-quarters of the jobs held by tribal members in 2000. As discussed previously, two sectors associated with government activity, the public administration sector and the educational, health, and social services sector, together generated more than half of the employment opportunities for reservation tribal members (

Table 3-29). Additionally, the industrial sector most closely related to the area's natural resources, the agriculture, forestry, fishing, hunting, and mining sector, provided 24 percent of the jobs held by Native Americans on the reservation. Note that the census, which reported 80 jobs in this sector, may have underestimated the fishing-related employment in this sector. According to Makah Fisheries Management (Svec 2007, pers. comm.), commercial fishing alone currently generates 250 jobs for tribal members, suggesting that commercial fishing may generate about one-third of the jobs held by tribal members. This fisheries-related employment is seasonal in nature.

3.7.3.3 Personal Income and Poverty Levels

The sections below provide information on personal income and poverty levels in Clallam County.

3.7.3.3.1 <u>Clallam County</u>

The income of minority populations in Clallam County is generally lower than that of the countywide population. According to United States Census Bureau (2002) income data, the median household income (household income includes the income of all persons considered part of an individual household) for the overall population in Clallam County was $36,449 in 1999. The median household income was lower for all minority populations other than Blacks and Asians (Table 3-30). For Native Americans and Hispanics, the county's two largest minority groups, the median household income was approximately 24.0 percent lower than it was countywide.

The income differences between Clallam County's minority populations and its countywide population were even greater on a per capita income basis (per capita income is the total income of an area or population averaged across all persons within an area or population). In 1999, per capita incomes for minority populations ranged from $9,593 for Hispanics to $18,072 for Asians, compared to per capita income of $19,517 for the countywide population (Table 3-30). For

Native Americans and Hispanics, per capita income levels were 42.1 percent and 50.8 percent lower, respectively, than countywide per capita income.

TABLE 3-30. INCOME AND POVERTY STATUS OF MINORITY POPULATIONS IN CLALLAM COUNTY IN 1999

RACIAL CATEGORY	MEDIAN HOUSEHOLD INCOME ($)	PER CAPITA INCOME ($)	INDIVIDUALS BELOW POVERTY LEVEL	
			NUMBER	PERCENT
Native American[1]	27,652	11,305	828	26.7
Asian[1]	44,583	18,072	93	11.8
Black[1]	40,893	15,813	33	21.7
Native Hawaiian and other Pacific Islanders[1]	34,167	10,643	21	46.7
Some other race[1]	22,188	8,230	267	36.5
Two or more races	28,177	10,410	382	23.2
Total	NA	NA	1,624	25.1
Hispanic or Latino[2]	27,750	9,593	642	33.0

NA = not applicable.

[1] This includes persons reporting only one race.

[2] For purposes of the United States Census, Hispanics or Latinos may be of any race, so they may already be included in other applicable race categories in this table.

Source: United States Census Bureau 2002

With the exception of the Asian population, all minority populations in Clallam County had poverty rates exceeding the countywide rate of 12.5 percent in 1999. The highest poverty rates were for Native Hawaiian and Other Pacific Islanders at 46.7 percent and Hispanics at 33.0 percent (Table 3-30).

3.7.3.3.2 County Tribal Income

As discussed in Section 3.7.3.3, Personal Income and Poverty Levels, median household income and per capita income were lower for the Native American population in Clallam County than for the general countywide population in 1999. Additionally, the poverty rate for all Native Americans residing in Clallam County, at 26.7 percent in 1999, was higher than the countywide rate of 12.5 percent (Table 3-30).

For those Native Americans living on Clallam County's four tribal reservations, median household and family income were much lower than countywide income levels in 1999. Reservation median household income was from 14.3 to 41.5 percent lower than the county's $36,449 median household income (Table 3-31). Similarly, median family income for reservation families was from 28.2 percent to 50.2 percent lower than the countywide median family income of $44,381.

TABLE 3-31. INCOME AND POVERTY STATUS OF NATIVE AMERICAN RESIDENTS ON RESERVATIONS IN CLALLAM COUNTY IN 1999

CATEGORY	MAKAH RESERVATION[1]	QUILEUTE RESERVATION[1]	LOWER ELWHA RESERVATION AND TRUST LANDS[1]	JAMESTOWN S'KLALLAM RESERVATION AND TRUST LANDS[2]
Median household income ($)	21,316	22,125	31,250	60,625
Median family income ($)	25,893	22,000	31,875	61,875
Per capita income ($)	9,835	9,104	8,082	28,238
Percent of families below poverty level (%)	28.9	34.2	31.1	0.0
Percent of individuals below poverty level (%)	31.3	31.7	33.2	0.0

[1] Data represents Native Americans reporting only one race. Non-native residents at reservations are excluded from this table.

[2] Because of the small size of the Native American population residing on the Jamestown S'Klallam Reservation and trust lands, the data represent the entire population of the reservation and trust lands rather than Native Americans alone.

Source: United States Census Bureau 2002

A larger disparity between tribal and countywide income exists for per capita income. In 1999, per capita income for tribal reservation members ranged from $8,082 for the Lower Elwha Reservation to $9,835 for the Makah Reservation (Table 3-31). These income levels are approximately half the $19,517 in per capita income for the countywide population in 1999. Census income and poverty statistics for the Jamestown S'Klallam Reservation are not discussed in this section, although they are presented in Table 3-31, because of the small number of persons residing on the reservation.

Given the disparity in incomes, poverty rates for tribal reservation families and individuals are substantially higher than for the general countywide population (the poverty rate is the percentage of families or individuals living below the poverty thresholds established each year by the United States Office of Management and Budget). In 1999, the percentage of tribal reservation families with incomes below the federal poverty threshold ranged from 28.9 percent to 34.2 percent, compared to 8.9 percent of families countywide (Table 3-31). For tribal individuals, poverty rates ranged from 31.3 to 33.2 percent, much higher than the countywide poverty rate of 12.5 percent.

3.7.3.3.3 Makah Tribe

Native Americans living on the Makah Reservation have substantially lower incomes and experience higher poverty rates than residents throughout Clallam County. According to the United States Census Bureau, the median household income of Native Americans on the Makah

Reservation was $21,300 in 1999 (Table 3-31), 42 percent lower than countywide median household income. Relative to all reservations in the United States, the median income of tribal households on the Makah Reservation has been falling over the past two decades. In 1979, the median household income of American Indians on the Makah Reservation was 48 percent higher than the median household income of all United States reservations. By 1999, this relationship reversed, with median household income on the Makah Reservation 2 percent lower than median household incomes for all reservations (United States Census Bureau in Northwest Area Foundation 2005).

Similar to household income, the per capita income of Makah Reservation tribal members is lower than per capita income countywide, registering 50 percent of the countywide level in 1999. The disparity in income levels explains the relatively high poverty rates for Native Americans residing on the Makah Reservation. In 1999, 28.9 percent of the Native American families residing on the Makah Reservation fell below the federal poverty level compared to 8.9 percent of all families in Clallam County (Table 3-31). Poverty figures for individuals were similar to those for families, with 31.3 percent of the Makah Reservation's tribal members living below the poverty level compared to 12.5 percent of all individuals in Clallam County.

According to the Makah Tribe (2005a), several families and individuals on the reservation depend on federal assistance, including 52 families receiving temporary assistance for needy families, 62 families receiving food stamps, and 106 individuals receiving medical coupons.

3.7.3.4 Outreach to Minority and Low-Income Populations

Outreach to minority and low-income populations was part of the overall scoping process NMFS conducted for the Makah Whale Hunt EIS. Chapter 1 of this EIS contains a description of the scoping process in Section 1.5.1, Scoping Process, as does the scoping report associated with this EIS (NMFS 2007a).

3.8 Social Environment

3.8.1 Introduction

This section discusses the social environment, the complexity of emotions and attitudes of people and communities potentially affected by the Makah whale hunt. The range of feelings and attitudes, as well as the resulting tensions, is described below in the context of the various groups that have expressed an interest in the hunt.

3.8.2 Regulatory Overview

No specific regulations directly address social tensions in the project area.

3.8.3 Existing Conditions

3.8.3.1 Makah Tribal Members

The Makah Tribe values whales for their ceremonial and subsistence uses, including the spiritual role they play in their culture. According to the *Application for a Waiver of the Marine Mammal Protection Act Take Moratorium to Exercise Gray Whale Hunting Rights Secured in the Treaty of Neah Bay*, the Makah have attempted to revive its cultural traditions for the past three decades (Makah Tribe 2005a). The Tribe believes it must revive these traditions to combat the social disruption resulting from the rapid changes of the last century and a half. The document states that rates of teenage pregnancy, high-school dropout, substance abuse, and juvenile crime indicate that the Makah community is still in flux and that the enormous social disruption caused by epidemics, boarding schools, and federal acculturation policy still exists. To reverse these trends, the Makah have reinstituted numerous song, dance, and artistic traditions. The Tribe currently operates a program to restore the Makah language to spoken proficiency on the reservation. Given the centrality of whaling to the Tribe's culture, the Makah believe that a revival of subsistence whaling is necessary to pursue its spiritual renaissance (Makah Tribe 2005a).

In preparation for the 1999 whale hunt, tribal participants engaged in both spiritual and physical training for the hunt. Overall, Makah tribal members experienced an increase in tribal pride (Bowechop 2004). This revival of Makah whaling rituals and traditional knowledge occurred after a 70-year hiatus (Section 3.10, Ceremonial and Subsistence Resources). Hunters reported that the activities accompanying the hunt strengthened tribal member identity as descendants of Makah whalers (Tweedie 2002). One of the elders who grew up speaking Makah reported that Makah language class attendance swelled after the hunt (Oldham 2003). Many community members were present when the first whale was landed at Neah Bay in 1999, and 80 percent

attended the tribal celebration of the first whale hunt (Makah Tribe 2005a). Most Makah felt that the restoration of whaling had improved social and cultural conditions on the reservation. Subsistence whaling, both in the historic and contemporary contexts of the Makah culture, is further discussed in Section 3.10.3.4, Makah Historic Whaling, and Section 3.10.3.5, Contemporary Makah Society, respectively.

Although most Makah Tribe members support the hunt, some do not. According to a 2001/2002 household whaling survey the Makah Tribe conducted, 93 percent responded that the Makah Tribe should continue to hunt whales, 6 percent responded that the Tribe should not hunt whales, and 1 percent was undecided (Renker 2002; Renker 2007). This survey is described further in Section 3.10, Ceremonial and Subsistence Resources. One Makah Tribe member has publicly opposed the hunt, and spoke at the 1996 annual IWC meeting. She reported encountering harassment and hostility from pro-whaling tribal members (Mapes 1998b). According to newspaper account, other members who did not approve of the hunt were less vocal about their dissent (Mapes 1998c). The article indicated that those who spoke out were criticized for disloyalty to their leaders and for exposing tribal dissention to the outside world. According to Keith Hunter, a Neah Bay resident who is not a Makah tribal member, there has been no opposition to whaling of the sort portrayed by many of the anti-whaling advocates (CERTAIN 2000). Hunter claimed that disagreements, concerns, or differences almost entirely healed, and those remaining disappeared on the day the Makah took the whale.

Many people beyond the reservation do not support whaling, and protests were common during the hunting periods. See Section 1.4.2, Summary of Recent Makah Whaling – 1998 through 2007, and Section 3.15.3.4, Behavior of People Associated with the Hunt, for a more complete description of protest activities. Makah Tribe members have expressed frustration with protesters and others who oppose the whale hunt. They believe that protesters, like missionaries and government Indian agents preceding them, are pushing their cultural values on the Makah people and telling them how and how not to be Makah (Johnson 1999).

The Makah Tribal Council provided financial support to both the whaling captain and whaling crew as they were training for the hunts in 1998 and hunting in 1999 and 2000. In 2002, the Council decided not to provide financial support, leaving it up to whaling families to support any hunts, consistent with tribal tradition. In 2002, at least three families were interested in a hunt, and two were actively training (Mapes 2002). The Makah Tribal Council has not indicated whether it would financially support future hunts if they were authorized.

3.8.3.2 Other Tribes

Many other tribes supported, and continue to support, the Makah's right to hunt whales, in part because they want the federal government to uphold treaty rights. In 1999, the *Peninsula Daily News* reported that thousands of Native Americans from Canada to New Mexico anticipated journeying to Neah Bay for a feast to celebrate the successful hunt (*Peninsula Daily News*, the Associated Press, and *Seattle Times* 1999). The hunt was supported by the Northwest Indian Fisheries Commission, an organization of 20 member tribes in western Washington; the president of the Northwest Indian Fisheries Commission gave a speech at the celebratory feast after the whale was killed (Bowechop 2004). In 2003, the Affiliated Tribes of Northwest Indians passed Resolution 03-13 in support of the Makah whaling treaty rights. In 2004, the National Congress of American Indians passed Resolution MOH-04-025, stating the following:

> . . . go on the record in full support of the right of the Makah to freely exercise their treaty right to hunt whales while supporting the rights of Fishing Tribes to marine mammal management without threats, intimidation, harassment, or interference.

The National Congress of American Indians also expressed support for the Makah after the *Anderson v. Evans* (2004) decision. It called upon the United States government and all of its agencies to "support the efforts of the Makah Tribe and affected tribes to restore its full treaty whaling rights." In a 2005 scoping letter on the DEIS, Honor Our Neighbor's Origins and Rights registered its support of the treaty-protected right of the Makah to pursue whaling. A Puyallup Tribe member supported this idea in an interview with the *Seattle Times* by noting the importance of Makah whaling in the context of tribal rights. He mentioned the importance of solidarity, saying "One of the ways we were conquered was by dividing us" (Hamilton 1999a). Some individual Native American commenters for this DEIS did express opposition to the hunt; a summary of the views of these and other individuals is encapsulated below in Section 3.8.3.3, Other Individuals and Organizations.

Immediately after the successful 1999 whale hunt, anti-whaling activists targeted the Muckleshoot, Puyallup, and Tulalip Tribes for their support of the Makah's whale hunt (Burkitt 1999a). The tribes received verbal threats and insults, including a bomb threat to a tribal school (Burkitt 1999a).

3.8.3.3 Other Individuals and Organizations

This section covers the range of attitudes about Makah whale hunting held by Clallam County residents, Washington State residents, United States residents, foreign nationals, and people affiliated with organizations. Both local and out-of-state residents have expressed support for and

opposition to the Makah whale hunt. This section also covers the attitudes of potential tourists who may or may not choose to visit the area due to their perceptions of the whale hunt.

Although the debate can often be characterized as polar extremes of whaling proponents and whaling opponents, the complicated views cannot be reduced to two simple perspectives (Sepez 2002). Some people believe, for instance, that all whaling, including commercial whaling, is acceptable as long as the whale resource remains at a sustainable level based on scientific, principled management. Some people believe that commercial whaling is unacceptable, but that subsistence whaling for aboriginal cultures is acceptable. Some people believe that whaling for any purpose is unacceptable and should not be allowed. The debate about how to manage whales is about culturally based values (Freeman 1994).

Specific to the Makah's past and proposed whale hunting activities, NMFS has received public comments on the 1997 EA, the 2001 EA, and this DEIS. The commenters can be divided into those who support the Makah's hunting of gray whales and those who oppose any hunting of gray whales. The commenters are not necessarily divided along cultural lines (people from indigenous cultures versus people from western societies). Some Native American commenters and individual Makah Tribe members interviewed in the past and while preparing this DEIS analysis disagree with the hunt. Some commenters who did not identify themselves as Native Americans support the hunt. Commenters who have supported or would support the Makah hunt give many reasons for their support, including, but not limited to, their perception of the established treaty whaling right of the Makah Tribe and federal obligations to the Makah Tribe (Section 1.2.2, Treaty of Neah Bay and the Federal Trust Responsibility), the relative health of the gray whale population (Section 3.4.3.4, Current Status of the Gray Whale Population), and the historical and contemporary cultural meaning ascribed to whaling by the Makah (Section 3.10, Ceremonial and Subsistence Resources).

Commenters who did not or would not support the Makah's hunt of gray whales also gave a multitude of reasons, some of them related to social and economic values attributed to the gray whales. Several people, for instance, commented on the beauty of the whales and the emotions they inspire. Many people oppose the killing of whales because they believe whales are intelligent (comparable in this regard to humans) and have sophisticated forms of community and communication. One review states, "stranger than fiction is fact that there already exists a species of animal life on earth that scientists speculate has higher than human intelligence. The whale has a brain that in some instances is six times bigger than the human brain and its neocortex is more

convoluted" (D'Amato and Chopra 1991). In a letter to the *Seattle Post-Intelligencer* editor, one person wrote ". . . I believe whales and other marine mammals are intelligent, and for lack of opposable thumbs, might be creatures equal to humans on the evolutionary ladder" (*Seattle Post-Intelligencer* 1999). In addition, human-like characteristics of whales, such as humpback whales' complicated communication system, and the strong family grouping of orcas, particularly endear whales to people (Sepez 2002). Some people also believe that whales are sentient beings that should be allowed to exist free from human harm.

People both inside and outside of the United States have said that they value the existence of gray whales in the project area as fellow mammals, and they want to know that whales exist unmolested. Many people (mostly local residents) who watch whales in the action area on a regular basis attach existence values to individual whales that have been identified through photo-identification studies. Many people were also concerned about the pain individual whales experience if struck or killed in a hunt. Some people believe that cruelty is necessarily involved in methods used to hunt whales (Freeman 1994).

After the 1999 hunt, many people expressed remorse and anger about the whale hunt in protests in Seattle and Port Angeles in letters and calls to local and regional newspapers such as the *Peninsula Daily News*, the *Seattle Times*, and the *Seattle Post-Intelligencer*. The *Seattle Times* reported that they received almost 400 phone calls and emails running about 10-to-1 against the hunt within hours of the Makah Tribe's successful kill of a gray whale (*Seattle Times* staff 1999). Many people's comments were reactions to the images of the killing of the whale on the morning television news. Some thought the coverage of the killing was inappropriate for television news (Levesque 1999). Some protesters and comment writers expressed violent feelings and displayed racism towards the Makah.

Some DEIS scoping comments suggested that people would boycott products and not participate in tourism on the peninsula and throughout the state as a result of whaling. They were concerned that whaling would cause economic impacts on hotels, restaurants, stores, and tourist-related businesses. Some people opposed using modern technology for the hunt, suggesting that a traditional hunt should be conducted using traditional technology (Section 2.4.5.1, Hunt Using Only Traditional Methods). Although most letters and calls received by newspapers after the successful 1999 whale hunt opposed the whale hunt, many commenters expressed support for the Tribe and the hunt. One letter said, "It is the right of the Makah to keep their culture alive and if whale hunting is part of it, so be it!" (*Peninsula Daily News* 1999). Some

DEIS scoping letters also expressed support for the hunt, remarking on tourist interest in whaling, cultural diversity, and the importance of upholding treaty rights. One scoping comment indicated that the Pacific Northwest embraces all cultures and practices and that people come to the area because of this diversity.

Organizations that oppose whaling in general include animal-rights and marine conservation organizations, the whale-watching industry, and anti-treaty constituents. Some of these groups are opposed to the Makah whale hunt, while others think that aboriginal whaling is an acceptable form of whaling, if conducted in a sustainable manner. More than 350 groups from 27 countries have expressed opposition to the Tribe's whale hunt (Oldham 2003).

In the 1970s, the popular Save the Whales conservation movement began with the objective of preventing the extinction of whale species (Sepez 2002). Information about whales and whaling was advertised by media releases, films, television programs, aquarium shows, videos, books, magazines, paintings, and whale-watching businesses, among other things (Barstow 1996; Sepez 2002). Over time, stemming from the unsustainable commercial whaling practices in the past, an ideological debate has emerged concerning the appropriateness of any whale hunting (Freeman 1994; Stoett 1997). Whales have become symbolic of the need to protect the natural environment, at least in western societies (Barstow 1996; Stoett 1997).

In 2002, after the IWC renewed the gray whale catch limits, some anti-whaling groups announced they would not obstruct the Makah hunt directly (Watson 2002), and one group expressed concern that opposition to the hunt might be misinterpreted as opposition to treaty rights (Mapes 2002). Most whale-watching tour operators are opposed to whale hunting primarily due to economic reasons. Some scoping comments expressed concerns that a gray whale hunt would affect local and regional whale-watching industry revenues by causing whales to avoid boats. The West Coast Anti-Whaling Society, made up of professional whale-watching tour guides, is one group that has opposed Makah whaling (Hamilton 1999b). More information on the whale-watching industry is available in Section 3.6.3.2.4, Contribution of Tourism to the Local Economy.

While Clallam County residents have expressed the range of attitudes about Makah whale hunting described above, a more intense debate about the issue seems to be occurring in and near Clallam County due to proximity to Neah Bay. This intense debate, which includes strong disapproval of and support for the hunt, is evident in the many DEIS scoping letters sent by Clallam County residents, verbal scoping comments recorded at the Port Angeles DEIS scoping

meeting, letters and calls from Clallam County residents received after the successful 1999 whale hunt, and whaling protests in Port Angeles. Of those Clallam County residents who expressed a view during scoping, more expressed disapproval of than support for the hunt.

A local group called Peninsula Citizens for the Protection of Whales actively opposes the hunt. The group's scoping letter expresses the fear that continued whaling will divide the community, and the many tribes in the area will be drawn into the controversy. Members of the group protested near the Makah reservation border in the spring of 1999 (Porterfield 1999). Another local group, Washington Citizens Coastal Alliance, based in nearby Friday Harbor, sent out a travel advisory to several hundred travel organizations, media groups, and individuals, expressing opposition to whaling (Hamilton 1999b). The advisory warned potential tourists to Neah Bay of recent conflicts and violence stemming from the whaling issue. The *Seattle Times* reported that other activists have said that the controversy was ripping apart rural Clallam County and Washington as a whole (Welch 2001).

Several incidents involving violent or near-violent confrontations between whaling opponents and Tribe members have occurred in Clallam County since the Tribe first announced its intention to hunt whales in 1995. It is difficult to determine which protesters are local residents and which are representatives of anti-whaling organizations based outside the area. An anti-whaling activist meeting in Port Angeles in 1998 was the scene of a near-riot when Makah Tribe members showed up uninvited to support whaling (Peterson 2000). One incident in 1999 involved two animal-rights activists tossing ignited smoke canisters at a tribal motorized support boat and throwing an ignited flare into the water near the boat (Porterfield 1999). Another incident involved a protest boat being pelted with rocks and bottle rockets after a group of protest boats converged inside the Neah Bay Marina (Gottlieb 1999). One man burned the American flag and some tires in a Port Angeles park in protest of the whale hunt (Gottlieb 1999). After the successful 1999 whale hunt, Tribe members and the Coast Guard received emails and phone calls with death threats and anti-whaling messages (Hamilton 1999c). Some Tribe members have been refused service at businesses in Port Angeles (Hamilton 1999c). See Section 1.4.2, Summary of Recent Makah Whaling – 1998 through 2007, and Section 3.15.3.4, Behavior of People Associated with the Hunt, for a more complete description of protest activities.

Other evidence of heightened local tensions can be found in a 2001 letter from the Port Angeles Chief of Police and Clallam County Sheriff to NMFS, asking NMFS not to hold public hearings on the whaling issue in Port Angeles for the 2001 EA. The request was made due to concerns that

violent demonstrations would overwhelm the resources of local law enforcement (Port Angeles Police Department 2001).

3.9 Cultural Resources

3.9.1 Introduction

The following section discusses the cultural resources in the project area that may be affected by the proposed action.

3.9.2 Regulatory Overview

Federal and state laws protect and preserve cultural resources. The United States' first preservation law, the Antiquities Act of 1906, was updated and expanded in 1966 when Congress enacted the National Historic Preservation Act, declaring that "the historical and cultural foundations of the Nation should be preserved as a living part of our community life and development in order to give a sense of orientation to the American people." Thus, the National Historic Preservation Act established a national historic preservation program that has operated as a decentralized partnership between the federal government and the states. The National Historic Preservation Act, amended in 1980 and again in 1992 (16 USC 470 et seq.), identified a leadership role for the federal government in historic preservation. Through a partnership with the states, in addition to relationships with Indian tribes, local governments, and private organizations, the National Historic Preservation Act fosters conditions "under which our modern society and our prehistoric and historic resources can exist in productive harmony." These relationships provide broad participation in national historic preservation programs, while maintaining standards consistent with the National Historic Preservation Act and the Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation* (48 FR 44716, September 29, 1983).

Federal agency requirements to consult with Indian tribes are clarified in the Advisory Council on Historic Preservation's regulations, Protection of Historic Properties (36 CFR Part 800), implementing Section 106 of the National Historic Preservation Act. These regulations emphasize participation in this process by state historic preservation officers and the public, including Native American groups. Where the pertinent tribe has taken over all or some functions of the state historic preservation officers, as the Makah Tribe has done, the federal agency must consult with the tribal historic preservation officer for projects occurring on Indian reservations or potentially affecting a tribe's off-reservation traditional cultural properties.

Archaeological resources on federal lands received federal protection under the 1979 Archaeological Resources Protection Act and the 1990 Native American Graves Protection and Repatriation Act. Federal law applies to all federal and Native American lands, and Washington State law applies to all other lands. Washington State Executive Order 05-05 provides for the Department of Archaeology and Historic Preservation to review certain projects not undergoing Section 106 review to determine potential impacts to cultural resources. With respect to cultural resources within the Makah Tribe's traditional territory, the Tribe takes an active role in the documentation and preservation of these resources, including the assessment of potential impacts to its cultural resources.

3.9.3 Existing Conditions

3.9.3.1 National Historical Register Sites

There are three historic sites listed on the National Register of Historic Places near the project area where a whale could be landed (i.e., the Makah U&A waters and shoreline). The first is Quimper's Landing at Neah Bay, which is the site where the Spanish anchored in Neah Bay and laid claim to Cape Flattery in 1790. The anchorage site is in the northeast waters/shore of Neah Bay near Waadah Island. The second is Tatoosh Island, which was a summer home to the Makah Tribe. The Makah landed whales on Tatoosh Island. A lighthouse was erected there in 1857. The third listed site is Wedding Rock Petroglyphs, located on the beach between the Ozette and Sand Point Trails in the coastal strip of the Olympic National Park (i.e., Ozette Triangle). The Wedding Rock Petroglyphs are located in the rocks about the high tide line, and they attract many visitors each year.

3.9.3.2 Archaeological Sites

Around 1750, a substantial section of the Ozette village on the outer coast of the Olympic Peninsula was encased in a spring mudslide. This anaerobic environment preserved wood, bone, textile, and cordage to create unprecedented archaeological preservation. More than a decade of archaeological excavations at this site, beginning around 1970, yielded 55,000 artifacts, 12,000 structural remains, and more than 1 million faunal remains. These archaeological investigations revealed about 2000 years of human occupation along the Olympic Peninsula in the Late Period of the Northwest Coast (Wessen 1981).

3.9.3.3 Other Culturally Important Sites

Of particular assistance in determining the presence and location of traditional cultural properties was the "Makah Traditional Cultural Property Study," prepared for the Office of Archaeology

and Historic Preservation, State of Washington, Olympia, in cooperation with the Makah Cultural and Research Center, Neah Bay (Renker and Pascua 1989). That study recognized the entire Makah traditional territory as a traditional cultural property. For the purposes of the EIS, however, the definition of a traditional cultural property was narrowed to include only those sites known to be directly associated with whaling for which the location has been reported. Makah elders identified First Beach, situated immediately adjacent to Neah Bay, as a site associated with butchering whales. A review of the ethnographic literature did not locate other sites that would meet the criterion of a traditional cultural property for this EIS.

First Beach, situated next to Neah Bay, was where the chief of the Neah Bay village towed his whale for flensing. It was known in the Makah language as *čǐ·ʔawa·ʔiyak*, "place for butchering whales." Renker and Pascua (1989, no. 190) listed this site as a traditional cultural property retaining significance to the Makah Tribe. Other chiefs towed harvested whales to beaches closer to their villages.

There are several, unlisted shell midden sites in the Olympic National Park, and these are actively exposed along eroding beach terraces. There are also unlisted whaling sacred sites, where Makah Tribe whaling families and members would prepare for whaling. The locations of such sites are regarded as private knowledge that is not generally divulged to non-family members. There are no specific known locations that the Tribe uses continually and that could be considered historical sites.

3.10 Ceremonial and Subsistence Resources

3.10.1 Introduction

The following section presents the cultural aspects of the Makah Tribe's proposal to hunt gray whales for subsistence and ceremonial purposes (Section 3.16, Human Health, for further information about the nutritional aspect of subsistence and ceremonial hunting). This section also includes a discussion of the symbolic value of the whale to the Makah people's cultural identity.

3.10.2 Regulatory Overview

The American Indian Religious Freedom Act of 1978 (42 USC 1996) contains the following language:

> . . . it shall be the policy of the United States to protect and preserve for American Indians . . . their inherent right of freedom to believe, express and exercise [their] traditional religions,. . . including but not limited to access to sites, use and possession of sacred objects and the freedom to worship through ceremonials and traditional rites.

Additionally, the Religious Freedom Restoration Act of 1993 (42 USC 2000b) provides protections for religious practice. The statute places the initial burden on a person to establish that religious practices have been substantially burdened. The Makah have asserted that the spiritual and ceremonial practices associated with whaling are protected by these two statutes (Makah Tribe 2006b).

In the Treaty of Neah Bay, the Makah Indian Tribe reserved its right to engage in subsistence activities, including hunting, fishing, whaling, and sealing in its usual and accustomed grounds (Section 1.2.2, Treaty of Neah Bay and the Federal Trust Responsibility). In the Ninth Circuit decision in *Anderson v. Evans*, the Court of Appeals expressly stated that ". . . [w]e need not and do not decide whether the Tribe's whaling rights have been abrogated by the MMPA." The court also noted that ". . . [u]nlike other persons applying for a permit or waiver under the MMPA, the Tribe may urge a treaty right to be considered" during review of the Makah Tribe's request (*Anderson v. Evans* 2004).

3.10.3 Existing Conditions

The Makah call themselves *qwidiččaʔatx̣,* which is generally thought to mean "residents of the place of rocks and seagulls." They are, however, best known by the anglicized term *máq̓áʔa*, which is used by their Klallam neighbors to refer to the Makah Tribe. The Makah Tribe continue to reside on lands within their traditional territory situated on the northwest tip of the Olympic Peninsula, bordered by the Strait of Juan de Fuca and the Pacific Ocean. Tribe members maintain a strong orientation to the sea and the resources it provides.

Both linguistically and culturally, the aboriginal Makah people were closest to the Ditidaht and Nuu-chah-nulth peoples of western Vancouver Island, with whom they shared the occupation of whaling. While ties to these Canadian neighbors continue, the people of the contemporary Makah Tribe participate with other western Washington tribes as members of the Northwest Indian Fisheries Commission, whose mission is the conservation of fisheries dependent upon effective and progressive management (Northwest Indian Fisheries Commission 2005).

3.10.3.1 Makah Archaeological Resources Connected with Whaling

Much of the archaeological and historical evidence of the Makah whaling tradition was obtained through a large excavation of a Makah whaling village (Ozette) that was occupied by the Makah Tribe from 400 B.C. to 1920. Around 1750, a substantial section of the Ozette village on the outer coast of the Olympic Peninsula was encased in a spring mudslide. This anaerobic environment preserved wood, bone, textile, and cordage to create an unprecedented archaeological

preservation. More than a decade of archaeological excavations at this site, beginning around 1970, yielded 55,000 artifacts, 12,000 structural remains, and more than one million faunal remains. These archaeological investigations revealed about 2000 years of human occupation along the Olympic Peninsula in the Late Period of the Northwest Coast (Wessen 1981).

Aboriginal people began moving from interior riverine sites to the bays along the Pacific Ocean around 400 B.C., where they then adapted to a maritime orientation. This adaptation brought about an increase in sea mammal hunting, including whaling, which, along with deep sea fishing, necessitated the development of the large, seagoing canoes described ethnographically by Waterman (1920). An archaeological walking survey of Makah territory, complemented with test excavations at six additional sites representing divergent environmental zones, indicated that all of the investigated sites shared an orientation towards sea mammal hunting that was seen most clearly at Ozette (Friedman 1976:204).

Based on the recovery of whaling equipment and whale bones with embedded fragments of harpoon blades at the Ozette excavation, archaeologists determined that, for at least 1,500 years, the Makah Tribe paddled out to sea to hunt whales. Earlier, as evidenced by butchered whale bone in archaeological deposits, the Makah Tribe harvested drift and stranded whales (Huelsbeck 1994). The skeletal remains of the gray whale and humpback whale were both equally represented and the dominant whale species recorded in the deposits where the whale species could be identified, suggesting that they were actively pursued by Makah hunters. Moreover, the number of whale bones recovered from different areas of the site representing different time periods did not vary, suggesting that whaling remained stable. Artifacts recovered archaeologically indicate that whaling techniques described ethnographically by Drucker (1951) were used prehistorically (Huelsbeck 1994). Canoe fragments, harpoon shafts, harpoon heads, sinew ropes, and wooden plugs from seal skin floats have all been found (Huelsbeck 1994).

Most of the excavated bones identified as whale could not, however, be identified by species due to limitations of the comparative material available (Huelsbeck 1994). From the skeletal material that could be identified, nevertheless, archaeologists concluded that, at Ozette, whales represented much more food than all the other kinds of animals combined (Huelsbeck 1994). Researchers estimated that as much as 85 percent of the pre-contact diet of the Makah Tribe, that is, their diet before the first arrival of Europeans in the late 18th century, could have been composed of whale meat, oil, and blubber (Huelsbeck 1988). Archaeological evidence in the form of roughly cut and gouged bones suggests that the Makah, in addition to rendering blubber for oil, extracted oil from

bones, a practice not reported ethnographically (that is, through interviews with Makah elders) or through observation of their practices. In addition, partially burned bone suggested roasting as a method of cooking the meat (Huelsbeck 1994). Fragments of whale skin were also found inside the remains of houses at Ozette, a finding consistent with Koppert's (1930) remark that whale skin was eaten. While Koppert (1930) thought that the entire whale was used, other reports differed on the extent of carcass used and/or consumed by the Makah (Waterman 1920).

3.10.3.2 Makah Cultural Environment

At the time of the treaty, the Makah Tribe permanently occupied five villages situated on the northwestern tip of the Olympic Peninsula before contact with Europeans: *di·ya·* or Neah Bay; *bi?id?a* or Biheda; *wa?ač̓* or Wayatch; *čʼu·yas* or Tsoo-Yess; and *?use·?iɬ* or Ozette. In addition to these five semiautonomous winter villages, Makah families occupied seasonal sites, such as fishing camps on the outer coast (Friedman 1976; Renker and Gunther 1990).

Anthropologists classify the Makah Tribe within the Nootkan (Nuu-chah-nulth) subdivision of the Northwest Coast Cultural Area, a cluster of societies that share certain traits and trait complexes. Drucker (1951) defines these traits:

- A marine and riverine orientation that permeated not only subsistence practices but ideology and outlook
- An emphasis on fishing and marine mammal hunting, as well as the gathering of shellfish, other marine invertebrates, and plants
- A highly developed woodworking technology
- A tripartite system of social stratification that included nobles, commoners, and slaves
- An emphasis on property, both tangible and noncorporeal
- The integration of rank and kinship as the basis for social interaction

The Makah Tribe's location and wealth in natural resources placed tribal members at the hub of a far-reaching trading network that extended north to Vancouver Island, south to the Lower Columbia River, and east to the tribes of the Strait of Juan de Fuca. Whale oil and other coastal products passed along this network (Swan 1870; Renker and Gunther 1990).

3.10.3.3 Historic Makah Community

The Makah winter village comprised the primary residential community. The people lived in large, shed-roofed, cedar plank dwellings during the rainy winter months when resource harvesting activities were at a low ebb, and ceremonial life was more active. People identified themselves primarily with their winter village, but individuals maintained kinship ties with

several villages, not all of them Makahs. Kin units among the Makah were organized on the basis of non-unilinear descent, meaning that members all acknowledge descent from a common ancestor traced through either males or females. Leadership tended to be controlled by a patrilineal core of elite residents, generally consisting of a father and his sons with their families, resulting in households being quasi-lineages that controlled production, consumption, and resources. Hence, these elite groups of kinsmen were the chiefs who owned the resources and organized the work of others for resource harvest and distribution.

The elite members of Makah society were the titleholders, the chiefs or nobles who held rights to inherited leadership positions. Despite their considerable prestige and ritual authority, however, they held limited political power. Chiefs had influence, but could seldom compel other individuals to act against their will. Commoners and slaves formed the lower two strata of society. The former enjoyed the privileges of membership in their descent group and had access to resources and ceremonial prerogatives, although commoners did not have rights to ranked titles. Slaves, however, obtained through capture or purchase from other tribes, were human property devoid of rights (Drucker 1951; Colson 1953; Renker and Gunther 1990). Such distinctions in rank and status declined following guidelines set forth in the Makah Tribe's 1855 treaty and the establishment of the Neah Bay Indian Agency in 1863. Under the influence of Indian agents who promoted assimilation, the Makah Tribe's pre-contact, visible sociopolitical organization was weakened. In 1879, the community of Neah Bay held its first election for headmen, the result of which was recorded by James Swan, who noted that similar proceedings were soon to be held at the other Makah villages (Goodman and Swan 2003).

3.10.3.4 Makah Historic Whaling

At least seven species of whale are distinguished in the dialects of the Makah Tribe and their Nuu-chah-nulth neighbors (Swan 1870; Sapir 1910 to 1914; Waterman 1920; Densmore 1939; Stonham 2005). From review of the ethnographic record, especially the work of Drucker (1951), whales, from the perspective of the Makah Tribe and neighboring aboriginal groups on the Northwest Coast, differed little from humans: both have human form, live in houses (although the whale's home is at the bottom of the ocean), and travel about in canoes. The aboriginal people believed that the familiar bulbous gray form observed as whale, gray or humpback, was merely a whale spirit riding in its canoe while fishing (Sapir 1910 to 1914). By means of the whaler's ritual supplications, the whale's spirit was enticed to leave its canoe, which allowed the whale's body to be caught (Jonaitis 1999).

Ethnographic reports indicate that Makah Tribe hunters pursued mostly gray whales and humpbacks (Waterman 1920; Drucker 1951), while skeletal remains in archaeological sites suggest that right whales and finbacks may have been taken occasionally, and sperm and orca whale remains probably represent salvaged drift whales (Huelsbeck 1988). The unifying characteristic of those whale species the Makah pursued was a slow swimming speed, enabling their capture by men in canoes. The hunting season for gray whales began in March, when they appeared in numbers off Tatoosh Island on their coastal migration north, and resumed in November during their migration south. Pods of humpback and grays may have remained in the area all summer (Huelsbeck 1994), permitting whale hunting to occur from early spring through the fall.

The killing of whales was the prerogative of titled men among the Makah Tribe (Swan 1870), due largely to the necessary elaborate rituals associated with whale hunting, the cost of outfitting an expedition, and the authority needed to assemble a crew (Drucker 1955). The success of the hunt relied upon the whalers' strict observance of ritual knowledge, which only the elite possessed and which the Makah Tribe believed to be the essential basis of a whaler. Knowledge of and adherence to the rites, along with spiritual assistance received through prayer to the ancestors, was reflected in a chief's wealth. Thus, in Makah theory, the rituals were responsible for one having wealth, and wealth demonstrated the presence and efficacy of a man's spiritual power. Wealthy men married the daughters of powerful chiefs, perpetuating the presence of an elite class and, by selecting spouses from other communities, creating a social and economic network through which wealth, people, and information passed. Drucker (1951) describes the Nuu-chah-nulth groom's harpooning of the door of the bride's house during the marriage ceremony, using an imitation whaling harpoon, complete with floats. The association of whaling with wealth and rank was also evident during marriage ceremonies such as one witnessed at Neah Bay in the 1850s, when the groom's party reenacted a whale hunt upon arrival (Hancock 1927).

In preparation for hunting, Makah whalers trained themselves to acquire spiritual strength and power so that the whale could be killed more easily. Training consisted of ritual bathing, praying, rubbing the skin with boughs or nettles, and imitative performances. Such practices took place at selected, secret locations that were regarded as spiritually powerful places, some of which included elaborate shrines adorned with carved figures and human skulls said to represent the whaler's ancestors (Waterman 1920; Gunther 1942; Drucker 1951; Jonaitis 1999). Each family or extended family had its own secret spot, usually no larger than a room, but kept private from all other families. Even the details of the bather's costume, the prayers, and the type of branches the

whaler used were private knowledge that was passed from one generation to the next according to the rules of inheritance. The absence of centralized dogmatic control of spiritual and ritual practices was characteristic of Makah society. Thus, the practices described in this document and recorded by anthropologists and other early observers as Makah may have been the practices of a particular extended family group, but ritual practice varied from family to family. The widow of one Makah whaler recalled how her husband visited a specific place immediately before the hunt in the early 1940s, and his training continued throughout the whaling season to be ready whenever whales were sighted (Gunther 1942). In one hunting strategy, lookouts were stationed at coastal high points to alert hunters of the presence of a whale.

Chiefs had two methods of obtaining whales: either hunting them from a canoe on the open water and harpooning them, or using ritual to entice them to die and float ashore. A focus of the whaler's ritual activity at his shrine was to entice the whale to relinquish its spirit and allow its body to drift ashore, thereby permitting the chief to avoid the dangers of hunting at sea (Drucker 1951; Jonaitis 1999).

The whale had a special relationship to the noblewomen and, during the hunt, the whaler's wife would act as if she had become the whale. Her movements would determine the behavior of the whale—if she moved about too much, the whale her husband was hunting would be equally active and difficult to spear; if she lay quietly, the whale would give itself to her husband. Towing chants often reflected this association, and the whalers addressed the dead carcass using a term that refers to a chief's wife. His wife greeted the whale when the hunters towed the carcass to shore, and she led the procession to the chief's house (Drucker 1951). This transformation that occurs during the ritual, i.e., noblewoman becoming a whale, has an empirical connection, as the presence of the whale in the village validates the chief's spiritual power, authority, and wealth, including his bond to noblewomen who are themselves descendants of great whalers (Gunther 1942; Drucker 1951; Renker 2002).

Hunting crews were led by the titled nobleman who owned the 30-foot cedar canoe and its specialized equipment and acted as harpooner. There were typically seven other crew members, including a steersman and six paddlers, one of whom was also a diver who fastened shut the whale's mouth after it had been killed. Each of the eight-man crew was physically fit and either possessed hereditary access to the position and its complementary ritual knowledge, or obtained such knowledge through a supernatural encounter (Curtis 1916; Waterman 1920). Each man dressed in special skin clothing adorned with feathers (Sapir 1910 to 1914). A number of canoes

hunted together, each outfitted with harpoons, sealskin floats, harpoon lines of whale sinew and others of cedar, and a variety of knives (Waterman 1920). Several ethnographic reports containing information based on accounts from whalers have described the hunt (Curtis 1916; Drucker 1951). When a whale was sighted from shore, the Makah hunters set out in previously equipped canoes that were kept ready for use. Whales could often be observed close to Umatilla Reef and Swiftsure Bank, near the entrance to the Strait of Juan de Fuca, where the migrating whales would be feeding. A hunt could last for several days and take the hunters far out to sea, a journey that required considerable navigational skills (Waterman 1920).

Curtis' (1916) description of the hunt conveys some of the hunters' specialized knowledge and finely tuned skills that were the necessary complement to the rigorous spiritual training each hunter endured. Yet there was likely no skill more important than that of the chief who wielded the immense harpoon and, only several feet from the whale, thrust it into the flesh of the submerging prey, after the whale's flukes went underwater and could not upset the hunters' canoe. Once harpooned, the Makah hunters threw several other harpoons into the injured animal, until it was finally exhausted. Then the whale hunters began singing to the whale, imploring it to head shoreward as they started the arduous task of towing home their immense catch. When the hunters followed the prescribed rituals, the whale spirit left the body of its host, and the hunters successfully towed the whale to the chief's village for butchering. As they traveled, the hunters continued to sing chants encouraging the whale to move to shore (Curtis 1916; Waterman 1920; Drucker 1951).

First Beach, situated next to Neah Bay, was where the chief of the Neah Bay village towed his whale for flensing. It was known in the Makah language as *čʸi·ʔawa·ʔiyak*, "place for butchering whales." Renker and Pascua (1989, no. 190) listed this site as a traditional cultural property retaining significance to the Makah Tribe. Other chiefs towed harvested whales to beaches closer to their villages.

The villagers hauled the catch as high on the beach as possible. In some communities, all the village children helped pull the whale the last few yards (Drucker 1951). Butchering procedures depended on the species, but ritual and ceremony always accompanied the initial steps as an elderly whaler made the first cut into the whale, now decorated by the Makah with eagle feathers and white down taken from waterfowl, and the men began to strip away square slabs of the valuable blubber. The dorsal section, richest in oil, was reserved for the chief hunter, though he is reported often to have sold or given it away. Choice morsels were reserved for the hunters and for

those leading men who had rights to particular pieces of the whale. The chief whaler, dressed in ceremonial gear, also entertained the villagers with his songs and imitations. He provided the villagers with freshly cooked blubber from his catch and distributed the remainder. The villagers, in turn, sang songs honoring the chief's and the whale's prowess and generosity. For as many as four nights, the chief led the community in ceremonial performances marked by imitations of the whale, the hunt, and songs that praised the whale. Individual whalers owned different songs (Waterman 1920; Swan 1870). Drucker (1951) noted that the Nuu-chah-nulth carried the concept of ownership to "an incredible extreme," with the result that all ceremonial privileges, such as the right to use certain songs and dances, perform certain rituals, or certain acts within them, were owned property.

The Makah probably regarded the whale as a guest in the village in the same way as the Nuu-chah-nulth of Vancouver Island. Thus, once the community had feasted, the hunters had to return the whale's spirit to the sea by casting small pieces of flesh and blubber into the ocean where it could not wash up on shore (Curtis 1916). The whale carcass was then left for the villagers to help themselves (Drucker 1951). This activity was shared by "the entire tribe, great and small, male and female," according to one observer in the 1850s (Hancock 1927), after which the birds and other scavengers picked at the remains on the beach (Waterman 1920). Thus, once the chief had directed the removal of all the blubber, to be eaten fresh or rendered into oil, the villagers took most of the flesh, also for consumption, in addition to the bones and baleen, as needed.

Drift whales ─ those whales that drifted to shore after death ─ were reported to the beach owner by messengers, who were paid for the find. The drift whales were examined to identify any signs of ownership, indicated by specific marks on any harpoon heads embedded in the whale's flesh, or on seal skin floats attached to the harpoon. Whales that had been identified as lost after being harpooned, or that had been cut free when bad weather threatened the hunters' return home, belonged to the hunter, unless another chief's mark was identified. The villagers would congregate on the beach to strip the whale's blubber for their respective chief, after which the people would help themselves to the meat and blubber, again leaving the carcass with most of the bones (Drucker 1951).

Meat that was decayed, which sometimes occurred with drift whales, or whales caught too far from shore on which the flesh began to rot, was left on the beach along with the bones. The villagers took the bones from the beach only when they could serve some purpose; thus, the skeleton with any remaining morsels of meat remained on the shore or was washed out to sea

(Waterman 1920; Drucker 1951). Blubber, however, seldom deteriorated to the extent that it could not be used, if only for technological purposes, and it was not consumed (Waterman 1920; Drucker 1951).

Whale products provided enough blubber and oil for the aboriginal village, as well as a surplus of oil to be traded with neighboring tribes (Lane 1972). An account of exchange included in the journal of John Jewitt, a crewman from an American vessel taken captive by the Nuu-chah-nulth chief Maquinna in 1803, noted that Maquinna's trade with neighboring tribes was "principally train oil," and from the Makah he received "great quantities of oil" and whale sinew (Jewitt 1993). The oil was stored in boxes specially made for the purpose or in bladders or stomachs of marine mammals and certain large fish (Curtis 1916). Whale oil was a standard condiment served with meals, typically used as a dip for dried foods such as salmon and berries (Drucker 1951). Whale oil was also thrown on central fires to fuel the blaze during rituals, and at least one visitor to the area in the mid-1800s observed shell lamps in which whale oil was burned (Drucker 1951). The Makah Tribe made offerings to the supernatural world by burning feathers and whale oil, an act accompanied by prayers from the head of the household (Curtis 1916). In the 1840s, Makah traders provided whale oil to the Hudson's Bay Company's Fort Victoria for shipment to England (e.g., Fort Victoria Journal, December 7, 1846). Additionally, Makah craftsmen used bones and baleen as raw material for tool manufacture and bones as building material (Huelsbeck 1994).

The ethnographic literature is inconsistent regarding the consumption of whale meat, the dark flesh found under the thick layer of blubber (Waterman 1920). Stories recorded by Edward Sapir in the early 1900s tell of Nuu-chah-nulth villagers boiling fresh whale meat, drinking the broth (Arima et al. 2000), and giving feasts of meat and blubber (Sapir 1910 to 1914). Drucker (1951) confirmed Curtis' (1916) earlier report that the whale flesh could be both sun and smoke dried, although statements by Drucker's Nuu-chah-nulth consultants indicate that the meat was dried in smaller quantities than the valuable blubber. So rich was the partly dried blubber that pieces of it were given to suckling newborns until the child's mother could produce enough milk, generally by boosting her own nutrition with extra servings of blubber (Curtis 1916). Swan (1870) reported that only the vertebrae and offal were left unused. Among the whale bone artifacts recovered from the Ozette site are spindle whorls, bark shedders and beaters, cutting boards, clubs, wedges, and tool handles (Huelsbeck 1994). Drucker (1951) also reported the historic use of whale bone for such implements.

Historical and ethnographic accounts provide only rough calculations of the numbers of whales taken annually. The catch of 15.99 and 36.9 tons of blubber was reported and likely a similar amount of meat, depending upon whether the whales were Pacific grays or humpbacks, respectively (Huelsbeck 1988). Another source, writing specifically of the Makah Tribe, estimated that an average whaler might take one or two whales a year, but that a skilled and fortunate hunter might catch as many as five in the same period (Densmore 1939). This is a higher estimate than the numbers harvested between 1889 and 1892 when the entire Makah Tribe (including all whalers) averaged 5.5 whales a year (Huelsbeck 1988).

Reassessments of the role of whaling in aboriginal society indicate that whaling had great economic and social significance (Huelsbeck 1994; Renker 2002) and was not simply a "symbol of chieftains' greatness," with "little economic importance," as anthropologist Philip Drucker (1951) once described whale hunting, in light of the few whales caught by Nuu-chah-nulth men he interviewed in the mid-1930s. Ceremonies, music, and dance associated with this occupation, based on chiefly ownership and rank, held a central role in the maintenance of the Makah social system. A titled family maintained its standing by hosting ceremonies, particularly intervillage potlatches, performing hereditary songs, displaying owned prerogatives, and giving away food and gifts, all of which required great wealth. Even before a successful hunt, whaling chiefs held potlatches at which they made gifts of sticks said to represent strips of blubber to be given at a later date (Drucker 1951). The hereditary privileges owned by whalers and displayed at significant events were games and songs associated with the whale (Goodman and Swan 2003), among them a performance in which the dancers wore gear and imitated the motions of a whale (Densmore 1939).

3.10.3.4.1 Cessation of the Hunt

Historical and ethnographic records indicate that the Makah Tribe hunted whales until the 1920s when this practice went into abeyance. However, this period represented the conclusion of a gradual decline in whale hunting that had taken place since the 1855 Treaty, when 30 Makah canoes hunted together, and each canoe was said to have processed 1,000 gallons of oil (Swan in McDonald 1972). Swan (1870) noted that, even in the 1850s, the Makah Tribe was whaling less than in the past, but he could provide no clear explanation for the decline.

An account of one of the last Makah Tribe whale hunts was reported to the Victoria Colonist in 1905, largely due to the observer's fascination with the Makah Tribe's use of new technology for whaling. In that hunt, 60 Makah hunters in six large canoes stalked a whale. Once the main

harpooner hit the prey, his fellow hunters thrust a large number of iron-tipped harpoons into the injured animal. A steam-powered commercial tow boat then pulled the whale into Neah Bay for butchering (cited in Webb 1988).

By 1916, Curtis (1916) observed that the Makah Tribe had recently revived the practice of whaling. It is clear, however, that the hunt had been untenable for a number of years and had ceased completely by the 1920s. By the time of the last Makah whale hunt, a constellation of factors ─ social, economic, and biological ─ had contributed to the Makah's cessation of the hunt until 1998 (see also Section 1.1.4, Summary of Makah Tribe's Historic Whaling Tradition). It was not the first time that the Makah Tribe interrupted a marine-based occupation, only to resume it when conditions improved. Makah witnesses appearing before the British Commissioners investigating the pelagic fur seal industry in the 1890s reported "for about twenty years the hunting was practically given up" because of the loss of lives at sea while hunting (cited in Crockford 1996). When conditions improved, the Makah Tribe resumed this activity in the early 1900s.

Recent research by Jennifer Sepez (2001) reveals that some Makah families continued to use whale meat and oil after the 1920s, when the hunt was discontinued. However, Sepez hypothesized that the likely source would have been from beached whales, whales caught in fishing nets, or possibly aboriginal whale hunts that continued to occur in Canada in the 1930s. At this time, British Columbia canneries sometimes processed whale meat obtained by aboriginal hunts (Webb 1988).

3.10.3.4.2 Factors Responsible for Discontinuation of the Hunt

Robert L. Webb's (1988) history of commercial whaling documents a steady decline in all species of whale that became the target of commercial whalers. Historical evidence indicates that the bay-whaling, which occurred in the lagoons of Mexico and Baja California in the 1840s, and the shore-based commercial whaling that began off the California coast in 1851 significantly reduced the once-healthy stocks of migrating ENP gray whales along the western coast of Washington. One observer estimated that, around the mid-1850s, 1,000 whales could be seen each day between December and February making their southern migration, suggesting to Scammon (1874) that whales migrating along the coast of California likely numbered about 30,000 a season. When Charles Scammon published his first edition of *The Marine Mammals of the North-Western Coast of North America* in 1874, only 20 years later, he estimated that the number of migrating gray whales did not exceed 10,000 whales.

With the development of the darting gun around 1870, which replaced the iron harpoon hurled by manual strength from the bow of a whaleboat, it became possible for commercial whalers to kill humpback whales (Webb 1988). This placed the industry in direct competition with the Makah Tribe, who hunted this species along with the gray whale.

The new whaling methods included steam-powered chaser boats on the sea and oil-fired steam rendering plants on shore, making easier, faster hunts possible and providing diverse new products from the raw materials. Although whale oil now competed with less costly petroleum products and vegetable and mineral oil, new ways of processing the oil kept it in demand and facilitated a renewed interest in whaling on the Northwest Coast in the early 1900s (Webb 1988). Humpback whales found in inlets and bays were hunted, along with blue and finback, and a new factory-ship technology permitted a resurgence of the gray whale hunt. Over a 10-year period, whale stocks dwindled. Thus, when the Makah Tribe and their Nuu-chah-nulth neighbors on Vancouver Island attempted to hunt whales in the early 1900s, few whales remained in the local waters (Webb 1988).

When World War I began, the government urged the public to consume whale meat without much success, as most Americans did not have a taste for the meat, although it appears that the Makah Tribe continued to enjoy it, and they consumed some whale meat processed by Canadian canneries (Goodman and Swan 2003). By the 1930s, with whale stocks almost entirely depleted, the whaling countries began to see the need to control the numbers of whales being taken. At a London conference in 1937, member countries adopted the International Agreement for the Regulation of Whaling, which applied stringent controls on the numbers and species of whales being killed. The gray whale became protected, along with right whales (except for a few taken by permit), by those countries participating in the agreement (Webb 1988). Commercial hunts depleted stocks of humpback whales as well, but international agreements did not protect this species until 1965 (Webb 1988).

Government policies, as Jennifer Sepez (2001) discussed in her doctoral thesis on the Makah Tribe's subsistence economy, affected both subsistence and commercial hunting efforts by regulating activities and creating incentives or disincentives. Historians and biologists agree that, other than regulations that protected the United States market for whale products, almost a century of commercial whaling occurred without regulation. This lack of regulation was viewed as responsible for the near-extinction of whale stocks on the Northwest Coast. Nevertheless, as reviewed below, it appears that, in addition to the decline in whale stocks, the Makah's increasing

involvement in the pelagic fur sealing industry also contributed to the Tribe's cessation of the whale hunt.

The skills that made the Makah successful whale hunters also made them valuable participants in the pelagic sealing industry of the nineteenth century. This commercial industry was an outgrowth of the Makah Tribe's aboriginal subsistence and fur-trade sealing efforts. By the 1860s, commercial sealing, relied substantially upon a contracted, aboriginal wage-labor force with the keen knowledge of navigation and watercraft needed to succeed at sealing. The shore-based hunt was considered dangerous, as the hunters followed the seals far from land in open canoes. In 1865, the Indian Agent at Neah Bay began chartering schooners to assist the Makah in their offshore hunts (Lane, cited in Crockford 1996). By the mid-1870s, the schooner owners benefited from the near-abandonment of the aboriginal people's shore-based seal hunt, as more men signed on to work from schooners and hunt seals (Crockford 1996).

The pelagic seal hunt relied upon certain elite tribal men continuing in their role as administrators of community economic activities. Whereas these men formerly organized the harvest and distribution of local resources, they now organized crews for the schooners. However, the more equitable distribution of the proceeds equalized the relative ranking of the participants, as the trade economy elevated the resource beyond the level of subsistence and put greater wealth directly in the pockets of crew members (Crockford 1996; Goodman and Swan 2003). Commoners were now ostensibly equal to chiefs, with opportunities available to them as individuals. Thus, the titled class could no longer expect the privileges that aboriginal whaling had helped them maintain, except in ceremonial potlatches and social networks. By 1875, sealing for furs was the Makah Tribe's chief form of income. By 1893, Makah Tribe members owned 10 sealing schooners. These vessels earned a healthy income for their aboriginal owners, but set these men apart from those who did not share in the profits of the new economy. Eventually, over-harvesting and government regulations led to diminished profits and, ultimately, the end of the seal hunting industry. In 1897, the United States government signed an international convention that effectively banned pelagic seal hunting by its citizens, and the once-successful Makah hunters were left waiting for compensation for their lost business, which they believed had been secured to them by treaty. As late as 1957, Murray (1988) reports the Makah Tribe was still appealing to Washington for payment due to losses incurred because of the 1897 law and the seizure of a Makah sealing schooner operating in Alaska. Shooting harbor seals for food continued through the 1990s, long after the hunting of fur seal ceased, as seal oil provided the Makah Tribe with fat that was rendered into oil and used as a condiment (Sepez 2001).

Government agents among the Makah Tribe made considerable, yet ineffective, efforts to promote self-sufficiency through agriculture on the reservation. Some agricultural opportunities became attractive to the Makah Tribe, especially because crop production provided cash, was open to all members of society, and, in the case of the hop and berry fields, permitted families to remain together while they worked as wage laborers. Unlike occupations such as sealing, in which only men were hired, and several Makah men became affluent, whole families could be employed on farms for low wages. Government agents also encouraged Makah children to adopt new values introduced through Christianity and education. In the 1870s, the United States government made potlatching, bone games, and other ceremonial activities illegal, as these activities were regarded as primitive and backwards, resulting in the Makah Tribe's loss of hosted occasions that advanced and recognized the status of leading whaling families (Goodman and Swan 2003). By the early 1900s, the Makah Klukwali (wolf ceremony), and Tsayak (curing ceremony), secret societies involving dramatic reenactments that had been performed by such families, had faded from public view (Goodman and Swan 2003). These secret societies either relocated to offshore islands or adopted a European-like façade to avoid interference by American authorities.

Another direct effect of government policy occurred in 1879 when the first election of chiefs or headmen took place at Neah Bay, followed by elections in the other Makah communities (Goodman and Swan 2003). It is likely that the community elected men of high rank, thus undermining the Indian agents' efforts to equalize the position of all Makah Tribe members. Introduction of the dominant American society's values, including the ideal of equality among all persons, was an expressed goal of United States government Indian assimilation policy in the late nineteenth century (Renker 2002; Goodman and Swan 2003). Yet the Indian agents' attempts to displace the authority, and consequently diminish the acquisition of wealth that accompanied chiefly positions, including that of the titled men who once carried out the whale hunt, took its toll on the community's recognition of traditional leadership. In the absence of the hereditary system, disagreements arose among those still claiming chiefly descent who expected recognition of the rights that flowed from these inherited positions (Goodman and Swan 2003). Despite changes in leadership positions, Makah families of high status kept alive some of the practical and ritual knowledge associated with the whale hunt, even in times of inactivity, although the relative influence of these families within the community declined with the changing economy (Drucker 1951; Goodman and Swan 2003). Drucker found similar retention of whaling knowledge among the Nuu-chah-nulth (1951). In the mid-1930s, he found that the chiefs of one

group passed down "both ritual and practical features of the [whaling] complex" to four generations without whaling, before their resumption of the hunt. According to Renker (2007), this transfer of whaling knowledge within Makah families has continued to the present day. The Tribe's 2007 needs statement explains as follows:

> …the Makah desire to reinvigorate the whaling tradition never dissipated. Families passed on whaling stories, traditions, and secrets from generation to generation. Whaling designs and crests still decorated public buildings and private homes. Accounts of Makah whalers were read again and again. Whaling displays in the Makah Cultural and Research Center and other museums kept visual scenes in the heads and hearts of Makah people. (Renker 2007)

3.10.3.5 Contemporary Makah Society

Several post-contact factors (that is, influences brought about after the arrival of the first Europeans in the late eighteenth century), including epidemic disease and mandatory schooling, resulted in consolidation of the five traditional villages into the single community situated at Neah Bay where most of the on-reservation Makah population now resides. The Neah Bay community primarily consists of single-family dwellings, including mobile homes and Housing and Urban Development houses, with housing for seniors located in the center of the village across from the Senior Citizens Center. The churches, schools, public health facilities, Makah Cultural and Research Center, and a large community center where revived potlatches, bone games, and other community functions are held are located in the community of Neah Bay.

Since 1931, Neah Bay has been connected with communities to the east by road on the Olympic Peninsula, although Makah life remains oriented to the sea. Subsistence and commercial salmon and halibut fishing have remained central to the Makah economy, especially after the cessation of the pelagic sealing industry at the end of the nineteenth century, due to the reservation's proximity to some of the biggest halibut fisheries on the Pacific coast (Colson 1953; Sepez 2001). From the 1950s through the 1970s, Makah men worked as loggers cutting timber from the reservation and nearby hills (Colson 1953).

The Makah Air Force Base, established in the area in the 1940s, closed in 1988. Its facilities are now occupied by tribal agencies and Tribal Council offices (Goodman and Swan 2003). Notwithstanding personal preference, a chronic housing shortage at Neah Bay now requires some tribal members to live in neighborhoods outside of Neah Bay, specifically Wa'atch, Baadah, Pacific Beaches, Diah't, and a housing development at Eastern Bayview (Sepez 2001).

The lineage group, or Makah family, is the fundamental element of contemporary intratribal identity, according to Sepez (2001), who notes that it is also the basic social unit in which cultural

traditions are passed between generations. Families hold divergent views of tradition, especially in spiritual and ceremonial activities, but also in the types of natural resources harvested and the amounts consumed. Most households, however, consume local subsistence foods during the year (Sepez 2001).

Logging that sustained the community relatively prosperously in the mid-twentieth century has now declined, although the Tribe operates Makah Forestry Enterprise, an expanding company engaged in forest management both on and off the reservation. Fishing, which had also declined, is now providing a higher total income than in the recent past, due to the development of trawl fisheries. Apart from these industries and a few small business enterprises, government is the largest employer in the area. Makah members no longer work in agriculture, because the hop and berry fields of western Washington turned into residential areas. Tribal artists produce jewelry, silk screen prints, and clothing with aboriginal designs for sale in local shops.

In response to the 1934 Indian Reorganization Act, the Makah Tribe wrote a tribal constitution and created the *Makah Tribal Council*, which replaced the former system of chiefs as the daily political arm of the Makah Tribe. Any enrolled member of the Tribe who resides on the reservation is now eligible to run for office, regardless of the class, rank, or status of particular ancestors (Goodman and Swan 2003). Other government policies were also reversed by the 1934 statute, particularly the previous practice of allotting tribal land to individuals. The act also supported Indian religious freedom and promoted a revival of Makah culture (Goodman and Swan 2003). Congress enacted the American Indian Religious Freedom Act in 1978 to further protect and preserve American Indians' inherent right to freedom to believe, express, and exercise their traditional religions (Trope 1994). This act was followed the next year by the Archaeological Resources Protection Act of 1979, which specifically mandates that the American Indian Religious Freedom Act be considered in the disposition of archeological resources. Subsequent legislation, the Native American Graves Protection and Repatriation Act of 1990, mandated the return of Makah and other tribes' sacred objects, objects of cultural patrimony, human remains, and associated funerary objects from federal agencies and federally funded museums (and universities) (Thornton 1994).

Makah Days, initially started in 1926 to celebrate the extension of American citizenship to American Indians, have evolved into a major three-day event held each August. The event celebrates Makah culture and attracts hundreds of visitors, both aboriginal and non-aboriginal. Months of community preparation culminate in a cultural festival highlighting traditional foods,

dancing, singing, and games, in addition to more contemporary events such as a parade, fireworks, and sporting events (Tweedie 2002). For this occasion, families share their less prestigious songs and offer training in dancing to non-family members. The songs and dances are used for public performances that, along with displays of athletic excellence, generate feelings of Makah solidarity in friendly opposition to other tribes, reinforcing the Makah Tribe's identity (Bates 1987).

Traditional Makah ceremonials that had declined by the 1950s have had a resurgence, beginning in the 1960s, due to the diligence of a small group of elderly Makah women who were well trained as children and retained knowledge of ceremonial affairs. They guided a new generation of Makah Tribe members who valued the cultural traditions of their people and began hosting community events (Goodman and Swan 2003). This coincided with the archaeological recoveries at the ancient Ozette site, which provided a material foundation for the revitalization of cultural activities. The Ozette investigations provided an important impetus for renewed respect of and interest in the knowledge of Makah elders who worked cooperatively with archaeologists in identifying artifacts. These individuals also provided the necessary guidance to establish the Makah Cultural and Research Center, a tribally owned and operated institution committed to the support of Makah cultural activities and the interpretation of the Ozette artifacts (Erikson 2002). The Makah elders decided to showcase the hunting of whales and seals in the Makah Museum's displays (Sepez 2001).

A number of clubs devoted to cultural activities also began in the 1950s and 1960s, including the Makah Club, the Sla-hal Club, the Makah Arts and Crafts Club, the Hamatsa Club, the Makah Canoe Club, and the Warrior's Club (that honored tribal members who served in the United States military). The revaluation of Makah traditions that occurred during this time provided an impetus for families to bring out songs and dances that had not been performed in decades (Erikson 2002). Federal funds made supplementary cultural programs possible, including a comprehensive summer program with funds for elders to develop classes in traditional crafts, music, and the Makah language (with a Makah language K through 12 program in the schools) (Erikson 2002:111 to 119). The resurgence of these programs has provided new outlets for Makah traditions; community events are now common occasions for singing and dancing, and the museum provides ongoing educational programming (Erikson 2002:168-171).

Potlatching increased in the 1960s, along with the resurgence in cultural awareness. Among the Makah tribal members, this activity appears to fluctuate with economic times. When better

economic prospects returned with an improved United States economy in the 1990s, several families hosted potlatches, some costing as much as $15,000 per ceremony (Goodman and Swan 2003). Ceremonial affairs may lack the complexity of former events, Goodman and Swan (2003) observe, yet many potlatch elements described in the nineteenth century can still be seen today as singers perform family-owned songs, young people receive ancestral names, guests participate in group dances, and the hosts serve great quantities of traditional native foods. Many of these songs and dances are those passed down among high-status whaling families and are used to publicly display their family wealth gained and maintained through generations of whaling.

Some of the five Christian denominations that established churches in Neah Bay have a history of intolerance towards aboriginal spirituality, while others have recognized the compatibility of Christian beliefs and Makah spiritual life. For traditionally minded Makah, a spiritual life is tied to the lands and waters of their territory, remote places devoid of human activity where private cleansing rituals can take place without intrusion, and initiates can draw near to the supernatural part of the world. Individuals perform rituals and seek proficiency in whatever endeavor they undertake by strengthening their relationship with particular spirits (Drucker 1951). The arduous requirements of whaling have led to the rejuvenation among some Makah hunters of whaling rituals, which are based on private family knowledge (Braund et al. 2007).

3.10.3.5.1 Makah Whaling

The cultural role of whaling is vividly demonstrated in the archaeological record and in the ethnographic accounts of the twentieth century that have been summarized above. These published accounts now supplement the Makah Tribe's oral traditions as they prepare for the contemporary whale hunt and consider past traditions for future manifestations of their culture. Many traditions related to whaling have waned, however, since the Makah Tribe's cessation of the hunt in the 1920s. Nevertheless, some of those individuals taking a leading role in revitalizing this occupation are from whaling families of high status who trace their ancestry to men who formerly hunted whales (Tweedie 2002). All this occurs at a time when the Makah Tribe is actively revitalizing its language and cultural traditions. According to Renker (2007), "Makah people had never stopped educating their children about their respective familial whaling traditions." Furthermore, the public school included a whaling curriculum, and the Makah Cultural and Research Center supported whaling education efforts. Renker (2007) noted, "While non-Makahs perceived a large temporal gap in the whaling history of the Tribe, tribal members saw continuity. Many individuals were patiently waiting for the whaling traditions to be taken from storage and implemented in reality."

The day in 1997 that the IWC acted on the United States' request on behalf of the Makah Tribe was marked on the Makah Reservation with celebrations, including giving tribal employees a half-day off and 30 local vehicles forming an impromptu parade, some of the cars and trucks appropriately decorated and horns blaring. An anthropologist observing the event later wrote, "It seemed that the entire village lined the parade route" (Tweedie 2002). The celebration continued the following week with a community potlatch at which tribal singers performed victory songs.

Support for the 1999 and 2000 hunts was subsequently confirmed in a household whaling survey compiled in 2001 and 2002 by the Makah Tribe. Surveyors canvassed the opinions of 35 percent of the on-reservation population concerning their views on the Tribe's resumption of whaling (Table 3-32). The expressed purpose of the survey was to address concerns of some non-tribal citizens who believed that the Makah Tribe did not support whaling and wasted the whale products received from the 1999 hunt. Anthropologist Ann Renker Ph.D., a Northwest Coast specialist with research experience among the Makah, designed the survey with input from the Makah Cultural and Research Center. Dr. Renker also analyzed the results of the surveys, administered by a team of trained Makah members. Of the 217 households of enrolled Makah members randomly selected and contacted for the study, 159 households agreed to participate. Four selected household heads were not interviewed due to their vocal public opposition to the hunt. Nevertheless, the survey instrument for each of these individuals was marked negative for all questions regarding support of the hunt or use of whale products and, thus, was included in the tabulation of results representing the views of 163 households. All respondents were at least 21 years and enrolled Makah members residing on the reservation. The respondents' confidentiality was maintained by using numbered surveys, keyed to a master list of households used for administration purposes, but not released to Dr. Renker during her analysis of the results. The Makah Cultural and Research Center holds the original surveys under restricted access. Dr. Renker's analysis is made available in report form for this DEIS assessment.

TABLE 3-32. MAKAH ATTITUDES TOWARD WHALE HUNTING

ATTITUDE	RESPONSE BY PERCENT (%)[1]
Makah Tribe should continue to hunt whales	93
Makah Tribe should not hunt whales	6
Undecided	1

[1] Survey had 163 respondents; percentages were rounded to the nearest whole number.
Source: Renker 2002.

As explanations of the interests and goals driving continuance of the whale hunt, Makah Tribe members' comments were placed into four categories during the survey review (Table 3-33). The

survey noted that 46 percent of respondents cited treaty rights to support the whale hunt (Renker 2007). For many Makah Tribe members, treaty rights, including the explicit right to hunt whales, have become an integral part of their cultural identity. The 150th anniversary of the signing of the Treaty of Neah Bay in 2005 was accompanied by a large community-wide potlatch and an essay contest for local high school students, which was sponsored by the Makah Tribal Council (Renker 2007). Thus, treaty rights play a significant role in Tribe members' present cultural identification with whaling.

Reasons given by the 7 percent of respondents not supporting the hunt, according to Bowechop (2005a), focused on "the timing of the hunt, feeling that the Tribe should wait for a more appropriate time," and "the inequality of women's involvement in the actual hunt."

TABLE 3-33. MAKAH REASONS FOR SUPPORT OF WHALE HUNTING

REASONS FOR SUPPORTING WHALE HUNTING	RESPONSE BY PERCENT (%)[1]
Treaty rights	46
Better nutrition or the desire for a traditional diet	35
Maintenance or restoration of cultural heritage or traditions	36
Moral or spiritual benefits that could be derived from the hunt	20

[1] Percentages are rounded to nearest whole number.
Source: Renker 2002.

The results of the survey reported in Renker (2002) were supported in an independent survey conducted by anthropologist Jennifer Sepez in connection with research undertaken for her doctoral thesis. In her random sample survey carried out in 1998, Sepez (2001) found that 73 percent of households planned to eat whale obtained from future hunts, but she cautioned that many household residents who did not plan to eat whale themselves explicitly stated that they supported the effort on behalf of those households with residents who wished to do so. Moreover, some household members clarified that, while they would not cook whale products themselves, they would consume whale if it were served at community feasts. Looking to the future, the Tribe's 2002 household whaling survey indicated that 87 percent surveyed desired whale meat as part of their regular diet, and 72 percent voiced a desire for whale oil (Renker 2002). Hence, both studies independently confirmed an expressed preference for this traditional food among the Makah Tribe.

The Tribe conducted the household whaling survey following the 1999 kill of a gray whale that was towed to Front Beach at Neah Bay for butchering. Seventy-nine percent of the survey respondents watched television coverage of the whale being taken. A larger number, 81 percent

of the 163 respondents, met the hunters on the beach when the whale was brought ashore. An estimated 1,400 tribal and non-tribal people witnessed the arrival of the whale and its hunters to Neah Bay. People traveled to Neah Bay from other communities to participate in the festivities and camped or stayed with relatives during festivities associated with the successful hunt (Renker 2002).

When asked about the positive benefits to be derived from continuing the hunt, 52 percent of the respondents reported a correlation between the hunt and a better lifestyle (Renker 2002). They viewed the hunt as a vehicle to reinforce traditional Makah values, such as pride, self-esteem, and male responsibility, in addition to combating the contemporary problem of substance abuse (Renker 2002, Braund et al. 2007). As preparation for the 1999 and 2000 hunts, Makah whalers reported enduring intense physical and spiritual training, which culminated in a deep bond between whalers (Braund 2007). Such preparation is considered a private affair among the Makah families (Braund et al. 2007). In some cases, whalers identified individuals who underwent major life changes as a result of participating in the whale hunt (Braund et al. 2007).

The Tribe's 2007 needs statement indicates that the lack of active whaling in the community since the 1999 and 2000 hunts had already negatively affected Makah youth by denying them role models in the form of active whalers. It contains the following passage: "[T]he lack of whaling made it harder for Makah youth to find role models among whalers and removed an incentive for young men to focus on the physical and spiritual requirements necessary to a training regimen" (Renker 2007).

As in the past, the killing of a whale is a focal event in which many Makah people are directly or indirectly involved. Table 3-34 lists some of the activities involved in the 1999 whale hunt, with a tally of the numbers or percentages of Makah Tribe members involved in each activity, based on data obtained during the household whaling survey and contemporary ethnographic literature (Renker 2002; Bowechop 2004, 2005a). Some individuals are counted in more than one category in Table 3-34

While only four canoes of men participated directly in towing the whale ashore in 1999, 38 percent of the Makah surveyed reported that they had participated in ceremonial activities connected with whaling since the 1999 hunt.

TABLE 3-34. NUMBERS AND PERCENTAGE OF PARTICIPANTS IN THE 1999 MAKAH WHALE HUNT

ACTIVITY ASSOCIATED WITH 1999 HUNT	NUMBERS/PERCENTAGE OF PARTICIPANTS
Members of Whaling Commission	23 Makah men representing "all major families"
Preparation of equipment, including canoe	2 Makah men, plus Nuu-chah-nulth mentors who built canoe, and 20 to 25 people making equipment
Training for hunt crew	18 to 20 Makah men
Whale hunt crew	1 canoe (1 head harpooner, 7 men) and 1 chase boat (5 people), all Makah
Towing crew	5 canoes (main canoe and 4 support canoes) and 1 fishing boat; about 60 people, 4 canoes from supporting Northwest tribes
Attendance on beach	1,400 people, mostly Makahs
Butchering	100 people, mostly Makahs
Distribution crew	50 Makahs
Consumption of meat/oil	81% of household whaling survey respondents
Attendance at post-hunt community feast	95% of household whaling survey respondents; "Thousands of other friends and relatives joined our tribe." Approximately 3,000 people total
Attendance at parade	79% of household whaling survey respondents; about 400 people total
Participation in post-hunt ceremonials	38% of household whaling survey respondents
Use of bones	Approximately 60 school children, mostly Makah
Use of baleen	8 Makah hunters

Source: Bowechop 2004 (413), 2005a.

Considering that 43 percent of the respondents also stated that the hunt fostered Makah and intertribal unity, the hunt appeared to be a means of bolstering social accord within the community and provided some positive support for the physical and mental health of the Makah Tribe.

The hunt also provided the opportunity for the revival of Makah whaling rituals and traditional knowledge after a 70-year hiatus (Braund et al. 2007). Hunters reported that the spiritual and physical training, the new-found whaling knowledge and skills gained from the experience, and the activation of inherited whaling customs and attitudes from older Makah members (obtained orally and through the ethnographic collaboration of previous generations) strengthened tribal member identity as descendants of Makah whalers (Tweedie 2002). Whaling songs and rituals also resumed following the 1999 hunt, with more people participating in family songs and sharing traditional knowledge (Braund et al. 2007).

Reintroduction of whaling activities also facilitated a specific vocabulary, now mostly in English, but some in the Makah language, that encapsulates context-based traditional ecological knowledge that once was widespread in the community (Bowechop 2005a). Without engaging in

the hunt, this knowledge lay dormant in the memories of the elders in a few families and in the ethnographic accounts of previous generations. Bowechop (2005a) reports a gradual increase in the attendance of language and cultural classes, with the highest attendance corresponding with the resumption of the whale hunt.

The whale hunt provided new experience-based educational opportunities that went beyond the current efforts of the Makah Cultural and Research Center to recover the language, crafts, and Makah ecological concepts that Sepez (2001) explains are offered in schools and at summer camps and underlie and sustain the elders' ecological teachings. The quest for knowledge relating to the ancient activity of whaling reached beyond the whaling crew and community children, for the majority of respondents in the Makah household whaling survey reported a desire to learn more about preparing whale products and using whalebone. They expressed a willingness to share such information with other Makah Tribe members (Renker 2002). Seventy-six percent of Makah households expressed a desire for whale bones, presumably to revitalize certain crafts. The Makah Tribal Council, however, decided to offer the 1999 whale hunt bones to the local school for a bone preservation project. Instructors taught Makah students how to clean skeletal remains and reassemble the whale skeleton for museum display. Early in December 2005, with the reconstruction completed, the whale skeleton was hung in the Makah Cultural and Research Center. Approximately 60 students participated in this project (Bowechop 2005a).

Participation in the 1999 hunt also allowed residents to experience a connection to the past that would not otherwise have been possible (Braund et al. 2007). The connection to their whaling ancestors and to the physical environment also renews Makah cultural and historical identity as whalers (Braund et al. 2007). Renker (2007), discussing the importance of ceremonial activities and practices related to the whale hunt in enhancing the spirituality of Makah Tribe members, wrote "…MWC [Makah Whaling Commission] members share the opinion that the ceremonies which must occur before a hunt, and the clean/sober lifestyle that hunters and their families must have, are a critical part of the Makah Tribe's spiritual profile." She also referred to the Makah whale hunt as "a manifestation of the spiritual connection between Makahs and their Creator." Renker (2007) later suggested that because the activity of whaling is so closely linked with physical, spiritual, and ceremonial obligations, the lack of whaling, especially after already being reintroduced to Makah people in recent years, is harmful to the spirituality of the Makah Tribe. Renker (2007) wrote the following:

> Additional whale hunts bring important ceremonial obligations, because spiritual preparation is an obligation of the whaling crew members and their respective family

> members. Now that almost half of the Makah Tribe's members participate in ancient religious ceremonies, the lack of an active hunt makes it impossible for certain spiritual rituals to be performed. A spiritual void of this nature is devastating for Tribal members, and the connection between unhealthy social behaviors and the inability to practice traditional rituals is common in the writings of noted American Indian authors (Deloria 1973, Josephy 1982).

Renker's tribal survey found that 81 percent of the respondents consumed whale products (blubber, meat, or oil) obtained from the 1999 hunt, although 87 percent would like to have these products available in the future (Renker 2002). Sepez (2001) also quantified the consumption of whale products obtained from the whale taken during the 1999 hunt. The whale provided roughly 2,000 to 3,000 pounds of meat and 4,000 to 5,000 pounds of blubber, most of which was consumed at the community potlatch. Community households received approximately 1.8 pounds per capita distribution of blubber. Together with the estimated 0.55 pound of meat, Sepez calculated that the whale products consumed in 1999 equaled about 2.4 pounds per capita.

Members of other tribes attended the community's celebrations in 1999 witnessing the proceedings and sharing food – necessary components of traditional ceremonials by which a group establishes its status with other groups. When the Makah Tribal Council hosted the community potlatch after the 1999 hunt, the individual whalers received public recognition for their proficiency and commitment, and the Makah, as a tribal group, reaffirmed itself as people of wealth and history who maintain a relationship with the resources of their territory (Bowechop 2004). Within the cultural framework of the Makah people, no other activity besides the whale hunt and community feast is considered to embody such powerful metaphoric expression. Symbols are made meaningful through experience and action, and the whale is the Makah Tribe's symbol for cultural pride and independence. The Makah Tribe regarded the hunt as a means to revitalize and transfer its cultural knowledge associated with the activity.

The resumption of the hunt also provided the Makah Tribe with an opportunity to highlight the relationship with the related Nuu-chah-nulth people of British Columbia, Canada. Both engaged in hunting whales and practiced highly complex rituals believed to ensure the success of the hunt. Makah whalers traveled to Vancouver Island for several weeks before participating in the 1999 hunt to learn whaling techniques and traditions from knowledgeable Canadian elders. Some tribal members from Alaska and British Columbia attended the Makah Tribe's celebration of the 1999 kill (Braund et al. 2007).

In 2006, six years after the last attempt by Makah whalers to hunt whales, the Makah Tribal Council commissioned a second whaling survey to gather information about residents' attitudes

toward participation in whaling, including the actual hunt, ceremonial activities, and consumption and use of whale products. The 2006 survey was designed to follow the same methods used during the 2001 survey. The results of this survey are discussed in the Tribe's 2007 needs statement (Renker 2007).

Support for Makah whaling remained high in 2006, with 88.8 percent of respondents indicating that they supported the continuation of the Makah Tribe's efforts to hunt whales (Renker 2007). This percentage had decreased slightly since 2001, when 95.6 percent of respondents voiced support for the whaling efforts. However, the percentage of respondents opposing the effort to hunt whales increased by less than one percentage point, to 4.0 percent. The remaining respondents were unsure about whether whaling efforts should continue, citing reasons such as financial burdens on the village due to legal efforts, concerns about "racial animosity" which rose during and following the 1999 and 2000 hunts, and the effect of whaling efforts on fishing quotas and treaties.

Most respondents who supported whaling viewed the whaling efforts as being positive for the Makah Tribe (Renker 2007). They attributed the whaling efforts with helping to restore or maintain heritage and ceremonies, as well as increasing tribal unity and encouraging healthy living among youth.

A high percentage of respondents (80.3 percent) continued to desire whale products for consumption or use. Respondents also expressed interest in learning more about the butchering, processing and use of whale products (Renker 2007.).

One area in which positive responses increased significantly from 2001 to 2006 was in regards to participation in ceremonial activities (Renker 2007). The percentage of respondents participating in ceremonial activities rose from 25.8 percent in 2001 to 41.5 percent in 2006. Regarding this outcome Dr. Renker stated the following:

> The HWS II (Household Whaling Survey II) attests that the ceremonial aspects of the Makah whale hunt are once again becoming a standard part of the life of a majority of Tribal members, even when the Tribe is prevented from hunting because of outside legal struggles (Renker 2007,53)

3.10.3.5.2 Makah Subsistence Consumption

An overview and analysis of contemporary Makah subsistence foraging, focusing on hunting, fishing, and shellfish collecting, indicated that the Makah people continue to rely on their U&A resource harvesting areas for a significant portion of their diet (Sepez 2001). The survey documented the use of approximately 80 species, with most of the diversity concentrated in the

marine resources. While the author of the study was reluctant to rank the resources in terms of importance — largely due to the inability of statistics to discern nonquantifiable qualities of resources that make them important — harvesting and consumption patterns did emerge from the data.

Using household surveys from a randomly selected sample as the basis for her analysis, Sepez (2001) found that 99 percent of the households indicated some type of consuming of local resources for subsistence purposes during the study period. Fully 71 percent of households engaged in harvesting resources, while 94 percent received resources harvested by another household, indicating that sharing resources was a common practice among tribal members. Table 3-35 presents the percent of households using local resources obtained directly or through exchange during the 1997 and 1998 study period.

TABLE 3-35. PERCENTAGE OF HOUSEHOLDS USING LOCAL RESOURCES DURING 1997 TO 1998

FOOD RESOURCE	PERCENTAGE OF HOUSEHOLDS (%)
Halibut, salmon, clams, crab	76 – 100
Mussels, deer, elk, goosenecks, seal, salmon eggs, barnacles	51 – 75
Steelhead, lingcod, olive shells, chitons, octopus, rockfish, smelt, blackcod, herring eggs, grouse	26 – 50
Urchins, lingcod eggs, local cow, petrale sole, trout, tuna, bear, scallop, oysters, sole/flatfish, sea cucumber, squid, sturgeon, true cod, shrimp, rabbits, abalone, duck, pigeon, skate, sea lion, small gastropods, wolf eel	1 – 25
Goose, porpoise, sea anemone, sea otter, sea turtle, shark, whale[1]	

Source: Sepez (2001).

[1] Resources currently used, but not included in the survey

Table 3-35 represents reported local use of the resource. The survey found that the widest range of households uses marine resources. Further analysis indicated that fish accounted for 55 percent of meat and seafoods in the Makah diet, a figure that highlights the cultural significance of marine resources when compared to the average 7 percent of meat and seafoods that occupy the diet of other Americans (Sepez 2001).

Sepez (2001) concluded in her study of Makah subsistence that the tribal members' preference for fish and other resources produced through subsistence channels was specific to the type of food being chosen, but that several social and economic factors influenced the role of subsistence in the contemporary tribal lifestyle:

- Perception of subsistence foods as free for the taking
- Link with cultural identity
- Perception that seafoods taken from other places are unclean or mistreated
- Pleasure in undertaking subsistence activities
- Sense of connection to the local environment and to those who used the resource in the past

Makah members articulated similar statements when asked about their desire for whale products (Renker 2002). No food is more symbolic of the traditional Makah culture than whale, for its consumption serves as a metaphoric reminder of the wealth, history, and social structure of the community (Braund et al. 2007).

The Tribe's 2007 needs statement provides a detailed account of current health issues present within the Makah's and other American Indians' communities and discusses the potential nutritional benefits of consuming whale products, suggesting that a return to eating whale could lead to better overall health of Makah Tribe members, both physically and spiritually (Renker 2007).

Sharing food in contemporary Makah society, Sepez (2001) observes, is "an accepted and expected aspect of subsistence" and recognizes a traditional obligation for generosity, particularly extended to those in need. Within a complex system of reciprocity and redistribution, sharing bolsters one's status within the community and serves to enact one's tribal identity. Table 3-36 charts the percentage of Makah harvesters who shared part of their gains during the 1997 to 1998 study year. Seal meat and oil emerged as the resources most likely to be distributed during the time of the survey, with all hunters of seal reporting distribution of the meat or rendered oil. Sepez (2001) notes that the resource column lists items in descending order of percent of harvesters giving some portion away.

TABLE 3-36. PERCENTAGE OF HARVESTERS OF EACH RESOURCE WHO GAVE AWAY SOME PORTION, 1997-1998

RESOURCE	PERCENTAGE OF HARVESTERS (%)
Seal	100
Halibut, black cod, smelt, octopus, clams, salmon, gooseneck barnacles, fish eggs	99 – 67
Crab, elk, mussels, deer, steelhead, scallops, chitons, ling cod	66 – 34
Olive shells, barnacles, rockfish, grouse, urchins	33 – 1
Trout	0

Source: Sepez (2001).

3.10.3.5.3 Symbolic Expression of Whaling

In both traditional and contemporary Makah society, depictions of the whale and the whale hunt are very meaningful. These symbols were once used only on the property of elite members of Makah or Nuu-chah-nulth society and, therefore, appeared on items such as dance screens or curtains narrated visually with images celebrating the lineage's history, memorial posts to commemorate a chief's greatness, twined whalers' hats decorated with motifs of whaling scenes, wooden images used in ceremonials, and small personal amulets or charms imbued with spiritual power (Black 1999). Chiefs have also tattooed whales upon their chest (Koppert 1930). The traditional view is focused primarily on the relationship between humans and whales, the transformation of the whale into wealth, and the physical features underpinning the metaphors of strength, courage, and generosity.

Ethnomusicologist Frances Densmore photographed a dance curtain containing the large image of a thunderbird carrying a whale, along with other images, hanging in front of one of the walls of the Neah Bay community hall where dances were performed for Makah Days in 1926 (Densmore 1939). James Swan, a New England pioneer who lived among the Makah in the 1860s, was impressed by a painting of a thunderbird on a chief's house at Neah Bay. He recorded the Makah Indians' description of thunderbird as a supernatural giant who killed whales with lightning fish tied around his waist, then carried them back to the mountains to eat (Quimby 1970). According to Janine Bowechop, current Executive Director of the Makah Cultural Research Center, a commonly held Makah belief is that during a time of starvation, Thunderbird brought a whale to the Makah people to eat, then showed them how to hunt whales.

The symbolic use of whales within contemporary Makah society continues to be important. As Renker (2007) wrote:

> Whales are everywhere on the reservation. They are the dominant art icon in Neah Bay and adorn T-shirts, jackets, jewelry, signage, and a good deal of the public art in the village, including images inside and outside the public school, as well as the Tribe's buildings. Makah children "doodle" whale images on their school papers and folders, and create serious artwork with whales, thunderbirds, and wolf masks for local art contests.

Statements made by Makah participants after the 1999 hunt suggest that the contemporary whalers' association with the whale retains some of the qualities described in the ethnographic literature (Tweedie 2002), but the symbolic use of whales and whaling has extended beyond an association of a chief with his wealth to that of the community as a whole. Symbols of this traditional discourse that were rooted in the practice and experience of the elite now inform the

contemporary model of tribal self-sufficiency. The cessation of the whale hunt and its associated privately owned rituals and ceremonials, along with changes in the traditional Makah social organization, resulted in lessening the direct relationship between the whale and the whalers. Subsequent emergence of the whale as a secular image nevertheless represented the loss of a former way of life, one in which physical and mental strength brought glory and wealth to the chiefs and, thus, to the community at large. Whale hunting in the current discourse possesses symbolic properties and qualities that make it a potent vehicle for the strength of Makah identity, sovereignty, and cultural revitalization. Hence, resumption of the hunt, as Janine Bowechop (2004:412) concluded in her essay, *Contemporary Makah Whaling*, was necessary to help her people become healthier and stronger and to close the gap between the past and the present.

3.11 Noise

3.11.1 Introduction

The following section documents noise-related issues pertaining to the proposed Makah whale hunts. Included are discussions of relevant noise-related policies and jurisdictions, sensitive noise receptors in the human environment, and background noise conditions near the project area. Key parameters for analysis include ambient noise levels in the project area and the distance between sensitive receptors and noise-producing project activities. See Section 3.5.3.3, Sensitivity of Wildlife to Noise and Other Disturbance, for a discussion of the potential for disturbance to wildlife and key wildlife use areas, such as seabird rookeries and haulouts for marine mammals.

Noise is generally defined as unwanted sound (EPA 1971). Sound level is expressed in units called decibels (dB). The dB scale quantifies sound levels relative to a reference point of 0 dB, which is defined as the threshold of human hearing and is roughly equivalent to the sound of a mosquito flying 10 feet away. To account for the large range of sound pressures the ear can detect, the dB scale is logarithmic. A 10-dB increase in sound level is perceived as a doubling of loudness. The ear is not equally sensitive to sound at all frequencies or musical pitches; two sounds of equal intensity (i.e., with equal dB values) may be perceived as having different loudness levels if they have different frequencies. Very high-pitched whistles demonstrate the relative sensitivity of the human ear (as compared to the ears of other species) at certain frequencies; dogs readily hear these sounds, but they are nearly inaudible to humans.

Sound frequency is measured in terms of cycles per second, or hertz (Hz). The human ear is most sensitive to sounds in the frequency range of 1,000 to 5,000 Hz. To account for this sensitivity, a process called frequency weighting is often used in sound descriptions. The most widely used

system is A-weighting, in which noise in the frequencies of maximum human sensitivity factors more heavily than other frequencies in determining the overall noise level. Decibel values in this system are commonly denoted as dBA. Most noise regulations use the A-weighted scale to define acceptable limits for noise levels. See Section 3.5.3.3.4, Marine Mammals and Underwater Noise, for a discussion of the frequencies at which the ears of marine mammals are most sensitive.

3.11.2 Regulatory Overview

The OCNMS management plan provides no specific direction regarding noise (NOAA 1993). Control of noise is, however, consistent with Sanctuary goals of resource protection and compatible public use. Regulations governing OCNMS prohibit the operation of motorized aircraft less than 2,000 feet above the Sanctuary and within one nautical mile of the shoreline. In addition, FWS recommends a 200-yard exclusionary zone around islands in the Washington Island National Wildlife Refuges to avoid the flushing of nesting seabirds by boat and other vessel traffic.

The Olympic National Park, under federal jurisdiction, is managed consistent with enabling federal legislation to ". . . conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (National Park Service Organic Act, 16 USC 1). The control of noise by park authorities is relevant to leaving the natural and cultural resources and values of the park unimpaired. Noise control is particularly germane in portions of the park designated as wilderness; this includes the park area along the Pacific Ocean coastline. Specific regulations prohibit the operation of "motorized equipment or machinery in a manner that exceeds a noise level of 60 decibels measured on the A-weighted scale at 50 feet; or, if below that level, makes noise which is unreasonable, considering the nature and purpose for which the area was established" (36 CFR 2.12). The Wilderness Act does not establish noise regulations, but it implies that noise should be minimized in designated Wilderness areas to achieve "outstanding opportunities for solitude" (Public Law 88-577).

State of Washington noise regulations in WAC 173-60-040 are in effect statewide. Clallam County has no separate noise regulations and is subject to state standards. Maximum permissible environmental noise levels vary, depending on the land use categories of the noise source and the receiving property. Maximum permissible noise levels range from 55 to 60 dBA for residential properties, 57 to 65 dBA for commercial uses, and 60 to 70 dBA for industrial areas.

WAC 173-60-050 specifies exemptions from maximum permissible noise levels in certain cases, including the following:

- Sounds created by the discharge of firearms on authorized shooting ranges [Exemption applies only from 7:00 a.m. to 10:00 p.m.]
- Sounds originating from forest harvesting and silvicultural activity [Exemption does not apply near residential and recreational areas from 10:00 p.m. to 7:00 a.m.]
- Sounds originating from aircraft in flight
- Sounds created by emergency equipment and work necessary in the interests of law enforcement or for health safety or welfare of the community
- Sounds created by safety and protective devices where noise suppression would defeat the intent of the device or is not economically feasible
- Sounds created by the discharge of firearms in the course of hunting

3.11.3 Existing Conditions

The following sections identify sensitive noise receptors in the project area, followed by a discussion of existing noise levels in the two media of noise transmission (air and water) in the project area. The discussion in this section focuses on sensitive noise receptors in the human environment. The sensitivity of wildlife to noise and other disturbance is discussed in Section 3.5.3.3.

3.11.3.1 Sensitive Noise Receptors in the Human Environment

Sensitive noise receptors include facilities and activities for which excessive noise may cause annoyance, increased stress, loss of business, or other adverse effects. Examples of sensitive receptors include residential areas, hospitals, schools, performance spaces, and businesses. Open space is also noise-sensitive if excessive noise would adversely affect potential recreational use of the space. Nearly all portions of the project area sustain residential or recreational uses, with maximum permissible noise levels between 55 and 60 dBA. Businesses in Neah Bay and the offices of the Makah Tribal Center meet the criteria of commercial property, while timber harvest areas would be considered industrial sites.

3.11.3.1.1 <u>Olympic Coast National Marine Sanctuary</u>

Staff at OCNMS have identified noise as a management issue for the Sanctuary, particularly with regard to disturbance of humans and wildlife (Parrish et al. 2005). Noise associated with aircraft overflights has been identified as a primary concern, but the extent of overflights within the Sanctuary is not known. It is also unclear whether, or how much, disturbance to Sanctuary-

protected wildlife results from overflights (Parrish et al. 2005). OCNMS staff report that overflights occur primarily during the summer and that visitor complaints are rare (Parrish et al. 2005).

3.11.3.1.2 Makah Reservation

Sensitive noise receptors on the reservation occur primarily along trails and shoreline areas used for recreation by residents and tourists. Cape Flattery is a Makah Tribe designated wilderness area. South of Cape Flattery, the Pacific coastline is largely wooded; some inland areas are managed for timber harvest. There is little or no human settlement north of Wa'atch Point. The Makah Tribal Center on the north side of the Wa'atch River supports residential, administrative, and commercial uses. Areas farther south include low-density residential development, with several roads near the shoreline. South of Anderson Point to the Olympic National Park boundary, the shoreline is characterized by rocky bluffs and small pocket beaches. Primitive roads and trails provide recreational access.

3.11.3.1.3 Olympic National Park

Within the Olympic National Park, the shoreline is a designated wilderness area accessible only by foot. In most portions of this area, the total number of users is restricted by a wilderness permit system. A trail and boardwalk connect the parking area at Lake Ozette to the shoreline at Cape Alava and Sand Point. The number of visitors to this area is restricted only by the capacity of the parking lot. Because the coastal shoreline portion of the park is a designated wilderness area, this entire area of the park is a sensitive noise receptor.

3.11.3.2 Existing Noise Levels

The following sections describe the baseline conditions of the acoustic environment in the project area, including atmospheric and underwater noise. Particular attention is given to sources of noise associated with a whale hunt, namely, aircraft (e.g., news helicopters and other aircraft observing the hunt and associated activities), and vessel traffic. Section 3.5.3.3, Sensitivity of Wildlife to Noise and Other Disturbance, addresses existing levels of noise and disturbance at marine mammal haulouts and seabird colonies in the project area. Where available, information from the previous hunts is included to provide a background for subsequent analysis of the potential effects of the alternatives.

3.11.3.2.1 Atmospheric Noise

The primary sources of ambient sound in the area are natural, mostly wind and waves. Natural quiet found in wilderness recreation areas is characterized by the absence of human-made noise,

which creates conditions that allow visitors to enjoy the intermittent sounds of animals, wind, water, and other natural sources.

In addition to natural sounds, human activities are a source of noise in the project area. Near Cape Flattery, people hear the Tatoosh Island foghorn. The acoustic environment in the area of the Makah Tribal Center is likely characteristic of residential and small town centers, with ambient noise levels ranging from 50 to 65 dBA. Settings where people congregate, such as commercial areas, school playgrounds, and sports fields, are additional local sources of noise. Throughout the area, the most pervasive noise source is traffic on local roads. Noise from individual automobiles and trucks can range from 70 to 90 dBA. Sirens of emergency vehicles are likely the loudest noise source; they produce noise at approximately 130 dBA at 100 feet. The occurrence of such noise is infrequent, irregular, and primarily affects areas next to arterial roads. Noise sources associated with active logging operations include chain saws (110 dBA) and other equipment (80 to 110 dBA). Most timber harvest units associated with the Makah logging operations are located away from residences to avoid noise impacts. However, the Makah Forest Management Plan (Makah Tribe 1999) does not mention noise as an issue to be addressed during logging operations.

Another source of noise in the area is airplane traffic, particularly near the three airports in western Clallam County (Section 3.13.3.3, Air Traffic). The most heavily used airport in the area is the Forks Municipal Airport, which receives an average of approximately 40 operations every day (Washington Department of Transportation 2002a). Noise from aircraft taking off and landing is unlikely to be a major issue in the U&A, however, because the airport is more than 15 miles away from the southern extreme of the U&A. The Quillayute Airport, which has less than 10 takeoffs and landings per week, on average, is approximately 9 miles away from the southern extreme of the U&A. The Sekiu Airport, which has approximately 20 takeoffs and landings per week, is immediately adjacent to the portion of the U&A within the Strait of Juan de Fuca and approximately 20 miles from the Pacific Ocean portion of the U&A.

In their study of overflights in west coast National Marine Sanctuaries, Parrish et al. (2005) gathered information about small, private, general aviation airplanes and helicopters. Such aircraft, typically flown by private pilots for sightseeing purposes, have the potential to disturb humans and wildlife by flying low over Sanctuary waters (Parrish et al. 2005). Other types of aircraft that may occur in the area include regularly scheduled tourist flights, such as those provided by National Park tour concessionaires, and Sanctuary-permitted or Sanctuary-owned

research flights. Military and Coast Guard flights also occur over the area (Parrish et al. 2005). During field studies at Tatoosh Island in the summer months (June, July, and August) of 1997 through 2003, researchers from the University of Washington documented 106 instances in which aircraft violated overflight regulations by flying below 2,000 feet within 1 mile of shore in the Sanctuary. The frequency with which violations occurred ranged from approximately 0.1 to 0.75 per hour (Galasso 2005).

During the previous whale hunts, media helicopters and other aircraft likely created elevated noise levels. The Coast Guard used helicopters to enforce the exclusion zone around tribal vessels actively engaged in the hunt (Section 3.14.3.1, Coast Guard). During the successful hunt, three television news helicopters were present throughout the day (United States Coast Guard 1999a). No information is available to document noise levels associated with those sources. OCNMS regulations that require motorized aircraft to fly at least 2,000 feet above certain portions of the Sanctuary probably limited the effects of aircraft noise on residents and recreational users near the hunt. Only one instance of an aircraft failing to observe these regulations was reported during the previous hunts (Section 3.13.3.3, Air Traffic).

Other noise sources associated with the previous hunt included marine vessels used by the whale hunters, protesters, and law enforcement personnel (Section 3.13.3.2.3, Marine Traffic During the Previous Hunt). Most hunt-related activities took place well offshore, and vessel noise was likely inaudible to sensitive receptors in Olympic National Park and OCNMS. To avoid disturbance to resting and breeding birds and marine mammals, the Makah gray whale management plan prohibited the initial strike of a whale within 200 yards of Tatoosh Island or White Rock between May and September. All three strike attempts occurred 1 to 2 miles offshore (NMFS 1999). Increased vessel traffic was likely audible to local residents near the marina and Coast Guard station at Neah Bay and at Clallam Bay, where most protest vessels moored.

3.11.3.2.2 Marine Noise

Marine environments can be noisy. Natural noise sources include wind, waves, precipitation, earthquakes, lightning strikes, and surf. Biological sounds include whale songs, dolphin clicks, fish vocalizations, and the clicking of crustaceans (Urick 1983; National Research Council 2003). Noise sources associated with human activities include commercial shipping, geophysical surveys, oil drilling and production, dredging and construction, sonar systems, and oceanographic research (National Research Council 2003).

Open ocean ambient noise levels estimated from sound data collected in portions of the South Pacific with relatively low levels of human activity suggest that low-frequency sound levels range from 40 to 50 dB (relative to 1 microPascal at 1 meter[9]) in calm seas (Cato and McCauley 2002; National Research Council 2003). In areas of the Pacific Ocean where commercial shipping is more prevalent, measured ambient sound levels have ranged between 80 and 90 dB (Andrew et al. 2002; McDonald et al. 2006). A variety of natural processes increases these levels: precipitation on the ocean surface contributes sound levels up to 35 dB across a broad range of frequencies (Nystuen and Farmer 1987); an increase in wind speed from 5 to 10 knots causes a 5-dB increase in ambient ocean noise across most frequencies. The highest dB noise levels generally occur in nearshore areas where the sound of surf can increase underwater noise levels by more than 20 dB a few hundred meters outside the surf zone across a frequency band from 10 to 10,000 Hz (Wilson et al. 1985; National Research Council 2003).

Among noise sources associated with human activity, surface shipping is widely considered the most widespread source of low-frequency (5 to 1,000 Hz) noise in the oceans (Wenz 1962; Simmonds and Hutchinson 1996; National Research Council 2003). Although there are no data that provide an assessment of long-term trends in ocean noise, increases in commercial shipping during the past 50 years imply a gradual increase in noise levels from shipping traffic. This relationship is complicated, however, by technology changes that have resulted in quieter ships during the same period (National Research Council 2003). Puget Sound experiences a concentration of commercial shipping in and out of United States ports, with the ports of Seattle and Tacoma collectively representing 9 percent of 20-foot-equivalent container traffic in 2003 (United States Army Corps of Engineers 2004). The OCNMS has designated a large portion of the project area as an area to be avoided. Under this voluntary ship traffic management program, vessels are advised to stay clear of this area if they carry cargoes of oil or hazardous materials or if they exceed 1,600 gross tons (Section 3.1.1.1.3, Current Issues, Area to be Avoided, for more information).

[9] Relative sound intensities (i.e., decibel values) in water are not directly comparable to relative sound intensities in air. This is primarily because the reference intensities used to compute sound intensity are different in water and air. A standard reference intensity must always be used when comparing relative intensities to one another. For underwater sound, the intensity of a sound wave with a pressure of 1 microPascal at 1 meter from the source point is used as the reference intensity. In air, however, the reference intensity is 20 microPascals at 1 meter.

Owing to the physics of underwater sound propagation, small vessels do not contribute substantially to ocean ambient noise on a global scale, but they may be important local sound sources in coastal areas. In 2000, approximately 210,000 motor boats were licensed in Washington State (Washington Interagency Committee for Outdoor Recreation 2002), with the majority likely operating near heavily populated areas surrounding Puget Sound. The National Research Council (2003) lists scientific vessels operating in a given area for days with stops and starts driven by data collection needs as a source of 160 to 190 dB. Received sound levels for whale-watching boats measured at approximately 91 meters ranged up to 127 dB across a broad band of frequencies (315 to 2,500 Hz) (Au and Green 2000). Erbe (2002) documented increased sound levels for high-speed operation. Small powerboats may have peak sound intensities of 145 to 150 dB in the 350 to 1,200 Hz band (Barlett and Wilson 2002). Fishing vessels also have moderate sound levels. According to Figure 3-12, vessel traffic associated with commercial and recreational fishing is heaviest and, therefore, probably loudest, from May to August in the project area.

3.12 Aesthetics

3.12.1 Introduction

This section discusses aesthetics as visual resources associated with the project area, a place where the Pacific Ocean, beaches, rocky tidepools and headlands, and adjacent forested wilderness meet. In the designation documentation for the OCNMS, Congress described the area as "one of the more dramatic natural wonders of the coastal United States, paralleling the majestic splendor of such terrestrial counterparts as Yosemite National Park and the Grand Tetons," (50 FR 24586, 24604, May 11, 1994). Key visual resources in the project area include natural landscapes and seascapes, wildlife, and tangible cultural resources and historic artifacts.

Peoples' opportunities to view past and proposed Makah whale-hunting activities in the project area are described by detailing access points where hunting and landing of a whale might be seen. Annual numbers of visitors and primary seasons of viewing are also described. Because whale hunts would take place offshore, and because the Makah practice exercises in 1998 and hunts in 1999 and 2000 were highly covered and televised events, most opportunities for viewing the hunt and hunt-related activities would occur through the media, including newspapers and television. For this reason, this section also describes media coverage of the previous hunts, along with public response to that coverage.

3.12.2 Regulatory Overview

As noted in Section 3.1, Geographically Based Management in the Project Area, several federal and tribal managed areas occur and overlap within the project area. These include the Olympic Coast National Marine Sanctuary, the Washington Islands National Wildlife Refuges, the coastal strip of the Olympic National Park, and the Makah and Ozette Indian Reservations (Figure 1-1). Because of their proximity to the project area, these management areas provide possible vantage points to whaling activities under each of the alternatives. The laws and regulations governing the management of these areas include recognition of the importance of aesthetic resources. In some cases, specific policy or management documents expand upon the aesthetic qualities that lend importance or value to the managed areas.

The National Marine Sanctuary Act, and NOAA's implementing regulations under which the Olympic Coast National Marine Sanctuary is designated and managed, include aesthetic values as important to the sanctuary concept. Sanctuary resources are defined as "any living or nonliving resource that contributes to the conservation, recreational, ecological, historical, educational, cultural, archeological, scientific, or aesthetic value of the Sanctuary," (16 USC 1432(8), 50 CFR 922.3). Section 3.1.1.1, Olympic Coast National Marine Sanctuary, describes the multiple-use nature of the Sanctuary, NOAA's regulations establishing prohibitions on certain uses of the Sanctuary, and the biological and historic characteristics of the Sanctuary that give it particular value as identified by the OCNMS designation document. Aesthetic resources of the Sanctuary that give it particular value include its remoteness, its undeveloped character, and its marine life, as well as tangible, historical resources including Indian village sites, ancient canoe runs, petroglyphs, and Indian artifacts (59 FR 24586, 24604, May 11, 1994; NOAA 1993).

The National Park Service Organic Act, governing the management of all national parks including the Olympic National Park, states that the fundamental purpose of national parks is "to conserve the scenery and the natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such a manner and by such means as will leave them unimpaired for the enjoyment of future generations" (16 USC 1). The National Park Service has not developed a visual resource policy or management system for public lands under its jurisdiction; however, the overriding management purpose in a park is preservation of all significant resources, including the scenery (National Park Service 1996). Both the National Park Service and Ecology manage the aesthetics of the shoreline under federally granted Coastal Zone Management Act authority. The Coastal Zone Management Act identifies beaches as aesthetic resources of the nation (16 USC 1451(b)). Washington State's Shoreline Management Act

establishes a program to coordinate the protection and development of the state's shoreline, preserving to the greatest extent possible the public's opportunity to enjoy the physical and aesthetic qualities of state natural shorelines (RCW 90.58.020). The Makah Tribe also has a coastal zone management plan for reservation shorelines.

Approximately 70 percent of Olympic National Park's coastal strip, including 36,000 acres mostly north of the Hoh River, is designated as wilderness (National Park Service 2008). Under the Wilderness Act of 1964 (Public Law 88-577), wilderness areas are managed for the "preservation of their wilderness character" for current and future generations of Americans (16 USC 1131). Both natural and cultural resources are contributing elements to the Olympic National Park Wilderness (National Park Service 2008). The principles applied to federal wilderness areas also apply to management of the Washington National Wildlife Refuges, which are all designated as wilderness areas, except for Destruction Island in the Quillayute Needles National Wildlife Refuge. Other protective regulations are described in Section 3.1.1.2, Washington Islands National Wildlife Refuges. Reservation lands along the shoreline around Cape Flattery are also designated wilderness.

Living marine resources within the project area, including but not limited to whales and other marine mammals, are also protected by federal and state statute and regulation as aesthetic resources. The Whaling Convention Act, for instance, includes the finding that whales are a unique marine resource of great aesthetic and scientific interest to mankind and notes that the protection and conservation of whales are of particular interest to citizens of the United States (16 USC 916 note, Public Law 96-60, Aug. 15, 1979). The MMPA also includes the congressional finding that "marine mammals have proven themselves to be resources of great international significance, aesthetic and recreational as well as economic" (16 USC 1361(6)).

3.12.3 Existing Conditions

The following sections describe the key visual resources in the project area, vantage points into the Makah U&A, and estimates of the number of visitors to these areas every year. Following the discussion of potential direct viewing opportunities is a summary of media coverage of previous hunts.

3.12.3.1 Visual Resources in the Project Area

The sea stacks, pillars, and islands that make up the Washington Islands National Wildlife Refuges within the Olympic Coast National Marine Sanctuary are a visual resource of statewide significance, representing the remote and rugged nature of the Olympic Peninsula's coastline

(FWS 2007). The islands rise out of the ocean in a variety of shapes and forms and are varying distances from the shoreline; formations in the foreground often appear as flat-topped cliffs rising out of the water, while formations in the background appear as clusters of often fog-shrouded stacks (FWS 2007). Many of the islands have vegetation, including small trees and shrubs, particularly the larger islands (such as Ozette Island). Other smaller islands have extensive steep grassy slopes or vegetated ledges (FWS 2007). The islands also provide views of hauled-out sea lions and harbor seals, migrating and feeding gray whales, minke whales, and sea otters, among other species (Section 3.5.3.1.2, Common Species off Washington Coast). Many species of seabirds are visible in the marine waters, off the coastal headlands and islands, and along the shore, including raptors, gulls, cormorants, common murres, petrels, auklets, and puffins, among others (Section 3.5.3.2.1, ESA-Listed Species, and Section 3.5.3.2.2, Non-Listed Marine Birds and Their Associated Habitats, for more information on marine birds that occur in the project area).

In the Olympic National Park, more than 650 archaeological sites document 10,000 years of human occupation, while historic sites reveal clues about the 200-year history of exploration, homesteading, and community development in the Pacific Northwest (National Park Service 2008). Maritime archaeological sites include stratified shell midden deposits and petroglyph sites and represent one of the Olympic National Park's most important and threatened classes of archaeological resources. Threats include coastal erosion and visitor use. Past mitigation at these areas has included excavation, bank stabilization, and revegetation (National Park Service 2008). Public education and interpretation, coupled with increased monitoring and ranger patrols, aims to curb the impacts of visitation and tidal debris on the coastal petroglyph sites, particularly at Wedding Rocks, a site on the beach near Cape Alava (National Park Service 2008).

3.12.3.2 Vantage Points and Viewing Opportunities

Visitors can view the portion of the Makah U&A in the Strait of Juan de Fuca from the land by vehicle at several locations along Highway 112, including the towns of Sekiu, Clallam Bay, and Neah Bay. In contrast, vehicle-based viewing opportunities for the Pacific coastal portion of the U&A are limited to a few sites on the Makah Reservation, mostly in the Sooes and Hobuck Beach area of Makah Bay. No roadways offer views of the southern portion of the Makah U&A. The La Push/Rialto Beach area is approximately 8 miles south of the Makah U&A. The only scenic driving opportunity along the coast of the Olympic Peninsula is an 8-mile stretch of United States Highway 101 in the Kalaloch area, which is more than 30 miles south of the Makah U&A (National Park Service 2008).

Most of the land-based viewing access in the project area is from hiking trails and beaches (where camping opportunities exist), including the Cape Flattery Trail and Hobuck and Sooes Beaches on the Makah Reservation. The Olympic National Park also provides hiking and backpacking access to 50 miles of beaches with views of the islands. The Ozette/Shi Shi portion of the Olympic National Park, including the Point of Arches, is the most visible and photographed place in the Olympic National Park coastal strip. Many visitors also access the beach for 2.9 miles of the 9-mile Cape Alava and Sand Point Trails on the Ozette Indian Reservation (National Park Service 2008).

Part of the Makah U&A is visible to OCNMS visitors. NOAA (2006) reports that more than 3 million people visit the north Washington coast every year, drawn by the beautiful scenery and the pristine wilderness, as well as opportunities to view wildlife and challenge themselves in a natural environment. Similarly, the Olympic National Park has attracted an average of 3.2 million recreation visitors a year since 1990, mostly from June through September and peaking in July and August (National Park Service 2008). Hiking and boating trips provide viewing opportunities to the Makah U&A.

In 2005 and 2006, the Makah interpreters hosted more than 15,000 visitors on the Cape Flattery Trail. They addressed coastal issues, Makah culture, and natural history within the area (NOAA 2006). In 2004, the Makah interpreter recorded an average of 169 visitors per day in July, 189 visitors per day in August, and 93 visitors per day for September. An estimated 5,000 to 7,000 people annually attend Makah Days in Neah Bay. This is a celebration of Makah identity and features a parade, street fair, canoe races, children's races, traditional dancing, a salmon bake, and fireworks (Tizon 1998a).

Previous authorized hunts in 1999 and 2000 occurred within the Makah U&A and OCNMS, along and adjacent to the coastal area of the Olympic National Park. Whale hunting activities were visible from Ozette Island, Cape Alava, and Sand Point to Father and Son Rock, the Point of the Arches, and Spike Rock near the Ozette Reservation and Shi Shi Beach (Gosho 1999) (Section 1.4.2, Summary of Recent Makah Whaling — 1998 through 2007, for more information about the locations of the 1999 hunt). People on trails and beach vantage points of the Olympic National Park may have viewed the hunts, including the May 17, 1999, killing of a gray whale. The possibility that some viewers were caught unaware is extremely unlikely because May is not a peak visitor month, the hunts were well-advertised in the media, and the weather conditions were poor (Gosho 1999) at least some of the time. People on the shores of Neah Bay on the

Makah Reservation could view the whale being towed to shore and flensed. These activities were also visible to protesters, enforcement personnel, and tribal members in vessels surrounding the hunts. Most of those viewing the whaling activities on the shore within the Makah Reservation were tribal members who supported the hunt and had favorable reactions. As reported by the *Seattle Times*, Makah Tribe members in Neah Bay considered the visual effects of the hunt as ". . . cause for celebration, a triumphant embrace of tradition and heritage, a culture's central symbol giving itself up for the kill" (Sorensen 1999).

During the May 1999 whale hunts, news reports indicate that vehicular access to State Route 112 paralleling the Strait of Juan de Fuca was blocked by protesters and tribal police for about 2.5 hours (Mapes and Solomon 1999a). Such blockages may have interrupted access to visual resources on the Olympic Peninsula. Traffic volumes on the land were otherwise normal (Section 3.13.3.1.2, Vehicle Traffic Patterns During the 1999 Hunt).

3.12.3.3 Media Coverage of Previous Authorized Hunts

The practice exercises, whale hunts, and associated protest activities that occurred in 1998, 1999, and 2000 were the focus of intensive media coverage in the region, including Seattle. In late summer and autumn of 1998, approximately 50 representatives of media organizations from all over the world arrived at Neah Bay to watch the Makah Tribe hunt whales (Mapes 1998a). Media coverage became an issue during the Makah Days celebration in August 1998, when its representatives crowded in front of tribal dancers, disrupting the formal welcoming ceremony (Clarridge 1998). From June 1998 to June 1999, whale-hunt-related news stories abounded in local newspapers. The *Seattle Post-Intelligencer* published 77 news items and three editorials on the topic during that period. The *Seattle Times* published 76 news items, 11 columnists' commentaries, and eight editorials during the same timeframe. Such intense attention was largely limited to the region, however. During the same period, the *New York Times* published 16 news items with the words 'Makah' and 'whale,' the *Los Angeles Times* published 13 related news items, and the *Washington Post* published three related news items.

Media coverage resumed when the Makah resumed hunting activities in April of 2000, but with less intensity than for prior hunts. Between April 1 and December 31, 2000, the *Seattle Post-Intelligencer* published 13 news items and one editorial about the hunt, protests and protesters, and associated legal actions. The *Seattle Times* published 15 news items and one editorial on hunt-related topics during the same period. As before, the hunt received considerably less attention outside of the Pacific Northwest. The *New York Times* published two hunt-related news

items from April through December of 2000, the *Los Angeles Times* published four, and the *Washington Post* published a single hunt-related news item.

News of the Makah Tribe's successful hunt on May 17, 1999, received attention in local print and broadcast media. Locally, the Seattle *Post-Intelligencer* printed five photographs showing the whale in the water or on the beach; the *Seattle Times* printed four photographs, and the *Peninsula Daily News* printed seven photographs. At least two local television stations, KING-TV and KOMO-TV, sent helicopters to collect video footage of the hunt and subsequent activities. KING, KOMO, and KIRO-TV all extended their morning news shows to cover the story of the successful hunt, which occurred shortly before 7 a.m. (Levesque 1999). KCPQ, which did not have a morning news show at that time, interrupted regular programming with occasional updates. Northwest Cable News network, a sister station of KING-TV, ran near-constant footage and commentary on May 17, and 10 hours of live broadcast of the previous day's unsuccessful hunt (Levesque 1999; McFadden 1999).

Nationwide, the story of the successful hunt received considerably less attention. Most newspapers simply published the Associated Press wire story. There was no international Web site coverage by well-known news sources such as the *London Times*, *Le Monde*, *Asahi Shimbun*, and the *Japan Times* (Barber 1999). The story was broadcast on nationwide television, however, accompanied by commentary by Peter Jennings, ABC Network, and Tom Brokaw, NBC Network. Some observers characterized the images of the dying and dead whale as brutal and suggested that footage of the whale killing would pose a public relations problem for the Makah Tribe (Sorensen 1999).

Local newspaper reader response to the hunt was substantial. The *Seattle Times* received nearly 500 letters on the topic during the latter half of May 1999, nearly one-third of the total number of letters received for that month (Anderson 1999). On the day following the successful hunt, the *Seattle Post-Intelligencer* received more than 50 e-mail messages and more than 100 telephone calls voicing opinions about the hunt (Barber 1999). The *Peninsula Daily News* also reported an unusually large volume of letters and devoted a special letters page to the topic on the Friday following the hunt (Brewer 1999). KING-TV reported that the issue generated three or four times the normal volume of phone calls and e-mail messages related to a news story (Levesque 1999).

The news director at KIRO-TV chose not to broadcast images of the actual killing of the whale because some viewers had said they did not want to see explicit footage (Levesque 1999). Nearly all public response focused on the issue of killing the whale. Only a few comments offered

reactions to images of the event, for example, "I can't believe you think most of the population in Western Washington is remotely interested in viewing the graphic video" (Levesque 1999).

The *Seattle Post-Intelligencer* published excerpts of some telephone and e-mail messages received in response to their coverage of the whale hunt (*Seattle Post-Intelligencer* 1999). While most responses expressed support for or protest against the hunt, some included reactions to published images. One commenter expressed disgust at the image of Makah whalers jumping on the carcass of the whale. Another stated that the hunt of a whale should not be broadcast on television. One letter to the editor read "tonight I refuse to watch any news program for fear I will see another replay of the Makah hunt" (*Seattle Post-Intelligencer* 1999).

Of more than 30 letters published in the *Peninsula Daily News* on Friday, May 21, two contained reactions to images of the hunt. One writer described the television footage as "the most disgusting sight" she had ever seen. Another expressed the opinion that the graphic coverage should prompt viewers to express their objections to their congressional representatives (*Peninsula Daily News* 1999).

A Google search indicated about 710 instances of media coverage in the 20 days following the September 8 unauthorized hunt, the majority in the first few days afterward. Media outlets all over the country reported the event, often using Associated Press information. Follow-up coverage included reports on the Tribe's apology and trip to Washington, DC. The *Los Angeles Times*, *Washington Post*, and *New York Times* each ran one or two stories. Most of the coverage emanated from western Washington media. Seattle TV stations provided live reports from Neah Bay for the first few days. The *Seattle Times* had the most extensive coverage, with Lynda Mapes writing several in-depth articles. The *Times* also asked for reader feedback; 93 comments with a wide range of views were posted in response. The *Seattle Post-Intelligencer* and Port Angeles *Peninsula Daily News* ran multiple stories about the kill and activities following it. Other regional media had less extensive coverage. As news interest waned, there were several editorials and opinion pieces published, also with a wide range of views expressed.

Some anti-whaling Websites that were active during the earlier authorized hunts are no longer in existence or are not current. The Humane Society of the United States., Whale Police, Sea Shepherd, and Animal Welfare Institute posted press releases on their Websites condemning the September 8 whale kill. The few blogs covering this issue linked to or extracted from various media reports on the Internet, with limited commentary. Views seemed to be about equal between

condemnations of the kill and of whale-hunting in general, and support for tribal rights and culture.

3.13 Transportation

3.13.1 Introduction

The following section documents several transportation-related issues pertaining to the Makah whale hunt. Transportation resources near Neah Bay include federal and state highways, marine vessels, and airports. Key parameters for analysis include the patterns of highway, marine vessel, and air traffic near Neah Bay.

3.13.2 Regulatory Overview

At the federal level, the Federal Highway Administration within the Department of Transportation is responsible for the management of the national highway system, which includes United States Highway 101 near Neah Bay (23 USC 101). The national highway system consists of interconnected urban and rural principal arterials and highways that serve major population centers, international border crossings, ports, airports, public transportation facilities, other intermodal transportation facilities, and major travel destinations; meet national defense requirements; and serve interstate and interregional travel (23 CFR 470A).

The Federal Highway Administration is responsible for stewardship and oversight of the federal-aid highway funds allocated to Washington State. The Washington State Department of Transportation is the state agency responsible for delivering these federal-aid funds. Under the Statewide Multi-Modal Transportation Plan (RCW 47.06), the Washington Department of Transportation is responsible for developing a statewide multi-modal transportation plan in conformance with federal requirements. The highway system includes both state and federal highways.

In the marine environment, the Washington State Department of Transportation has the responsibility to oversee the national transportation system, which includes the marine transportation system (49 USC 101). The Coast Guard is responsible for enforcement and administration of laws governing vessels, cargo, and passengers. The Coast Guard has established a permanent RNA along the northwestern Washington coast and in a portion of the entrance to the Strait of Juan de Fuca (33 CFR 165.1301). Within the RNA, a moving exclusionary zone restricts the movements of vessels near a Makah vessel that is actively engaged in a whale hunt. Coast Guard restrictions for marine vessels engaged in whale hunting activities are described in

greater detail in Section 3.1.1.3, Coast Guard Regulated Navigation Area, and Section 3.15.2.1, Vessel Safety Regulations and Authorities.

The International Maritime Organization has designated a formal area to be avoided for the OCNMS. Vessels advised to stay clear of this area include all ships and barges carrying cargoes of oil or hazardous materials and all ships 1,600 gross tons and larger (Section 3.1.1.1.3, Current Issues, Area to be Avoided, and Section 3.2.3.3, Spill Prevention).

Air traffic safety is the responsibility of the Federal Aviation Administration. In addition, regulations for the management of the OCNMS prohibit flying motorized aircraft less than 2,000 feet above certain portions of the Sanctuary (Section 3.1.1.1.2, Designation and Regulatory Overview [OCNMS]). These include all areas within 1 nautical mile of the coastal boundary of the sanctuary, as well as areas within 1 nautical mile of any of the islands that constitute the Flattery Rocks, Quillayute Needles, or Copalis NWRs (15 CFR 922.152). These prohibitions do not apply to activities in response to emergencies threatening life, property, or the environment, or those for valid law enforcement purposes.

3.13.3 Existing Conditions

3.13.3.1 Highway Vehicle Traffic

Primary access to the isolated community of Neah Bay is via State Route 112, a narrow, winding highway that parallels the Strait of Juan de Fuca through rolling, forested terrain. An alternative route is along the closest primary highway, United States Highway 101, to Sappho and then north on a separate highway (State Route 113) that ends at State Route 112 (Figure 3-2). In recognition of its outstanding scenic, recreational, and cultural qualities, State Route 112 has been designated as a national scenic byway by the United States Secretary of Transportation.

3.13.3.1.1 Typical Vehicle Traffic Volume Patterns

The Washington State Department of Transportation conducts traffic counts occasionally on State Route 112 at the boundary of the Makah Reservation. The most recent traffic counts were conducted in 2001 and 2004. Annual average daily traffic volumes at that location were 940 vehicles and 1,200 vehicles, respectively (Washington Department of Transportation 2005a).

The closest permanent, full-time automated data collection station is located on United States Highway 101, near the State Route 113 turnoff to Neah Bay. Data from this station provide an indication of highway traffic patterns and trends near Neah Bay. Daily traffic counts at that station vary with the day of the week, with Fridays typically 10 percent higher than average and Sundays 10 percent below average (Washington Department of Transportation 2005a). In addition,

traffic counts show a strong pattern of seasonal variability, with the highest daily averages occurring during the summer months and the lowest occurring in winter. Although actual values vary from year to year, the overall pattern remains consistent (Table 3-37, Figure 3-11).

Visitation data for the Cape Flattery Trail and the Makah Museum may serve as indirect indicators of the amount of vehicle traffic on the Makah Reservation. In 2004, a natural resource interpreter at the Cape Flattery Trail recorded visitor numbers in July, August, and September. The interpreter was present from roughly noon until 6:00 p.m.; visitors who arrived before and departed after the counting period were not counted, so these data represent an underestimate of actual visitation. Based on these data, the trail received an average of 169 visitors per day in July, 189 per day in August, and 93 per day in September (Bowechop 2005b). More than 60 percent of the annual visitors to the Makah Cultural and Research Center/Makah Museum arrive during June, July, and August (North Olympic Peninsula Visitor and Convention Bureau 2005c). Additional information about tourist visitation to the Makah Reservation can be found in Section 3.6.3.2.4, Contribution of Tourism to the Local Economy.

3.13.3.1.2 Vehicle Traffic Patterns During the 1999 Hunt

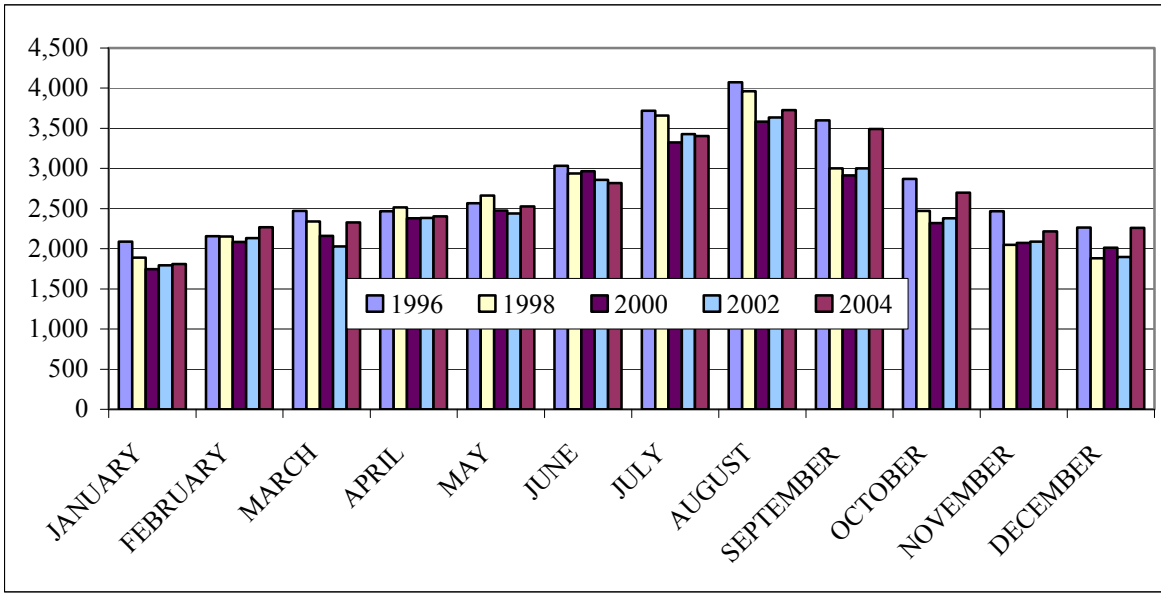
News accounts of the 1998-1999 whale hunts described one occasion on which highway traffic was affected by activities associated with the hunt. Two days before the successful hunt on May 17, 1999, traffic on State Route 112 was stopped for approximately 2.5 hours after the highway was blocked by protesters and tribal police (Mapes and Solomon 1999a). No other highway blockages are described in news accounts or law enforcement records from the previous hunt, although Coast Guard records mention the occurrence of weekly protests on State Route 112 at the Makah reservation boundary (United States Coast Guard 1999c). See Section 3.14.3.2, Police, for a discussion of traffic stops near Neah Bay.

Automated traffic count data Highway 101 for the month of May 1999 do not indicate any anomalous spikes in traffic volume during the days surrounding the events of May 17, 1999. Traffic volume data for that date, along with May 22, the date of the Tribe's celebration of the successful hunt, are denoted in bold font in Table 3-38. Two trends are evident in the data. First is a steady increase in traffic volumes throughout the month, peaking on Memorial Day weekend (May 31). Second is the weekly pattern described above, wherein Friday volumes typically exceed those on Sundays. This pattern is evident in the data from the months of May 1998, 1999, and 2000; Friday volumes typically exceed those of the subsequent Sunday by at least 15 percent (Washington Department of Transportation 2005b)

TABLE 3-37. AVERAGE WEEKDAY TRAFFIC COUNTS ON HIGHWAY 101 NEAR STATE ROUTE 113, 1995 TO 2004

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
January	1,987	2,088	2,153	1,889	2,064	1,746	1,993	1,793	1,865	1,809
February	2,052	2,158	2,417	2,152	1,972	2,084	2,047	2,133	2,117	2,266
March	2,587	2,472	2,286	2,338	2,323	2,159	2,236	2,030	2,097	2,329
April	2,715	2,466	2,365	2,516	2,245	2,380	2,289	2,383	2,282	2,402
May	3,234	2,565	no data	2,663	2,572	2,477	2,409	2,439	2,402	2,527
June	3,730	3,032	no data	2,939	2,984	2,967	2,821	2,857	2,829	2,818
July	3,988	3,720	no data	3,657	3,584	3,323	3,409	3,426	3,366	3,403
August	3,379	4,072	no data	3,962	3,838	3,582	3,722	3,635	3,626	3,728
September	2,787	3,600	no data	3,000	2,401	2,915	3,040	3,003	2,922	3,490
October	2,363	2,870	no data	2,473	2,299	2,320	2,401	2,381	2,304	2,698
November	no data	2,466	no data	2,049	2,114	2,073	1,979	2,087	2,108	2,217
December	no data	2,265	no data	1,883	2,103	2,012	1,867	1,896	2,079	2,259
Annual Average	**N/A**	**2,784**	**N/A**	**2,633**	**2,566**	**2,535**	**2,573**	**2,542**	**2,515**	**2,665**

Source: Washington Department of Transportation 1997, 1999, 2000, 2001, 2002b, 2003, 2004, 2005a, 2005c.



Source: Washington Department of Transportation 1997, 1999, 2001, 2003, 2005a.

Figure 3-11. Average Weekday Traffic Counts on Highway 101 Near State Route 113, 1996 to 2004

TABLE 3-38. DAILY TRAFFIC COUNTS ON HIGHWAY 101 NEAR STATE ROUTE 113, MAY 1999

WEEK NUMBER	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
1							2,340
2	2,002	2,376	2,393	2,420	2,382	2,618	2,422
3	2,143	2,432	2,458	2,486	2,530	2,764	2,558
4	2,318	2,465	2,502	2,635	2,680	3,159	3,221
5	3,161	2,994	2,647	2,782	2,954	3,431	3,446
6	3,569	3,150					

Source: Washington Department of Transportation 2005b.

Note: Bold font indicates the dates of the successful hunt (May 17, 1999) and the subsequent celebration (May 22, 1999).

This pattern does not hold true on Memorial Day weekends, when Sunday volumes can approach or even exceed those of the preceding Friday. The only other exception to this pattern occurs during the weekend of May 21 to 23, 1999, when Sunday traffic exceeded traffic on the preceding Friday, although barely. This anomaly may be attributable to many factors, such as weather, and may also reflect trips by participants attending the May 22 feast and celebration.

3.13.3.2 Marine Vessel Traffic

Marine vessels that travel to Neah Bay may find moorage at the Makah Marina, where more than 200 fishing vessels (commercial and recreational) and pleasure craft can anchor. In addition, several thousand large vessels pass by Neah Bay each year on their way through the Strait of Juan de Fuca to ports in Canada and the United States.

3.13.3.2.1 Fishing Vessel Traffic

The amount of marine vessel traffic associated with commercial fishing activity can be estimated by counting commercial fish tickets for vessels that land at the Neah Bay Marina. Both tribal and non-tribal fishers are required by law to complete a fish ticket when they land their catch. Rarely, catch from a single trip might be listed on two tickets. In other cases, a vessel may engage in day-fishing trips for several days and then make a single landing. Statistically, these two circumstances offset one another and do not occur frequently enough to affect the overall total counts (Culver 2005).

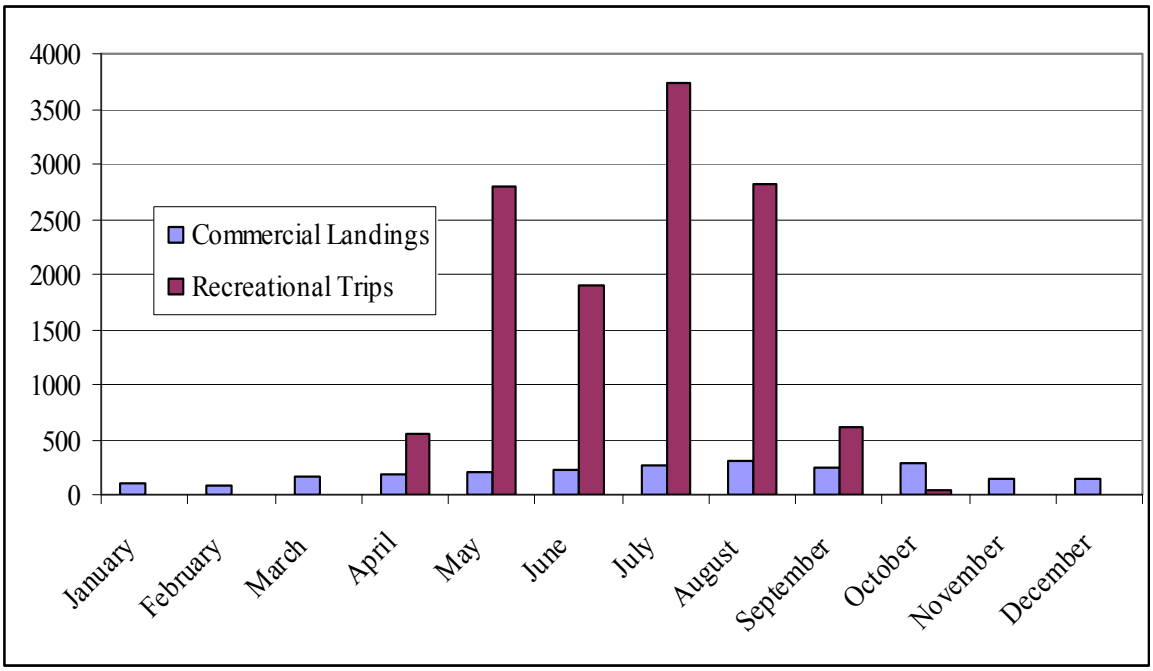
Estimates of vessel traffic associated with recreational fishing are based on vessel counts conducted by the Washington Ocean Sampling Program. Between mid-April and October, sport fishing vessels are counted either leaving the port (between 4:30 a.m. and the end of the day) or entering the port (between 8:00 a.m. and dusk). Due to a processing error, no data are currently available for 2002 (Culver 2005).

Between 1997 and 2004, total boat trips at Neah Bay showed an average annual increase of approximately 6 percent Table 3-39). Most vessel traffic at Neah Bay is associated with recreational trips, which account for at least 80 percent of all boat trips in all years. In most years, the peak of recreational fishing activity occurs in the month of July (salmon fishing season), with a secondary peak during the halibut season in May (Figure 3-12). Recreational fishing trips decrease dramatically in September, and commercial trips exceed recreational trips by October (WDFW 2005c; WDFW 2005d). On average, approximately 83 percent of all boat trips (commercial and recreational) occur during the months of May, June, July, and August. The five-month period from November to March accounts for less than 5 percent of all trips. Five percent of all trips occur in April, 6 percent in September, and 2 percent in October.

TABLE 3-39. RECREATIONAL FISHING BOAT TRIPS AND COMMERCIAL FISHING VESSEL LANDINGS AT NEAH BAY, 1997 TO 2004

	1997	1998	1999	2000	2001	2002	2003	2004
Recreational Trips	10,519	11,633	10,909	12,057	13,062	NA[1]	13,396	15,388
Commercial Landings	2,517	1,950	2,335	1,833	2,170	2,414	2,711	2,945
TOTAL	**13,036**	**13,583**	**13,244**	**13,890**	**15,232**	**NA**	**16,107**	**18,333**

[1] No recreational fishing trip data are available for 2002.
Source: WDFW 2005c, 2005d.



Source: WDFW 2005c, 2005d.

Figure 3-12. Average Monthly Levels of Marine Vessel Traffic at Neah Bay, 1997 to 2004

3.13.3.2.2 Offshore Vessel Transits

Ecology produces annual reports of the number of entering transits by various vessel types. An entering transit is defined as the passage of a vessel from sea or from Canadian waters into Washington State waters, regardless of destination (Ecology 2005a). The data collected by the department identify commercial fishing, cargo, and passenger vessels 300 gross tons and larger, as well as tank ships and tank barges transporting oil of any tonnage. Entering transits at the Strait of Juan de Fuca provide a measure of the amount of marine traffic near the Makah Tribe's U&A. From 2002 to 2004, Ecology reported roughly 4,500 to 4,700 entering transits annually via the

Strait of Juan de Fuca (Table 3-40). This averages to approximately 12 to 13 large vessels per day, with cargo and passenger vessels comprising more than 80 percent of entering transits. Personnel at the Canadian Coast Guard's Tofino Station have observed very little seasonal variability in traffic volume, except in the case of fishing vessels (Smolders 2005).

TABLE 3-40. VESSEL TRANSITS USING THE STRAIT OF JUAN DE FUCA, 2002 TO 2004

VESSEL TYPE AND DESTINATION	2002	2003	2004
Cargo and Passenger Greater than 300 Gross Tons			
Washington Port	1,724	1,699	1,462
Canadian Port	2,193	2,303	2,231
Tank Ships and Barges			
Washington Port	529	567	596
Canadian Port	60	55	66
Commercial Fishing			
Washington Port	45	35	18
Canadian Port	85	23	5
Factory Fishing			
Washington Port	69	69	79
Canadian Port	1	1	29
TOTAL	**4,706**	**4,752**	**4,486**

Source: Ecology 2003b, 2004, 2005a.

The Tofino Station provided an estimate of approximately 40 to 50 vessel transits per day in the Strait of Juan de Fuca (entering and leaving), which equates to 20 to 25 entering transits. Based on a comparison of this estimate with the values reported by Ecology, approximately half of the daily transits are vessels less than 300 gross tons and not transporting oil.

3.13.3.2.3 Marine Traffic During the Previous Hunt

In the fall of 1998, as the Makah Tribe attempted to implement the first season of its hunt, several protest vessels began a two-month occupation of Neah Bay to prevent the taking of a whale. From late September to late November, more than 15 protest vessels trailed any boat that left the Neah Bay marina (Dark 1999). Most of the protest vessels moored each night in Sekiu, a half-hour boat ride away (Mapes 1998a). The Sea Shepherd Conservation Society anchored the 180-foot *Sea Shepherd III* and the 95-foot cutter *Sierenian* outside Neah Bay and publicized plans to use a 27-foot former Norwegian military submarine painted to resemble a full-grown orca whale (Mapes 1998a; Tizon 1998b). The number of protest vessels was smaller when the hunt resumed the following spring; approximately a dozen boats returned to Sekiu (Mapes and Solomon 1999b).

3.13.3.3 Air Traffic

Three airports serve Neah Bay and the western portion of Clallam County. Closest to Neah Bay is the Sekiu Airport, approximately 20 miles east on Highway 112. The Washington Department of Transportation (2002a) provides an estimate of approximately 1,000 annual operations at the airport. The airport has a visual approach slope indicator system, which is a set of lights that provide visual descent guidance information during the approach to a runway.

The Forks area, approximately 30 air miles from Neah Bay (50 miles by highway), has two public access airports. The Forks Municipal Airport, located on the south edge of the City of Forks, has a 2,400-foot paved runway and receives approximately 13,550 annual operations (Washington Department of Transportation 2002a). The Coast Guard uses the airport as a refueling station for its helicopters. The airport is also used by emergency medical air transport helicopters that service the Forks Community Hospital (Newkirk and Casavant 2002). The Quillayute Airport is a former Naval Auxiliary Air Station located approximately 10 miles west of Forks. It receives approximately 450 annual operations (Washington Department of Transportation 2002a). Neither the Forks nor the Quillayute Airport has an approved instrument approach that would allow flights to proceed in most weather conditions (Newkirk and Casavant 2002).

Experience from the 1999 hunt indicates that media aircraft can operate at altitudes more than 2,000 feet above water. On the day of the successful hunt, three television news helicopters were present throughout the day; according to Coast Guard accounts of the day, the aircraft were very helpful and observed all safety precautions (United States Coast Guard 1999a). The only problem with aircraft occurred on one day in 1998 when a seaplane operated by protest groups made several passes lower than 2,000 feet over the area of the hunt. Operators of the aircraft were subsequently contacted by the Coast Guard, and the activity did not recur in 1999.

3.14 Public Services

3.14.1 Introduction

The following section documents several public-service-related issues pertaining to the Makah whale hunt. Key parameters for analysis include staffing and occurrence rates of incident responses for local law enforcement agencies, including the Coast Guard and police. Also included is a discussion of public health facilities near Neah Bay.

3.14.2 Regulatory Overview

No specific regulations pertain directly to the establishment or maintenance of public services in the project area.

3.14.3 Existing Conditions

3.14.3.1 Coast Guard

The Coast Guard maintains Station Neah Bay, a small boat station within the Makah Indian Reservation. The station is staffed by 32 active-duty personnel; equipment includes two 47-foot motor lifeboats and one 25-foot response boat (United States Coast Guard 2008). The station also features a helicopter landing pad with fueling facilities. The station's area of responsibility extends from the Strait of Juan de Fuca east to Pillar Point and south to Cape Alava. The station responds to approximately 100 search and rescue cases a year, primarily during the summer, when sports fishers and tourists are present in greatest numbers (United States Coast Guard 2004). The station's crew is also responsible for maritime law enforcement in the area, conducting approximately 200 safety boardings per year.

During the previous Makah whale practice exercise in 1998 and hunts in 1999 and 2000, Coast Guard personnel were responsible for ensuring the safety of persons and vessels near the hunt. To this end, the Coast Guard enforced an RNA and a 500-yard moving exclusionary zone around tribal vessels actively engaged in the hunt. This MEZ was designed to keep protesters, reporters, and spectators out of the area where life and property would face the greatest risk of endangerment from an injured or pursued whale or a round from a .50-caliber rifle. See Section 3.1.1.3, Coast Guard Regulated Navigation Area, and Section 3.15.2.1, Vessel Safety Regulations and Authorities for more information about operation of the RNA and MEZ in prior hunts. The Coast Guard used helicopters, a cutter, and several utility boats and Zodiacs to enforce the exclusion zone (Mapes and Solomon 1999b). In October and November of 1998, two additional 41-foot utility boats were made available, if needed, but no extra personnel were placed on duty (Mapes 1998d). In May 1999, the Coast Guard cited the operators of four protest boats for grossly negligent operations and/or MMPA take violations, and three of the vessels were taken into federal custody (NMFS 1999; United States Coast Guard 1999c; United States Coast Guard 1999d). In April 2000, a Coast Guard utility boat responded to a protest vessel that was violating the exclusionary zone around a Makah canoe engaged in the whale hunt. See Section 1.4.2, Summary of Recent Makah Whaling – 1998 through 2007, and Section 3.15.3.4, Behavior of People Associated with the Hunt, for more details about protest activities.

3.14.3.2 Police

The Makah Tribal Police have jurisdiction over crimes and infractions committed by Native Americans from any tribe on reservation lands. In addition, the tribal police have the authority to detain non-Indians for violations of law occurring on the reservation until they can be turned over to the appropriate authority (county, state, or federal). See Section 3.1.2.1, Makah Tribal Departments and Agencies, for a description of the tribal police department and Section 3.1.2.2.1, Makah Public Safety Program, for a description of the Tribe's emergency management plan. In 2005, Makah Public Safety responded to emergencies in the following ways:

- Tribal dispatchers, including 911 calls, received 26,815 calls.
- Provided 341 ambulance transports, including transportation to outlying hospitals and response to local emergencies (including vehicular accidents).
- Took 3,330 police calls.
- Provided 341 ambulance transports, including transportation to outlying hospitals and responses to local emergencies (including vehicular accidents).

Non-tribal law enforcement activity in the area is conducted by the Clallam County Sheriff's Department, which has one sergeant and four deputies stationed at Clallam Bay. The patrol division of the Sheriff's Department is responsible for police patrols in all unincorporated areas of Clallam County, responding to calls for service made by citizens in need of police assistance, and actively seeking out crime and traffic offenders. The closest deputy lives approximately 20 to 30 minutes from Neah Bay, which would be the minimum amount of time required to respond to an unanticipated law enforcement need. The Washington State Patrol oversees traffic safety compliance on roads and highways in the area. Two state troopers patrol the northwestern portion of the Olympic Peninsula, from the western end of Lake Crescent to the Quinault Indian Reservation (George 2005a). This area includes approximately 70 miles of United States Highway 101; 70 miles of State Routes 110, 112, and 113; and numerous local and other roads.

In 2003 and 2004, the Clallam County Sheriff's Department conducted an average of approximately 150 traffic stops annually in the western portion of the county, including State Route 112 and Highway 101 west of Lake Crescent, neither of which are on the Makah Reservation. Approximately 15 percent of the calls for service received by the patrol division typically come from that part of the county, which has about 10 percent of the county's population (Snover 2005). The Sheriff's Department has not had to respond to any calls for disturbance of the peace or similar problems since 1999.

The Washington State Patrol has more-detailed data available for policing activities conducted by state troopers (Table 3-41). From 1997 to 2004, state troopers conducted an annual average of more than 1,000 traffic stops on the 36 miles of state and federal highway closest to Neah Bay. This area includes United States Highway 101 between Forks and the turnoff for State Route 113, State Route 112 west of Sekiu, and the entire length of State Route 113. The sharp increase in traffic stops on State Route 113 in 1999 could be related to the Makah whale hunt (George 2005b). In addition to conducting traffic stops, state troopers responded to an average of more than 50 collisions in this area each year. In most years, more than half of these collisions occurred on the 15-mile stretch of State Route 112 between Sekiu and the Makah Reservation boundary, which had an average annual rate of 1.8 collisions per mile. The corresponding rates for United States Highway 101 and State Route 113 were 1.5 and 0.9 collisions per mile, respectively.

A law enforcement task force was assembled to ensure public safety during the previous hunts in 1998, 1999, and 2000 (Section 3.15, Public Safety, for more information about the task force). The task force was prepared to deploy any combination of 14 law enforcement agencies, from the Clallam County Sheriff's Department to the Royal Canadian Mounted Police. Ships, boats, planes, helicopters, squad cars, and the National Guard were prepared to participate, if necessary. The task force prepared for a worst-case scenario of 15 days of police protection, costing $160,000 in overtime, equipment, and supplies (Mapes 1998d). Despite serious concern about conflicts between protesters and whaling supporters, the full strength of the task force was never needed.

TABLE 3-41. NEAH BAY AREA TRAFFIC STOPS AND COLLISIONS, 1997 TO 2004

	1997	1998	1999	2000	2001	2002	2003	2004
State Route 101 Mileposts 192-203								
Traffic stops	608	954	831	851	770	683	829	682
Collisions	20	14	15	21	20	15	16	9
State Route 112 Mileposts 0-15								
Traffic stops	139	184	103	91	75	61	78	103
Collisions	28	37	28	24	23	30	28	21
State Route 113 Mileposts 0-10								
Traffic stops	103	133	251	122	110	181	164	156
Collisions	10	9	13	7	10	12	4	4
TOTAL								
TRAFFIC STOPS	**850**	**1,271**	**1,185**	**1,064**	**955**	**925**	**1,071**	**941**
COLLISIONS	**58**	**60**	**56**	**52**	**53**	**57**	**48**	**34**

Source: Washington State Patrol 2005.

The Clallam County Sheriff's Department did not find that the hunt and associated activities imposed a substantial burden on department staff (Snover 2005). Particular concern preceded the celebration of Makah Days in August 1998. There were rumors that up to 20,000 anti-whaling demonstrators might attend to disrupt the tribal community festival. Washington Governor Gary Locke mobilized 800 members of the National Guard to ensure public safety. By the end of the festival weekend, there had been no demonstrations and few protesters (Mapes 1998d). The following year, $825,000 of the state general fund was allocated to reimburse costs associated with this activation (Washington State Senate 1999).

3.14.3.3 Local Medical Facilities

The Sophie Trettevick Health Center on the Makah Reservation has three permanent providers, who are Indian Health Service employees – two medical doctors and one nurse practitioner. The clinic focuses on primary care and has x-ray services and a pharmacy. The normal hours of operation are Monday through Friday, from 8:00 a.m. to 5:00 p.m. After-hours and emergency services are provided be emergency responders via 911 calls, 24 hours per day, seven days per week. Emergency response includes stabilization and transport to the closest appropriate facility. Airlift NW (Seattle) can be called in, and patient destination is determined by the emergency responder. If Airlift NW is not available, the Coast Guard may provide transport. For emergencies on the water, the Coast Guard is the responder.

Although the health clinic provides day-to-day care service to tribal members, it will treat anyone with life or limb-threatening injuries. Injured non-Indians patients are stabilized and transported to an appropriate facility. The clinic has a memorandum of agreement with the Coast Guard to provide services and with Clallam Bay Fire District 5 to provide mutual assistance in emergency situations. The clinic has a Comprehensive Emergency Management Plan (2005) that dovetails to the Makah Comprehensive Management Plan (Section 3.1.2.2, Makah Tribal Porgrams and Management Plans).

The closest 24-hour medical facility is the Forks Community Hospital, approximately 50 miles away. This is a Level 4 trauma care facility; patients with life-threatening injuries are stabilized and transported by Airlift Northwest or ambulance to more advanced trauma facilities, if necessary. The closest Level 3 trauma care facility (a facility with the resources for emergency resuscitation, surgery, and intensive care for most trauma patients) is at Olympic Medical Center in Port Angeles, 71 miles from Neah Bay and 58 miles from Forks. The closest Level 1-2 trauma care facility, which supports the full availability of specialists and can provide back-up resources for the care of exceptionally severe injuries, is Harborview Medical Center in Seattle, 120 air miles away.

3.15 Public Safety

3.15.1 Introduction

Aboriginal subsistence whale hunting is an inherently dangerous activity. The 2006 IWC Whale Killing Methods Workshop Report indicated, for example, that fatal accidents are not uncommon in Arctic aboriginal subsistence whaling hunts; between one and six people die annually in the Alaska and Chukotka Native hunts, combined (IWC 2007a). Five factors in the local environment may affect public safety: location of the hunt; weather and sea conditions; behavior of the targeted species (the gray whale); number and behavior of people associated with the hunt (including protesters); and hunting equipment, including vessels and weapons.

3.15.2 Regulatory Overview

3.15.2.1 Vessel Safety Regulations and Authorities

Any Makah whale hunt would occur within the EEZ of the United States, where the Coast Guard has enforcement authority over vessel safety under the Ports and Waterways Safety Act (33 USC 1221 et seq.). The Coast Guard has established an RNA in the Strait of Juan de Fuca and adjacent coastal waters of northwest Washington (33 CFR 165.1310) to enforce vessel activities near any Makah whale hunt and reduce the danger of loss of life and property from any hunt. See Section

3.1.1.3, Coast Guard Regulated Navigation Area, and Figure 3-1, for information about location of the RNA in relation to the project area. When the Coast Guard finalized the RNA after the 1999 hunt had occurred, it specifically found that "[t]he uncertain reactions of a pursued or wounded whale and the inherent dangers in firing a hunting rifle from a pitching and rolling small boat are likely to be present in all future hunts, and present a significant danger to life and property if persons or vessels are not excluded from the immediate vicinity of a hunt" (64 FR 61209, Nov. 10, 1999).

Within the RNA, a MEZ is activated when one Makah whale hunt vessel displays an international numeral pennant 5. The whale hunt vessel may be the canoe or the chase boat; the MEZ extends 500 yards around the vessel. The zone operates between sunrise and sunset, when surface visibility exceeds 1 nautical mile (33 CFR 165.1310(b)). The MEZ is deactivated upon sunset, when visibility is reduced to less than 1 nautical mile, or when the Makah hunt vessel takes down the international numeral pennant 5 (33 CFR 165.1310(b)). No person or vessel may enter the MEZ when it is activated, except for the authorized Makah whale hunt vessel, an authorized media pool vessel preauthorized by the Coast Guard, or another vessel or person authorized by the Coast Guard (33 CFR 165.1310(c)), such as the observer vessel. The authorized media pool vessel must maneuver to avoid positioning itself between whales and hunt vessels, out of the line of fire, at a prudent distance and location relative to the whale hunt operations, and in a manner that avoids hindering the hunt or path of the whale in any way (33 CFR 165.1310(f)(3)). The media pool vessel must operate at its own risk, but in accordance with safety and law enforcement instructions from Coast Guard personnel (33 CFR 1310(f)). The regulation does not affect normal transit or navigation in the RNA. The Makah whalers must provide specific broadcasts on a marine radio channel (Channel 16 VHF-FM), starting one half hour before they begin whale-hunting operations and continuing every half hour until hunting activities end. The broadcasts advise mariners of the 500-yard exclusion area and urge them strongly to remain even further away from whale hunting activities as an additional safety measure (33 CFR 1310(e)).

The Coast Guard's regulations are consistent with the International Maritime Organization's guidelines for preventing collisions at sea (1972 Convention on the International Regulations for Preventing Collisions at Sea) and meet the goals of IWC Resolution 2006-2. At the 58th Annual Meeting on St. Kitts, the IWC adopted Resolution 2006-2 on the Safety of Vessels Engaged in Whaling and Whale Research-related Activities, recognizing concerns about confrontations at sea and ports related to whaling activities. The IWC and contracting governments acknowledged the right to legitimate and peaceful forms of protest and demonstration, but agreed and declared that

the IWC and contracting governments do not condone any actions that are a risk to life and property relative to confrontations related to whaling between vessels at sea.

3.15.2.2 Weapon Safety Regulations and Authorities

For Makah tribal members on the Makah Reservation or hunting in the Tribe's U&A, Title 10 of the Makah Law and Order Code, Weapons Control Ordinance, governs the possession and use of weapons. Adults may possess weapons on the reservation, provided that individuals do not carry their weapons with intent to assault another, do not threaten to use or exhibit weapons in a dangerous or threatening manner, and do not use weapons in a fight or quarrel (Section 10.5.01). Weapons also must not be concealed; loaded and carried in a vehicle on a public road; discharged from, upon, or across any public highway (Section 10.5.01); and not possessed or discharged in any closed area (Section 10.5.02). Juveniles from 16 to 18 years of age may possess weapons after completing a weapons training course and receiving a weapons safety certificate from the chief of the Makah Tribal Police (Section 10.2.01).

Under the proposed action and in the past hunts, the Makah Whaling Commission has also established certification guidelines and a certification process for whaling captains, harpooners, riflemen, divers, canoe paddlers, and other whaling team members. The guidelines and certification process ensure that every whaler has received adequate training to perform his assigned role on the team. Certification of riflemen includes a demonstration of proficiency and accuracy under simulated hunting conditions. Under the proposed action, and in past hunts under the 2001 Gray Whale Management Plan, the rifleman (onboard the Makah chase boat) cannot discharge a weapon until authorized to do so by a Makah safety officer (a diver or a Makah member also on board the Makah chase boat). There are three safety factors:

1. The safety officer has the authority to determine whether visibility is less than 500 yards in any direction, in which case the whaling captain suspends the hunt.
2. The safety officer would not authorize the rifleman to discharge the weapon unless the barrel of the rifle was above and within 30 feet or less from the target area of the whale.
3. The safety officer would determine whether the rifleman's field of view is clear of all persons, vessels, buildings, vehicles, highways, and other objects or structures that if hit by a rifle shot could cause injury to human life and property.

Off the Makah Reservation (including on the territorial sea), or for non-Indians on the Reservation, the laws of Washington State apply to weapon possession and use. The Revised Code of Washington (3.1 RCW 9.41.270(1)) contains the following language:

> [i]t shall be unlawful for any person to carry, exhibit, display, or draw any firearm, dagger, sword, knife or other cutting or stabbing instrument, club, or any other weapon apparently capable of producing bodily harm, in a manner, under circumstances, and at a time and place that either manifests an intent to intimidate another or that warrants alarm for the safety of other persons.

3.15.2.3 Other Safety Regulations and Authorities

For Makah Tribe members on the Makah Reservation or hunting in the Tribe's U&A, several different provisions of Title 5 of the Makah Law and Order Code, Criminal Code, prohibit acts such as assault, harassment, trespass, criminal mischief and injury to public property, which could apply to disruptions associated with protest activities. Section 3.1.2.1, Makah Tribal Departments and Agencies, describes the Makah Public Safety Department, which is responsible for enforcing the Tribal Code, and Section 3.1.2.2, Makah Tribal Programs and Management Plans, describes the Makah Tribe's law enforcement programs. Off the Makah Reservation, or for non-Indians on the reservation, the laws of Washington State apply to such activities. The Revised Code of Washington prohibits a similar suite of criminal activities that could be associated with protest activities.

3.15.3 Existing Conditions

3.15.3.1 Location of the Hunt

The bulk of the Makah U&A lies along the geographically remote and isolated Washington coast, but an arm of the U&A extends into the Strait of Juan de Fuca, in United States waters from Neah Bay to Tongue Point near Port Angeles (Figure 1-1, Project Area). The portion of the U&A along the Strait of Juan de Fuca is less remote and is bordered by public lands, communities, and State Route 112, which runs parallel to the shoreline for nearly the entire length of the Strait portion of the U&A. A few points of State Route 112 closely hug the shore. The current Coast Guard RNA is smaller than the U&A, and the portion of the RNA that extends into the Strait stops just past the Makah Reservation (Figure 3-1, Designated and Managed Areas).

3.15.3.2 Weather and Sea Conditions

3.15.3.2.1 Relevance of Weather and Sea Conditions

The IWC has recognized that prevailing weather conditions in association with relatively small vessels and traditional hunting techniques may diminish the efficiency of aboriginal subsistence whaling (see, for example, IWC Resolution 2001-2, IWC Resolution 2004-3). Seasonal and weather variations in the local environment where aboriginal hunts occur also affect the safety of whale hunts, including locating, striking, and killing the whale; recovering the whale; and towing it back to a butchering location. In its Report on Weapons, Techniques, and Observations in the Alaskan Bowhead Whale Subsistence Harvest, the United States reported that fall bowhead hunts occur under conditions that include high winds, rough seas, and ice-choked waters and stated that fatal accidents are a fact of the hunt under such treacherous conditions (Alaska Eskimo Whaling Commission 2006). The weather and sea conditions in the project area can also be treacherous, as described further below.

Dangerous weather and sea conditions for the Makah historic whale hunts are evident in their traditional equipment design, such as 36-foot-long and five-foot-wide canoes designed for seaworthiness and ability to travel great distances offshore (Arima 1983; Renker 2002) and in their statements before the British Commissioners in the 1890s, where tribal members reported that pelagic seal hunting was "practically given up" for about 20 years due to loss of lives at sea while hunting (Section 3.10.3.4, Makah Historic Whaling, Cessation of the Hunt, citing Crockford 1996). During the 1998 training exercises and the 1999 to 2000 Makah whale hunts, no weather-related accidents or fatalities occurred. All hunts occurred in late April and May, when weather and seas generally begin to improve in the Makah U&A. On May 11, 1999, the Makah suspended one of their four days of hunting for that year after less than 2 hours of hunting, due to inclement weather conditions (Gosho 1999; NMFS 1999). During the fall/winter of 1999/2000, the Makah Tribal Council did not issue any whaling permits because weather conditions were unsuitable.

Relevant weather and sea-state parameters for the project area and proposed action include air temperature, sea temperature, fog and precipitation, wind speed, and wave height. Air temperature is important to hunting safety because ocean water can freeze on deck (generally at 28.5°F [-1.9 °C]), potentially causing equipment to be slick or otherwise hampered. This could lead to injuries or reduce the accuracy and efficiency of the harpooner and rifleman. Sea temperature may also be relevant to determining the risk of hypothermia if a person involved in or protesting the hunt enters the water (for example as the result of a boat overturning or other

accident). Fog and precipitation can reduce visibility, creating a potential for vessel collisions or reducing the accuracy of the harpooner or rifleman. Beattie (2001) recommended a minimum visibility standard of 500 yards in all directions during the Makah hunts, to eliminate problems with boats entering the 500-yard MEZ (Section 1.4.2, Summary of Makah Whaling — 1998 through 2007, for information about the many boats that have been associated with past Makah hunts). The Makah included this 500-yard visibility recommendation in their proposed action. Wind speed can also affect the accuracy of the harpooner or rifleman.

Wave height can affect vessel operations and stability, as well as visibility and orientation of the whale, all of which can influence the accuracy of the harpooner or rifleman. Beattie (2001) recommended that the Makah hunts institute a 30-foot distance limitation between the rifleman and the whale and require that a rifleman only fire at a downward angle, based on concerns about sea swell as it relates to accuracy (i.e., missed shots) and ricochets. The Makah's proposed action includes the 30-foot distance limit and downward firing angle. In a later report again examining the safety and guidelines for the Makah hunt, Graves et al. (2004) concluded that shots fired at or below a certain angle will not produce ricochets, "whether the water surface is glass smooth or rough with waves" (Section 3.15.3.5.2, Weapons Associated with the Hunt, Secondary Killing Methods).

3.15.3.2.2 Description of Weather and Sea Conditions in the Project Area

Sea temperature by month is displayed in Figure 3-13, Sea Temperatures at Cape Elizabeth Buoy from June 1987 through December 2001. Significant wave height (the average of the highest one-third of all wave heights recorded during 20-minute sampling periods) by month is displayed in Figure 3-14. Air temperature, precipitation, visibility, and wind information are displayed in Table 3-42, Climatological Data from Tatoosh Island. Winds in the project area are strongest from October through March (with monthly averages ranging from 14.1 to 17.4 knots), tapering off from April through August, and beginning to increase again in September (monthly averages during this period range from 8.9 to 12.2 knots) (Table 3-42). Variations in both air and sea temperature follow a seasonal pattern, with a moderate range from average monthly highs to average monthly lows. Air temperature drops steadily from September through January and February, with warming beginning in March and continuing through August. The range in average monthly temperature is 41.4° F (5.2° C) in January and 56.2° F (13.4° C) in August. Sea temperature follows a similar pattern, ranging from a low around 8° C (46° F) in January and February to 14° C (57° F) in August. Significant wave height increases during the fall and winter

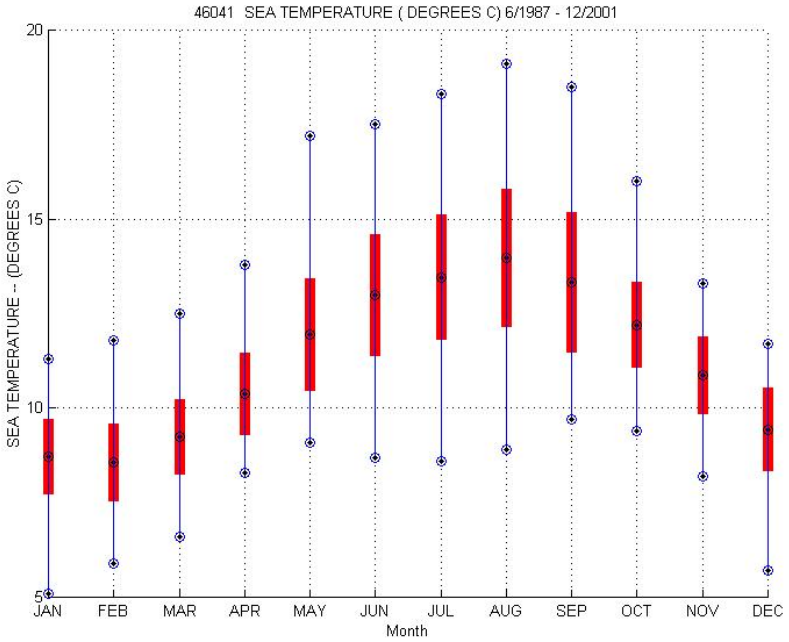
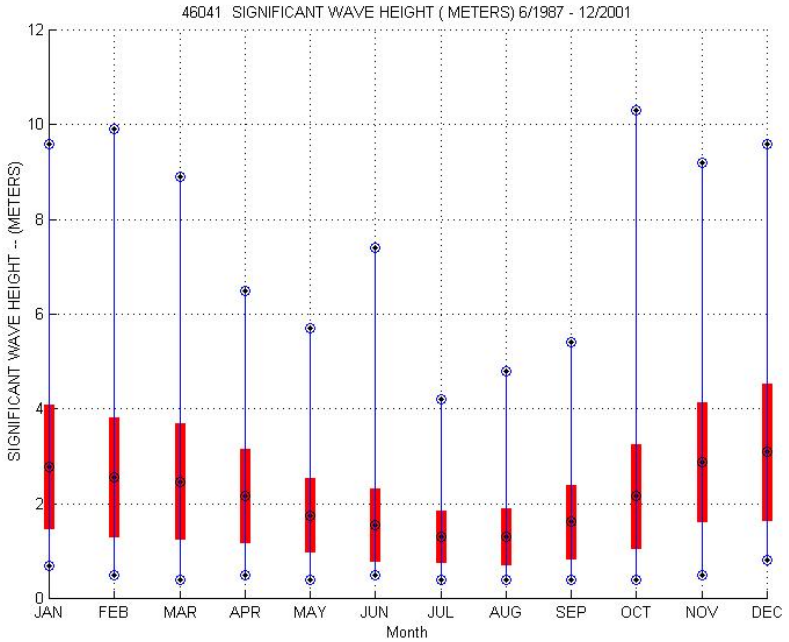


Figure 3-13. Sea Temperatures at Cape Elizabeth Buoy from June 1987 through December 2001



Source: NOAA National Data Buoy Center 2007a.

Figure 3-14. Significant Wave Height at Cape Elizabeth Buoy from June 1987 through December 2001

Source: NOAA National Data Buoy Center 2007b.

months. The range of average significant wave heights is also moderate (from around 6 feet in the summer months to around 13 feet in the winter months), but the period of time from October through March has greater variability within months, showing periods of significant wave heights exceeding 30 feet (October). There are more days of fog in July through September than the rest of the year, while precipitation (the other factor affecting visibility) is lowest from April through October.

TABLE 3-42. CLIMATOLOGICAL DATA FROM TATOOSH ISLAND, WA (48°23'N, 124°44'W, 115 FEET ELEVATION)

Weather Elements	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Yrs Of Record
Temperature (Degrees F)														
Mean	41.4	43.3	43.5	46.9	50.6	53.4	55.4	56.2	55.1	52.0	47.3	44.1	49.1	18
Mean daily maximum	44.7	46.9	47.4	51.0	54.6	57.2	59.2	60.1	59.5	55.9	50.8	47.4	52.9	18
Mean daily minimum	37.6	39.2	39.1	42.4	46.1	49.2	51.1	51.8	50.2	47.7	43.3	40.3	44.8	18
Extreme -highest	57	63	66	69	74	82	80	76	80	70	64	61	82	18
Extreme -lowest	14	20	25	33	37	43	46	45	43	36	19	14	14	18
Precipitation														
Mean amount (inches)	10.93	9.59	7.91	5.48	2.63	2.59	2.06	2.35	3.38	8.65	11.52	12.52	79.62	18
Greatest amount (inches)	20.02	21.16	14.80	10.20	6.10	6.31	6.05	4.78	7.04	13.65	22.17	16.81	101.64	18
Least amount (inches)	1.84	4.23	2.94	0.68	0.87	0.47	0.03	0.18	1.18	2.50	4.47	7.25	68.70	18
Maximum amount-in 24 hours (inches)	2.93	2.74	2.68	3.05	1.64	2.18	1.50	2.14	1.95	3.80	3.76	3.28	3.80	18
Mean number of days with precipitation	25	22	24	20	19	19	18	19	16	20	23	26	251	18
Wind														
Percent of observations with gales	6.09	3.59	1.21	1.01	0.19	0.07	0.02	0.02	0.28	2.06	3.87	5.49	2.32	19
Mean wind speed (knots)	17.4	15.9	14.1	12.2	10.3	9.1	8.9	8.9	10.4	14.1	16.6	17.4	12.9	19
Visibility														
Mean number of days with fog	11	11	9	9	10	14	18	21	17	13	10	12	155	18
Percent of observations with visibility less than or equal to ½ mile	0.96	0.74	0.46	0.67	2.73	4.97	9.50	15.12	9.81	3.96	0.95	0.43	4.19	19

*Sea level pressure is station pressure reduced to sea level.
T = trace (not measurable) of precipitation.
MISS or (blank) is a missing value.
Source: NOAA's National Climatic Data Center, National Environmental Satellite, Data & Information Service

3.15.3.3 Behavior of the Gray Whale

Early whalers referred to gray whales as 'devil fish' and 'hard head' because gray whales were reported to attack whaling skiffs when harpooned, frequently causing a loss of human life (Henderson 1984). During the IWC's 2003 workshop on whale killing methods, the Russian delegate emphasized the aggressive behavior of gray whales (IWC 2004c). The violent struggles of a struck whale can result in vessels being capsized, persons on vessels being knocked into the water (Alaska Eskimo Whaling Commission 2006), or individuals becoming entangled in the lines fastened to the whale. Even postmortem movements of a whale may be dangerous. Towing a dead whale also presents hazards, particularly if the whale is not well moored to the vessel (e.g., Alaska Eskimo Whaling Commission 2006). While the Makah hunts in 1998 through 2000 did not result in any fatal accidents, hunting disasters did occur in prior whaling days. Arima (1983) reported that, "[t]he dangerous [moments of the hunt] lasted until all the line and floats were . . . out because someone could get caught in a loop or the canoe could be capsized or smashed in the first violent struggles of the whale before it sounded."

3.15.3.4 Behavior of People Associated with the Hunt

Based on experience in the 1998 Makah training exercises and the 1999/2000 hunts, any future Makah whale hunting will likely generate some degree of public interest that may involve public protests and the media. For additional information, see Section 1.4.2, Summary of Recent Makah Whaling – 1998 through 2007, and Section 3.12.3.3, Media Coverage of the 1998 through 2000 Hunts.

Before the Makah began the gray whale hunt in 1998, law enforcement authorities had advance notice of likely protests and conflicts between those protesting and those supporting the hunt. Prior to the hunt, the Makah Tribal Council directed the Makah Police Chief to form a task force of Makah departments (including the Police Department and Health Clinic) and off-reservation public safety resources (including Washington State Patrol, Clallam County Sheriff Department, Coast Guard, FBI, Department of Defense, other tribal police departments, etc.) to recommend a strategy to address any potential public disturbance related to whale hunts. The strategy called for close coordination of tribal, state, and federal authorities, including the military (Public Services, Section 3.14.3.2, Police, for more detail). The following discussion summarizes the protest activities and conflicts before and during the 1998 to 2000 whale hunts, including law enforcement response.

In 1998, the Makah whaling crew began to prepare for a hunt scheduled to start October 1, 1998. On August 25, 1998, the Makah Tribal Council passed Tribal Resolution 189-98 stating that protest vessels were not to dock at Neah Bay. This meant that protesters were not to attempt to disembark from vessels. A flotilla of protest vessels began to arrive before October 1, anchoring offshore in Neah Bay near Waadah Island. It included zodiacs, kayaks, a few larger boats belonging to the Sea Shepherd Conservation Society, and a two-person Norwegian Navy surplus submarine, painted like an orca and intended to deliver orca calls into the water to scare gray whales away. Federal and state officials advised the Sea Shepherd Conservation Society that noise emitted by the orca sub might constitute harassment under the MMPA (*Victoria Times Colonist* 1998). Others moored in nearby Sekiu, away from the reservation. The Sea Shepherd Conservation Society coordinated volunteers to conduct scouting trips up and down the coast in 15 boats, watching for the whaling canoe (Mapes 1998e). A British Columbia whale-watching charter organization representing 10 firms also appeared on October 1 (Mapes 1998e). By October 8, the protest vessels had deployed twice in reaction to a false alarm that the Makah were hunting whales (Mapes 1998e).

On November 1, 1998, one of the protesting organizations (Sea Shepherd Conservation Society) notified the Makah Tribal Council and law enforcement officials that a staged demonstration would take place. Coast Guard and Clallam County Sheriff's Office personnel remained at the Coast Guard base in Neah Bay, but stayed in contact with Neah Bay Police, who took the lead according to the previously agreed-upon task force structure (Buckingham et al. 2006). The M/V *Sirenian*, one of the larger boats, was steered up near the boat dock, and several zodiacs, kayaks, and jet skis approached and sped around inner Neah Bay. The protest boats played killer whale vocalizations over a loudspeaker and blew air horns (Mapes 1998f), shouted at tribal members onshore, and displayed protest banners. Crowds of Makah tribal members assembled on the waterfront, in cars, and on the shore, exchanging insults and honking horns; several members beat tribal drums, danced, and sang songs (Mapes 1998f; Shukovsky 1998a). Some Makah youths ran out on the docks with firecrackers and rocks, throwing them at the protest vessels, breaking a window on the *Sirenian*. Three protesters in a zodiac attempted to dock the vessel (to accept a dinner invitation from a Makah member); someone pushed one of the protesters off the dock into the water, without injury (Lacitis 1998; Mapes 1998f). Neah Bay Police subsequently detained all three protesters (Mapes 1998f). Tribal members and the police confiscated the zodiac; a fourth protester waded ashore to retrieve the zodiac and was arrested. The Neah Bay Policed turned all the detained individuals over to the Clallam Bay Sheriff's Department. The protesters all gave

voluntary statements and were released without charges (Mapes 1998f). The tribal police established order on shore, and the crowd dispersed. Clallam Bay Sheriff's Department and the Federal Bureau of Investigation conducted investigations in the following days (Mapes 1998f; Shukovsky 1998b).

A group of 30 protesters attempted a simultaneous vehicle protest on State Route 112, but Neah Bay Police stopped the protesters at the reservation boundary (Mapes 1998g). On November 5, Jean-Michel Cousteau visited the Makah Reservation and asked the Makah not to hunt; the visit was cordial by all accounts (Shukovsky and Barber 1998). On November 11, 1998 protest vessels mobilized, but were responding to a false report that the Tribe was hunting and had killed and landed a whale (United States Coast Guard 1998). Talks between the leader of the Sea Shepherd Conservation Society and the Makah Tribal Council took place on November 24, 1998. Sea Shepherd reportedly assured the Makah that motivations were not racial, and the Makah reportedly assured Sea Shepherd that they did not intend to sell whale meat to Japan (Denn 1998). All the protest vessels left by November 26, 1998 (The *Edmonton Journal* 1998). A second group of anti-whaling activists offered the Tribe monetary compensation in lieu of whaling (Denn 1998b), but Tribe did not accept the offer (Denn 1998c).

The spring 1999 hunt began on May 10, 1999, and continued over four nonconsecutive days (May 10, 11, 15, and 17) in the coastal portion of the Makah U&A south of Cape Flattery (Section 1.4.2, Summary of Recent Makah Whaling, for a more complete description of hunting locations). On May 10, 1999, the hunt was disrupted by vessel-based protesters who maneuvered between the two Makah vessels and the whales. Protesters tried to scare the whales, and they also fired flares and smoke flares at the Makah whaling party vessels (NMFS 1999; Sunde et al. 1999; United States Coast Guard 1999a). Because most of the hunting occurred south of the Coast Guard's RNA, a 500-yard MEZ around the Makah vessels was not in effect (NMFS 1999). Coast Guard officials detained two of the protesters and subsequently cited them for grossly negligent operation. The Clallam County sheriff arrested them for reckless endangerment (NMFS 1999; Sunde et al. 1999; United States Coast Guard 1999a). On May 11, the Makah whaling captain called off the second hunt shortly after it began due to inclement weather.

On May 15, 1999, protest vessels operated around the whalers much of the day. Two protest vessels encountered whales. One vessel ran over the top of a whale and temporarily stunned it, while another vessel hit the flukes of a diving whale beside the Makah canoe (NMFS 1999). The Coast Guard cited four vessels for grossly negligent operations and/or MMPA infractions and took three of the vessels into federal custody (NMFS 1999). On May 17, 1999, the fourth and final day of the hunt, no protest vessels attempted to disrupt the hunt (United States Coast Guard 1999b). The Makah crew successfully landed a whale on that day. Local and regional anti-whaling activists engaged in various acts of protest after the successful 1999 hunt. Activities ranged from peaceful candlelight vigils in Seattle (Burkitt 1999b), to protests on Washington State Route 112 at the Makah Reservation boundary. The leaders of some activist groups encouraged more direct action, such as being arrested, using lock boxes (barrels filled with concrete), and lock downs (use of chains, pipes, etc. to lock individuals together) (United States Coast Guard 1999c).

Before the spring 2000 hunt began, protesters arrived, patrolling the coast in a 38-foot retired Canadian search-and-rescue vessel, equipped with two jet skis and carrying some of the activists who had been charged in 1999 with negligently operating a motorized vessel (Welch and Morris 2000). A group of 30 protesters also blocked road access to the Makah Reservation for about an hour in early April (Welch and Morris 2000). The spring 2000 hunt began on April 17, 2000, and covered seven nonconsecutive days (April 17 and 20; May 6, 7, 10, 12, and 29) in the coastal portion of the Makah U&A south of Cape Flattery (Section 1.4.2, Summary of Recent Makah Whaling, for a more complete description of hunting locations). All hunts occurred within the Coast Guard's RNA and MEZ (Gearin and Gosho 2000), unlike spring 1999 hunts, because the southward boundary of the RNA had been extended by final rule on November 10, 1999 (64 FR 61209). During the first two days of hunting (April 17 and 20), protesters disrupted the hunts (Gearin and Gosho 2000). On April 21, Coast Guard personnel boarded two protest vessels and issued warnings (United States Coast Guard 2000). One of the vessels entered the 500-yard MEZ on three occasions subsequent to the Coast Guard advisory and was intercepted and again warned by the Coast Guard (United States Coast Guard 2000). On at least one of these three entrances into the MEZ, the vessel entered the 500-yard MEZ at high speed and was intercepted within 50 yards of the Makah's canoe (Gearin and Gosho 2000). Two individuals on jet skis also entered the MEZ, making high-speed charges at the Makah canoe (United States Coast Guard 2000). The Coast Guard intercepted both jet skiers. One jet ski operator ran into a Coast Guard vessel and sustained shoulder injuries; Coast Guard personnel retrieved the individual from the water, placed

the person under arrest, and transported her to Olympic Memorial Hospital (United States Coast Guard 2000). The Coast Guard also intercepted and arrested the second jet ski operator, transferring the individual to the Clallam County Sheriff's Office (United States Coast Guard 2000). On the five remaining hunting days (May 6, 7, 10, 12, and 29, 2000), one to three protester vessels were present during hunting, but they did not enter the MEZ to disrupt whale hunting.

3.15.3.5 Hunting Methods

3.15.3.5.1 Vessels Associated with the Hunt

The Makah traditionally hunted whales from large canoes approximately 36 feet long and more than 5 feet wide. Carvers made the canoes from a single cedar log. Currently, the Makah propose to make the initial approach and strike the whale in their traditional hunting canoe. A more modern chase vessel (a small skiff equipped with an outboard motor) would follow the traditional canoe. The second vessel would provide a platform for Tribe members (a rifleman, safety officer, and observer) who would assist in the hunt by killing a struck whale, finding a struck and lost whale, or towing a killed whale to shore. The driver of the chase boat would maneuver the rifleman to the harpooned whale to deliver a rifle shot at distances less than 30 feet from the target area.

3.15.3.5.2 Weapons Associated with the Hunt

Traditionally, the Makah used wooden harpoons with mussel shell tips to strike whales. The harpoon was attached to sealskin floats and lines made of sinew and cedar to secure whales. A long wooden lance was used to kill whales. After contact with American whalers, the Makah began to use iron harpoon heads and accept tows from commercial steamers. The Makah propose to hunt gray whales using a toggle-point steel harpoon, with a rope and floats attached, to strike and secure the whale and a .50 caliber rifle to kill it. This EIS also examines striking whales with a hand-thrown darting gun with either a black powder or penthrite explosive projectile, as well as killing whales with a black powder explosive projectile fired from a shoulder gun.

Primary Weapons Used to Strike (and Potentially Kill) Whales

Toggle-point Harpoon

A toggle-point harpoon is a wooden or metal shaft with a movable point (head) and is usually attached to a line (rope) and float. When the harpoon is thrust into a whale, the point twists horizontally (toggles) under the animal's skin. Pulling on the attached line secures the harpoon to the whale. The harpoon probably would not kill the whale, but it would be used initially strike and secure it with the line and floats. The Makah used a toggle point harpoon with a stainless

steel point to strike and secure the whale during the 1999 hunt, and their proposal is to continue using this method of striking whales.

Darting Gun (with toggle-point harpoon plus black powder or penthrite explosive projectiles)

A darting gun is a primary weapon some subsistence hunters use to strike and potentially kill whales. It is thrown by hand and consists of a steel toggle-point harpoon (connected to a line and floats) with a barrel attached to hold an explosive projectile (also referred to as a grenade, explosive charge, super bomb, and bomb lance) (O'Hara et al. 1999). A more extensive discussion of the types of explosive projectiles used in whaling follows. The steel harpoon serves the same purpose as the toggle-point harpoon described above, attaching a line and floats to the whale. The explosive projectile has a time-delay fuse designed to detonate after penetrating the whale; it is intended to stun or potentially kill the whale in conjunction with the first strike. Whales not killed by this first strike are killed using secondary weapons (another strike with the darting gun or the shoulder gun).

Secondary Weapons Used to Kill Whales

For most aboriginal whale hunts, secondary weapons (defined as those following the primary strike) are required to kill the whale. Secondary methods used by subsistence hunters include making additional strikes with the darting gun, shooting high caliber rifles, or firing explosive projectiles from a shoulder gun. The IWC encourages hunters to use secondary weapons for animals that move or in other ways show any signs of life as a routine precaution (IWC 2007a). The IWC has identified the appropriate target area for whales killed with rifles as the brain case (brain and upper neck) and, in emergencies, the heart. For whales killed with explosive projectiles, the appropriate target areas are the thorax and neck (IWC 2007a).

High-Caliber Rifle

Several aboriginal subsistence whalers and some commercial whalers use rifles as the secondary killing method. In 1997 and 1999, the Makah Whaling Commission contracted with Dr. Allen Ingling, a University of Maryland veterinarian with a background in ballistics, to choose the optimal weapons for hunting gray whales. The Tribe's goal was to provide safe conditions for humans and to employ a humane, effective, and efficient method of killing gray whales once attached to a line and floats. Dr. Ingling and the Makah investigated the performance of several firearms, including the Garand 30'06, Winchester .458 Magnum, Weatherby .460 Magnum, State Arms and LAR .50BMG, and the .577 A-Square Tyrannosaur. Participants assessed the weapons

for efficiency, safety, and humaneness by testing the depth of penetration of bullets in a water tank and evaluating weight, recoil, and loading ease (Ingling 1997; Ingling 1999). All of the weapons could kill a whale, based on test results, but participants selected the highest caliber rifles, the .50BMG and .577 A-Square Tyrannosaur, as the best options (Ingling 1999), primarily because the bullets would penetrate deeper in water, allowing a larger margin of error in targeting. The Tribe ultimately used the .577 A-Square Tyrannosaur in the 1999 hunt, because it was 6 pounds lighter that the .50BMG, it had a 3-round rather than single-shot capacity, and its shots penetrated deeper into the water.

In NMFS' 2001 EA (NMFS 2001a), reports indicated that no data on ricochet were available from the Army's .50BMG Field Manual (United States Army 1991). During a public comment period, NMFS received a report from Kline Engineering Company (Kline 2001) that assessed ricochet data, ricochet probability, and modeled trajectories for .50 caliber M33 rounds fired against sand. Kline (2001) concluded that no firings should be conducted within 6,670 yards from shore and advised that a ricochet could travel almost 1,860 yards off the line of fire. Subsequent to the Kline report, Beattie Natural Resources Consulting assessed the public safety of the 1999 hunt, specifically, the potential for injury or death from rifle fire to non-participants in the hunt. Beattie (2001) disagreed with Kline's earlier conclusions about a safety zone, but agreed there was a potential for missed shots to ricochet. Beattie (2001) made the following recommendations to enhance public safety of the hunt in the Strait of Juan de Fuca:

- Riflemen should have to use either a .50 caliber or .577 caliber rifle as the primary rifle.
- A rifleman should not shoot if the intended target is more than 30 feet from the muzzle of the rifle [to ensure that misses do not occur and to reduce the possibility of a ricochet].
- A rifleman should fire only at a downward angle [because a harpooned whale could surface at the top of a swell while the chase boat was in a position toward the middle of the trough or swell. In that situation, firing a shot might result in the unimpeded travel of the projectile toward the boundary of the MEZ, should the shot miss the whale and water].
- The Makah Whaling Commission should use simulated hunting conditions to document the riflemen's proficiency using rifles actually employed during whale hunting.
- There must be minimum visibility of 500 yards in all directions when it is harpooned (to eliminate problems with the boats entering the 500-yard MEZ due to low visibility).

- Where Highway 112 closely parallels the shoreline, the rifleman on the chase boat should fire at a whale with the rifle pointed away from the shoreline if the harpooned whale is within 500 yards of the shoreline.
- The diver on the chase boat should be the designated safety officer for the hunt (because the diver does not have another assignment or responsibility until others kill the whale). The diver should be assigned the sole task of monitoring safety conditions within the MEZ to ensure that the rifleman has a clear field of fire.

In 2004, NMFS contracted experts in military firearms training and technological capabilities to review all relevant public safety issues surrounding the conduct of Makah whale hunts, including the information presented in Kline (2001) and Beattie (2001). These experts confirmed the selection of the .50 caliber rifle as the weapon of choice, over the .577 A-Square, because it combines high power with consistently manufactured, commercial grade ammunition (Graves et al. 2004; Graves and Hazelton 2004). Graves et al. (2004) also conducted ricochet and range experiments on still water using similar weapons. They concluded that shots fired below an elevation angle of -6.2° (that is, with the gun pointed downward at the target in the water and below the shooter's horizon by at least 6.2 degrees) will ensure a very low probability of ricochets. Moreover, the probability of a ricochet declines to zero when shots are kept below the elevation angle, but wave height is greater, because wave changes in the surface geometry vastly reduce the surface area (i.e., wave tops) that can cause ricochets (Graves et al. 2004). Graves et al. (2004) also recommended that all persons near the hunt wear eye and double ear protection (i.e., earplugs and shooting muffs) when firing the rifle. This recommendation might conflict with those of Beattie (2001), which require the rifleman to communicate verbally with the safety officer.

Some aboriginal subsistence whalers use shoulder guns to deliver explosive projectiles intended to kill a whale that has already been struck with a harpoon with an attached line and floats. The explosive projectile detonates after penetrating the whale, and the explosion should kill it. A shoulder gun is generally a smooth bore seven or eight gauge weapon fired from the shoulder like a shotgun. Like a shotgun, it uses gunpowder to launch the projectile at the target. Although Øen (1995) recommended development of a shoulder gun capable of delivering a penthrite grenade, no shoulder guns adapted for this projectile currently exist.

Explosive Projectiles (Grenades)

Explosive projectiles for killing whales may contain either black powder or penthrite. Currently only darting guns have been modified to accommodate penthrite projectiles. The projectile is aimed at the neck and thoracic regions and kills the whale by damaging internal organs, either with the shock wave of the blast or tearing of tissues and hemorrhage caused by shrapnel (O'Hara et al. 1999). For each type of grenade, whether used with a hand-thrown darting gun or a shoulder gun, the grenades are very similar in shape (Øen 1995).

Black powder grenades are approximately 11.2 inches (28 cm) long and 0.9-inch (.2 cm) in diameter. The black powder in the grenade is a mixture of sulfur, saltpeter, and charcoal (Øen 1995; O'Hara et al. 1999), which explodes when ignited. Alaska Eskimos have used black powder grenades in hand-thrown darting guns in the bowhead hunt for approximately 150 years (Alaska Eskimo Whaling Commission 2006) and more recently in shoulder guns. The grenade's time-delayed fuse is designed to ignite in the barrel and detonate the grenade after it enters the whale's body. If the gun jams or the projectile detonates prematurely, it can cause a dangerous explosion on the whaling vessel (O'Hara et al. 1999). Øen reported that 18 percent of the black powder grenades malfunctioned (1995) in the 1984 to 1986 bowhead hunting seasons, though he did not describe the nature of the malfunctions. Black powder burns slowly, and less than half converts to gas (North Atlantic Marine Mammal Commission 2004). Black powder is also very sensitive to friction and electricity. Several accidents have occurred during production and the use of black powder. It is now classified as explosive, and storage and sale are entirely banned in some communities (North Atlantic Marine Mammal Commission 2004).

The penthrite grenade uses penthrite as the explosive material. A penthrite grenade consists of a tubular body that holds a charge (the penthrite), has a head with a firing mechanism, and contains safety devices. The time-delayed fuse on the penthrite grenade ignites after the grenade penetrates the whale, in contrast to the black powder grenade, which ignites in the barrel, reducing the risk of an explosion on the whaling vessel (Øen 2000). Numerous other grenade safety features are intended to prevent injury to whalers (Øen 2000). Penthrite combusts nearly instantaneously and provides substantially larger explosive power than black powder (Øen 2000). Reflecting use of advanced design and materials, a single penthrite projectile currently costs $1,000 (IWC 2007a).

The Alaska Eskimo Whaling Commission Weapons Improvement Program Committee worked with cooperating scientists from Norway on the design, testing, and manufacture of penthrite between 1987 and 1998. Participants' intent was to adapt penthrite grenades used in commercial

whaling for use in the darting guns used by Alaska whalers (Alaska Eskimo Whaling Commission 2006). In 2004, the Alaska Eskimo Whaling Commission, working in conjunction with the Norwegian government, developed a safety handbook and training video regarding the function and proper use of the penthrite projectile. Whaling captains must complete training and obtain certification in the use of the penthrite projectile and modified darting gun barrel.

It is uncertain whether penthrite grenades would be readily available for a Makah Tribe gray whale hunt. The costs have risen recently due to difficulty with the manufacture and shipping of a component of the fuse head/safe and arming mechanism. A Swedish manufacturer who supplied the fuse component closed shop in 2003. Although a similar French-made component would work as a replacement, the French manufacturer has been unable to obtain necessary export authorizations (Alaska Eskimo Whaling Commission 2006; IWC 2007a). If the fuse component must come from a new supplier in Norway, the production and the new product would require detailed and costly control and testing before being available for the safe and arming mechanisms used by aboriginal subsistence whalers (Alaska Eskimo Whaling Commission 2006).

3.16 Human Health

3.16.1 Introduction

3.16.2 Regulatory Overview

The Makah Tribal Council has developed a health code in recognition of the need for delivery of comprehensive health services to tribal members and their families. Title I, Policy, states that these codes apply uniformly throughout the Makah Indian Reservation to help tribal members achieve the health status of the general population and to increase effectiveness and efficiency of services offered within the reservation. The Makah Health Code offers a framework for decision-making related to health issues. None of the provisions relates to subsistence use of whales.

3.16.3 Existing Conditions

3.16.3.1 Nutritional and Health Benefits from Consuming Whale Food Products and Other Traditional Subsistence Foods

Historically, whale oil and whale products were important nutritional components of the diet of the Makah Tribe. They also played an important role in the Makah's cultural and spiritual well being (Section 3.10.3.5, Contemporary Makah Society, for a description of Makah Tribe's subsistence consumption). Whale oil, in particular, was widely used, because it did not spoil as quickly as whale meat. Early archaeological studies indicated that as much as 84 percent of the Makah diet was whale meat, oil, and other food products (Renker 2002). The Makah currently and historically have used the following whale products (Renker 2002): raw blubber, oil rendered

from whale blubber, organ meats (e.g., brain, heart) and muscle tissue from all parts of the whale (including around the jaw and under the eye). They use the rich oil for cooking, flavoring foods, and as a condiment (Renker 2002).

The introduction of the western diet (i.e., refined sugar and flour, beef, vegetable oil and lard, etc.) and the reduction in subsistence foods have been linked to poor health in Native American populations (Budowski 1988; Simopoulos 1999; Renker 2002) and also in Alaska Eskimos (IWC 1979b; Ebbesson et al. 2005a). The Makah Tribe, however, continues to consume large quantities of marine fish and shellfish. On average, Makah households consume 126 pounds per year (156 grams per day) of finfish and shellfish (Renker 2002).

Historically, the Makah consumed large quantities of whale products and fish (Renker 2002) and this reliance on marine foods resulted in a diet with a narrow nutritional base. General nutritional components of whale meat[10] and other protein sources are compared in Table 3-43.

Nutritional data are from the United States Department of Agriculture Nutrient Database (United States Department of Agriculture 2005). With the exception of whale oil and blubber, whale products have a similar nutritional profile (e.g., calories, protein, fat, and calcium) as other finfish, shellfish, wild game, and domestic meats. Whale oils and blubber provide a richer source of energy (calories) than other food types listed in Table 3-43, and whale meat has higher levels of iron. Whale oil is a good source of vitamin E (an antioxidant), and whale meat is a good source of selenium; both of which may play a role in protecting against the toxicity of certain seafood contaminants like mercury (Arnold and Middaugh 2004). Overall, however, it is difficult to compare essential nutrients and minerals of whale products directly to other protein sources because the former have not been studied extensively.

In addition to providing protein and energy, marine foods also contain essential vitamins, minerals, and lipids. Essential lipids include polyunsaturated fatty acids, which are important components of both whale and fish oils and are high in omega-3 polyunsaturated fatty acids (e.g., alpha-linolenic acid, eicosapentaenoic acid, docosapentaenoic acid, and docosahexenoic acid). These essential fatty acids improve or prevent symptoms associated with coronary heart disease, hypertension, Type 2 diabetes, kidney disease, rheumatoid arthritis, Crohn's disease, and

10 Whale food products nutritional information shown in Table 3-43 includes data for bowhead and minke whales (both baleen whales like the gray whale) and beluga (a toothed whale distinct from baleen whales).

chronic obstructive pulmonary disease (Budowski 1988; Simopoulos 1999; Simopoulos 2002; Holub and Holub 2004; Ebbesson et al. 2005b; Ebbesson et al. 2005b c; Reynolds et al 2006).

The human body does not naturally produce essential polyunsaturated fatty acids, so they must come from food consumed. Polyunsaturated fatty acids exist in a variety of food sources including fish oils, vegetable oils (e.g., soybean), nuts, and meat from terrestrial or marine mammals (e.g., whales), and vitamin supplements (National Academy of Sciences 2005).

Studies of subsistence populations that consume higher quantities of seafood than the general United States population, and consequently ingest higher levels of omega-3 fatty acids, suggest that these populations have lower rates of heart disease than the general population (Dewailly et al. 2001; McLaughlin et al. 2005). For example, McLaughlin et al. (2005) found that Alaska Natives with high dietary intake of polyunsaturated fatty acids (evidenced by higher tissue levels of polyunsaturated fatty acids) had lower heart disease mortality than non-natives.

Ebbesson et al. (2005b) measured fatty acid concentrations in Norton Sound (Alaska) Eskimos and screened for insulin resistance and diabetes. Findings indicated that high consumption of omega-3-fatty acids positively affected insulin sensitivity and glucose tolerance. Osterud et al. (1995) studied healthy men and women given supplements of oils (15 milliliters [mL]/day) from the blubber of seal, cod liver, and Minke whale for 10 weeks. Supplementation of the diet, especially with whale oil, had beneficial effects on biological measures associated with cardiovascular and thrombotic diseases.

Reynolds et al. (2006) reported on the high levels of omega-3 fatty acids in bowhead whale blubber consumed by Alaska Natives. The high levels of omega-3-fatty acids in the blubber and other marine mammal food products confer considerable health benefits on subsistence consumers and are important in the treatment or prevention of insulin resistance, diabetes, elevated blood pressure, cardiovascular disease, arthritis, and stroke (Reynolds et al. 2006).

Seafood diets containing essential polyunsaturated fatty acids are also beneficial for women at risk for hypertension during pregnancy (Popeski et al. 1991) and may prolong gestation and increase birth weight (Olsen et al. 1993; Grandjean et al. 2001). There was, however, a limit to the observed positive effects on birth weight, as researchers did not find increased weights at higher intake levels (greater than three fish meals per week) of essential fatty acids (Olsen et al. 1993; Grandjean et al. 2001). The National Academy of Sciences (2005) recommends dietary intake of polyunsaturated fatty acids (i.e., alpha-linolenic acids) at 0.5 grams/day (infants), 0.7 to 0.9 grams/day (children), and 1.0 to 1.6 grams/day (adults).

TABLE 3-43. USDA NUTRITIONAL VALUES FOR SELECTED FOOD TYPES

FOOD TYPE	ENERGY (CALORIES /100G)	PROTEIN (G/100G)	CALCIUM (MG/100G)	IRON (MG/100G)	SELENIUM (µG/100G)	VITAMIN A (IU/100G)	VITAMIN E (MG/100G)	VITAMIN B6 (MG/100G)	VITAMIN B12 (µG/100G)	TOTAL FAT (G/100G)	TOTAL SATURATED FAT (G/100G)	TOTAL MONO-UNSATURATED FAT (G/100G)	TOTAL POLY-UNSATU-ATED FAT (G/100G)
Whale													
Beluga meat, raw	111	26.5	7	25.9	36.5	340	n/a	0.05	2.59	0.5	0.092	0.337	0.025
Beluga oil	900	n/a	n/a	n/a	3.0	2310	8.27	n/a	n/a	100	14.49	54.19	10.8
Beluga eyes	291	19.6	n/a	n/a	n/a	1870	n/a	n/a	n/a	23.3	n/a	n/a	n/a
Beluga flipper, raw	271	19.0	11	2.8	n/a	930	n/a	n/a	n/a	21.7	n/a	n/a	n/a
Beluga liver, raw	117	18.4	11	n/a	n/a	22100	n/a	n/a	n/a	3.9	n/a	n/a	n/a
Bowhead skin and subcutaneous fat [1]	470	12.6	5	n/a	n/a	750	n/a	n/a	n/a	46.1	6.56	28.12	7.97
Bowhead, meat [2]	n/a	26.2 [2]	n/a	14.1 [2]	n/a	330 [2]	n/a	n/a	n/a	2.6 [2]	n/a	n/a	n/a
Bowhead oil	900	n/a	n/a	n/a	n/a	2810	n/a	n/a	n/a	100	n/a	n/a	n/a
Bowhead, blubber	870	0.4	n/a	0.5	n/a	n/a	n/a	n/a	n/a	96.5	n/a	n/a	n/a
Minke skin and subcutaneous fat, raw [1]	n/a	n/a	n/a	n/a	6.28[4]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Minke lean meat [3]	116	24.8	4.1	8.54	0.21[4]	n/a	n/a	n/a	n/a	1.2	18.5	49.2	21
Fish and Shellfish													

Food Type	Energy (calories /100g)	Protein (g/100g)	Calcium (mg/100g)	Iron (mg/100g)	Selenium (µg/100g)	Vitamin A (IU/100g)	Vitamin E (mg/100g)	Vitamin B6 (mg/100g)	Vitamin B12 (µg/100g)	Total Fat (g/100g)	Total Saturated Fat (g/100g)	Total Mono-unsaturated Fat (g/100g)	Total poly-unsaturated Fat (g/100g)
Salmon, Chinook, raw	179	19.9	26	0.3	36.5	453	1.22	0.4	1.3	10.4	3.1	4.4	2.8
Salmon, coho, wild, raw	146	21.6	36	0.6	36.5	100	0.65	0.55	4.17	5.9	1.26	2.13	1.99
Salmon, sockeye, raw	168	21.3	6	0.5	33.7	192	n/a	0.19	5.0	8.6	1.5	4.13	1.88
Halibut, raw	110	20.8	47	0.8	36.5	157	0.85	0.34	1.18	2.3	0.33	0.75	0.73
Crab, Dungeness, raw	86	17.4	46	0.4	37.1	90	n/a	0.15	9.0	1.0	0.12	0.17	0.32
Wild Game													
Elk, meat, raw	111	23.0	4	2.8	9.8	n/a	n/a	n/a	n/a	1.5	0.53	0.36	0.30
Deer, meat, raw	120	23.0	5	3.4	9.7	n/a	0.2	0.37	6.31	2.4	0.95	0.67	0.47
Domestic Meat													
Beef, composite of trimmed retail cuts, trimmed to 1/2-inch fat, prime, raw	169	21.0	6	2.3	18.7	n/a	n/a	0.43	3.25	8.8	3.41	3.82	0.37
Chicken, breast, meat and skin, raw	172	20.9	11	0.7	16.6	83	0.31	0.53	0.34	9.3	2.66	3.82	1.96

n/a = Data are not available. [1] This type of tissue is referred to by several different names (population specific), including maktak, muktuk or mattak.

(g) = grams (mg) = milligrams (ug) = micrograms (IU) = international units Sources: USDA National Nutrient Database (http://www.nal.usda.gov/fnic/foodcomp/search/); [2] IWC 1979b; [3] Suzuki 1993; [4] Hansen et al 1990

In summary, the many benefits associated with consuming marine seafood products, including whale, are well documented in the scientific literature. Marine mammal food products are rich with many of the same nutrients found in commonly consumed seafood products (fish and shellfish), and, in the case of some minerals and vitamins, marine mammal products provide an even richer source.

3.16.3.2 Environmental Contaminants in Gray Whales

While there is documented evidence of the beneficial effects of the nutrients in marine foods, persistent and potentially toxic chemicals also occur and are documented in the diets of native subsistence populations (Verbrugge and Middaugh 2004; Arnold and Middaugh 2004). In considering the type and amount of chemicals the Makah could ingest by consuming whale products, their continuing exposure to these contaminants is also a result of their ongoing, high consumption of other seafood products, including finfish and shellfish. Numerous researchers have documented concentrations of organic and inorganic contaminants in the tissues (muscle, organs, etc.) of the gray whales proposed for hunting by the Makah (Varanasi et al. 1994; Jarman et al. 1996; Krahn et al. 2001; Mendez et al. 2002; Ruelas-Inzunza and Paez-Osuna 2002; Tilbury et al. 2002; Ruelas-Inzunza et al. 2003; Dehn et al 2006a. Dehn et al 2006b).

Whale habitat and migration patterns should be considered when evaluating contaminant concentrations because these factors may affect the magnitude of contaminant concentrations (Houde et al 2005). The concentration of contaminants in whale tissues will also vary based on the feeding habits of the whale (Houde et al 2005) and whether the whale is freshly killed or stranded. Gray whales targeted by the Makah filter their food using the bony baleen plates located in their mouths (Vaughn 1978). Typically, this food consists of plankton and other micro- and macrofauna (Vaughn 1978). The levels of contaminants it contains are often lower because of the lesser position of these fauna in the overall marine food chain. Therefore, data on contaminant concentrations in whales that use other feeding strategies, such as toothed whales feeding on larger, older fish that accumulate greater levels of chemicals, are not presented here because they have less relevance to the types of whale (or associated contaminant levels) that are hunted by the Makah (i.e., gray whales). Distinctions are made between contaminant levels in freshly harvested versus stranded whales, because they are often lower in freshly harvested whales than in stranded whales (Rugh et al 1999; Krahn et al 2001).

As previously discussed, the Makah Tribe historically consumed large quantities of whale meat and blubber and, to a lesser extent, other portions of the whale (Renker 2002). In the past decade, the

Makah have consumed much smaller quantities of whale products (i.e., on a total biomass basis) compared with historical times. The animals consumed include both stranded as well as one freshly harvested animal following the 1999 hunt. The remainder of this section focuses on describing chemical concentrations measured in whale meat (muscle) and blubber because these are the parts of the whale that are most often consumed. A summary of contaminant concentrations in gray whale blubber and muscle tissue is presented in Table 3-44. Organic compounds (e.g., PCBs, pesticides, and dioxins) are associated predominantly with whale blubber because these compounds are lipophilic (i.e., easily dissolve in lipids or fat). Mean blubber concentrations of chlordane, DDTs, dieldrin, hexachlorobenzene, mirex, and PCBs in gray whales collected during subsistence hunts (Russian) in the Bering Sea in 1994 (Krahn et al. 2001 and Table 3-44) were 150, 150, 77, 230, 1.6, and 630 micrograms per kilogram (µg/kg) wet weight, respectively. These concentrations tended to be two to three times lower than those measured in stranded gray whales collected over the 1990s in Washington (Table 3-44), indicating that contaminant concentrations may be higher in diseased or aged whales, or in animals in poor nutritional health, that may strand in the Puget Sound region (Table 3-44). Concentrations of PCBs (1,200 µg/kg wet weight) and DDTs (520 µg/kg wet weight) in blubber of the whale caught by the Makah Tribe in 1999 were, however, higher than the mean levels reported in stranded gray whales or in those hunted in the Bering Sea.

Concentrations of organic contaminants in whale blubber typically were higher or comparable to those in other tissues (e.g., muscle, liver, kidney, or brain) (Krahn et al. 2001). Tissue biopsy concentrations (DDT, hexachlorobenzene, and PCBs), collected from Washington State waters using a dart collection method on live whales, tended to be lower than those measured from subsistence or stranded samples (Table 3-44). Jarman et al. (1996) found mostly non-detected concentrations (less than 0.002 µg/kg wet weight) of dioxins in two gray whales measured off California. The concentrations of organic compounds in gray whales typically were lower than in other whale species (Varanasi et al. 1994; Jarman et al. 1996; Krahn et al. 2001; Tilbury et al. 2002).

Few measurements of metal concentrations are available for blubber or muscle of gray whales, and those available are from stranded whales (Mendez et al. 2002; Ruelas-Inzunza and Paez-Osuna 2002; Rueles-Inzunza et al. 2003). Metal concentrations typically are higher in muscle tissue compared to whale blubber (Table 3-45). Mean concentrations of metals in muscle tissue from various studies range from 0.4 to 0.86 cadmium, 3.1 to 4.1 copper, 305 to 1,009 iron, 0.6 to 1.11 lead, 0.33 to 0.8 manganese, 0.145 mercury, 1.39 nickel, and 120 to 279 zinc µg/kg dry weight. Methyl mercury comprised approximately 75 percent of the total mercury measured in gray whale

muscle (Ruelas-Inzunza et al. 2003). Metal concentrations typically were higher in liver and kidney tissues than in muscle or blubber tissues (Mendez et al. 2002; Ruelas-Inzunza and Paez-Osuna 2002; Ruelas-Inzunza et al. 2003). Metal concentrations were not reported for the whale the Makah Tribe caught in 1999.

Since 1998, Chukotka Natives have been reporting a number of hunted whales from the Bering Sea that exhibit a strong medicinal odor, referred to as the 'stinky whale' phenomenon (IWC 2007b). Tissues from these whales have been deemed inedible by hunters. No known cause has been found, but research is ongoing to determine whether the smells are caused by chemical contaminants, disease, or other factors. At the IWC annual meeting in 2006, the United States and the Russian Federation reported on progress with their 2005 investigations. Samples were obtained from two stinky whales killed in the 2005 Chukotka Native hunts; data included chemical and toxicological analyses. These data will be available, and they will be reported on at the IWC annual meeting in 2007. At the 2006 meeting, Mexico also reported on a related gray whale study started on winter range breeding and calving grounds in March 2006, in response to inquiries about potential chemical pollution in Mexican waters. Mexico obtained breath samples for chemical analyses from free swimming whales and will present analyses of those data at the IWC annual meeting in 2007. Similar data were to be collected 2007 from free swimming whales off the Washington coast and reported on at IWC (IWC 2007b).

TABLE 3-44. CONCENTRATIONS OF ORGANIC COMPOUNDS MEASURED IN FRESHLY HARVESTED AND STRANDED GRAY WHALE TISSUES

ORGANIC COMPOUND	CONCENTRATION IN BLUBBER (µG/KG-WW)[1]	CONCENTRATION IN MUSCLE (µG/KG-WW)[1]	COMMENT	REFERENCE
Chlordane	150 ± 21	1± 0.2	Tissue from subsistence hunts (Russian Bering Sea 1994)	Krahn et al. 2001; Tilbury et al. 2002; Varanasi et al. 1994
	340 ± 120	NA	Tissue collected from stranded whales (1988 to 1991)	
DDTs	130 ± 26	NA	Tissue biopsies from live whales in WA State (1996 to 1998)	Krahn et al. 2001; Tilbury et al. 2002; Varanasi et al. 1994; Ylitalo et al. 1999
	150 ± 32	1± 0.2	Tissue from subsistence hunts (Russian Bering Sea 1994)	
	450 ± 140	NA	Tissue collected from stranded whales (1988 to 1991)	
	240 ± 44	NA	Tissue collected from stranded whales (1999)	
	520	3.2	Tissue from the Makah whale hunt (1999)	
Dieldrin	77 ± 14	NA	Tissue from subsistence hunts (Russian Bering Sea 1994)	Krahn et al. 2001; Varanasi et al. 1994
	160 ± 72	NA	Tissue collected from stranded whales (1988 to 1991)	
Hexachlorobenzene	100 ± 41	NA	Tissue biopsies from live whales in WA State (1996 to 1998)	Krahn et al. 2001; Tilbury et al. 2002; Varanasi et al. 1994
	230 ± 32	2 ± 1	Tissue from subsistence hunts (Russian Bering Sea 1994)	
	350 ± 130	NA	Tissue collected from stranded whales (1988 to 1991)	
	510 ± 130	NA	Tissue collected from stranded whales (1999)	
Mirex	1.6 ± 0.2	NA	Tissue from subsistence hunts (Russian Bering Sea 1994)	Krahn et al. 2001; Varanasi et al. 1994
	14 ± 4.6	NA	Tissue collected from stranded whales (1988 to 1991)	
PCBs	220 ± 42	NA	Tissue biopsies from live whales in WA State (1996 to 1998)	Krahn et al. 2001; Tilbury et al. 2002; Varanasi et al. 1994; Ylitalo et al. 1999
	630 ± 82	9 ± 2	Tissue from subsistence hunts (Russian Bering Sea 1994)	
	970 ± 240	NA	Tissue collected from stranded whales (1988 to 1991)	
	600 ± 130	NA	Tissue collected from stranded whales (1999)	
	1200	12	Tissue from the Makah whale hunt (1999)	
PCDDs/PCDFs	<0.002	NA	Concentrations measured in tissue (1987 to 1988)	Jarman et al. 1996
2,3,7,8-TCDD	<0.002 – 0.003	NA	Concentrations measured in tissue (1987 to 1988)	
2,3,7,8-TCDF				

1 Values represent the mean ± the standard error of the mean µg/kg – micrograms per kilogram

ww wet weight

NA Not Available

DDT Dichloro-Diphenyl-Trichloroethane

PCB Polychlorinated Biphenyl

PCDD Polychlorinated Dibenzodioxin

PCDF Polychlorinated Dibenzofuran

TCDD Tetrachlorodibenzodioxin

TCDF Tetrachlorodibenzofuran

Source: see reference column.

TABLE 3-45. CONCENTRATIONS OF METAL/METALLOID(S) MEASURED IN FRESHLY HARVESTED AND STRANDED GRAY WHALE TISSUES

METAL/METALLOID	CONCENTRATION IN BLUBBER (MG/KG-DW)[1]	CONCENTRATION IN MUSCLE (MG/KG-DW)[1]	COMMENT	REFERENCE
Cadmium	0.16	0.86 + 1.05	Tissue collected from stranded whales (1999)	Mendez et al. 2002
	NA	0.4 + 0.2	Tissue collected from stranded whales (1999)	Ruelas-Inzunza and Paez-Osuna 2002
	NA	0.02 + 0.002	Tissue collected from harvested whales (2001)	Dehn et al. 2006
Copper	1.72 ± 0.90	3.10 + 1.65	Tissue collected from stranded whales (1999)	Mendez et al. 2002
	NA	4.1 + 1.7	Tissue collected from stranded whales (1999)	Ruelas-Inzunza and Paez-Osuna 2002
	NA	3.17 + 0.62	Tissue collected from harvested whales (2001)	Dehn et al. 2006
Iron	28.9 ± 14.7	305 + 217	Tissue collected from stranded whales (1999)	Mendez et al. 2002
	NA	1009 + 802	Tissue collected from stranded whales (1999)	Ruelas-Inzunza and Paez-Osuna 2002
Lead	1.06 ± 0.73	1.11 + 0.69	Tissue collected from stranded whales (1999)	Mendez et al. 2002
	NA	0.6 + 0.4	Tissue collected from stranded whales (1999)	Ruelas-Inzunza and Paez-Osuna 2002
Manganese	0.44 ± 0.13	0.33 + 0.22	Tissue collected from stranded whales (1999)	Mendez et al. 2002
	NA	0.8 + 0.1	Tissue collected from stranded whales (1999)	Ruelas-Inzunza and Paez-Osuna 2002
Mercury	NA	0.145 + 0.082	Tissue collected from stranded whales (1999)	Ruelas-Inzunza et al. 2003
	NA	0.02 + 0.002	Tissue collected from harvested whales (2001)	Dehn et al. 2006
Methyl mercury	NA	0.109 + 0.040	Tissue collected from stranded whales (1999)	Ruelas-Inzunza et al. 2003
Nickel	1.10 ± 0.60	1.39 + 0.79	Tissue collected from stranded whales (1999)	Mendez et al. 2002
Selenium	NA	0.19 + 0.01	Tissue collected from harvested whales (2001)	Dehn et al. 2006
Silver	NA	0.004 + 0.0001	Tissue collected from harvested whales (2001)	Dehn et al. 2006
Zinc	16.0 ± 4.89	120 + 34.4	Tissue collected from stranded whales (1999)	Mendez et al. 2002
	NA	279 + 104	Tissue collected from stranded whales (1999)	Ruelas-Inzunza and Paez-Osuna 2002
	NA	39.47 + 4.53	Tissue collected from harvested whales (2001)	Dehn et al. 2006

1 Values represent the mean ± the standard error of the mean dw = dry weight µg/kg = micrograms per kilogram mg/kg = milligrams per kilogram
NA Not Available Source: see reference column

3.16.3.3 Exposure to Food-Borne Pathogens

Millions of cases of food-borne illness occur each year in the United States, and causes include consumption of subsistence products (Himelbloom 1998). Humans can be exposed to several types of pathogenic bacteria (e.g., *Clostridium botulinum*) during the harvesting, processing, preparation, and consumption of marine foods (e.g., fish, shellfish, or whale meat). There are reports of food-borne illness in Alaska Native subsistence communities where residents frequently consume whale meat and blubber, e.g., cases of botulism and salmonellosis in Alaska Natives consuming hunted or drift whales (Bender et al. 1972; Shaffer et al. 1990; McLaughlin et al. 2004; Sobel et al. 2004). From 1990 to 2000, 58 botulism events occurred in Alaska with 103 persons affected (Sobel et al. 2004). In 49 of these events, the contaminated food was identified as homemade Alaska Native foods consisting of fermented aquatic animal tissues, including whale skin or blubber (Sobel et al. 2004). The most common forms of food-borne pathogens identified when subsistence populations consume improperly cooked or handled food products (not just gray whale products) are characterized in Table 3-46. Like other subsistence cultures, the harvesting and consumption of ill-prepared or improperly stored gray whale products represent a potential pathway for exposure of the Makah Tribe to food-borne pathogens.

The Makah Tribe hunted and harvested a gray whale in 1999. The following is an account Renker (2002) describes the processing of the whale caught in 1999. The account illustrates some potential health-related issues.

Some 1,400 Makahs welcomed the whale to Front Beach in Neah Bay, and paid honor to the great creature. Many Makahs ate raw blubber right on the spot, and then began the task of preparing the food and resources that the whale contributed to the Makah people. Butchering the whale proved a huge task for the Makah people. Lack of familiarity with the gray whale anatomy, tools which were not well adapted for gray whale meat and blubber, and logistical issues presented immediate obstacles for the butchering process which began on Front Beach. Some confusion also centered on whale parts other than meat and blubber. Most importantly, Makah were able to overcome these problems and continue with the job of processing the whale.

TABLE 3-46. CHARACTERISTICS OF FOOD-BORNE PATHOGENS[1]

PATHOGEN	SOURCE	PREFERRED ENVIRONMENT	SYMPTOMS
Clostridium botulinum	Soil and aquatic environments	Temperature range: 3.3 to 50 °C (38 to 122 °F) pH range 4.6 to 9.0 Salt tolerance: 5 to 10 percent Oxygen: Strict anaerobe[2]	Symptoms are double vision, paralysis, dizziness, difficulty swallowing, speaking and breathing. Symptoms occur 12 to 72 hours after ingestion.
Enteropathogenic bacteria (Salmonella, Shigella, Escherichia coli, Yersinia and Campylobacter)	Human and animal intestines, feces	Temperature range: 5 to 47 °C (41 to 117 °F) pH range: 4.5 to 9.0 Salt tolerance: 1 to 3 percent Oxygen: Facultative anaerobe[3]	Symptoms are diarrhea, abdominal pain, fever, nausea, dehydration, urinary tract infection, kidney failure. Symptoms occur 6 to 48 hours after ingestion.
Listeria monocytogenes	Humans, animals, vegetation	Temperature range: 2.5 to 44 °C (36 to 111 °F) pH range: 5.0 to 9.5 Salt tolerance: 10 to 30 percent Oxygen: Facultative anaerobe	Symptoms are flu-like, diarrhea, mild fever, stillbirth or spontaneous abortion. Symptoms occur 1 day to weeks after ingestion.
Staphylococcus aureus	Humans and animals	Temperature range: 10 to 45 °C (50 to 113 °F) pH range: 4.5 to 9.3 Salt tolerance: 10 to 20 percent Oxygen: Facultative anaerobe	Symptoms are vomiting, diarrhea, no fever. Symptoms occur 1 to 8 hours after ingestion.

1 The food-borne pathogens in Table 3-46 are provided for general information and do not imply that gray whale products contain all of these pathogenic organisms.

2 Strict anaerobes are bacteria that grow under anaerobic conditions (without oxygen), use anaerobic respiration, and are poisoned by oxygen.

3 Facultative anaerobes are bacteria capable of growing under either aerobic (with oxygen) or anaerobic conditions.

Source: Himelbloom (1998).

In a matter of hours, a flatbed truck had taken what was left of the whale and driven to the Makah Tribe's fish plant, a processing plant with 800 cubic feet of freezer space and a service entrance large enough to allow the flatbed to drive inside. Within 24 hours, Front Beach showed no sign of the momentous event which had happened the previous day. The Makah butchering crew, which included Makahs who had traveled to Alaska to learn the processing techniques, had some assistance from a Native Alaskan. Many people worked to butcher the parts of the whale that had not been distributed to Tribal members on the night of 17 May. In addition to meat and blubber, Makahs interviewed during the Makah Household Survey reported requesting and receiving whale lice, sinew, baleen, brain, and heart. Other Makahs reported that they would have liked to receive liver, cheeks, eyes, and intestines. Some of these items, like whale lice and baleen, are primarily used for ceremonial reasons, while others can be used in tool production or as food. The

bulk of the food products derived from the whale were reserved for the Tribe's celebratory feast, which was to be held on 22 May.

In private homes, people welcomed whale meat, blubber, and other whale parts. Between 17 May and 22 May, some households began to use recipes held in family confidence for decades, and others experimented with techniques used for other sea creatures, like seals and fish.

In summary, pathogenic organisms can and do occur in marine mammal food products, including seals, walrus, dolphins, and whales. Illness has been reported in those who eat these products, though they typically come from consuming either stranded or drift animals, or they result from improper preparation of traditional food products.

3.17 National and International Regulatory Environment

3.17.1 Introduction

The following sections describe national conditions related to the harvest of marine mammals, international conditions related to the harvest of whales, and international conditions related to the pursuit of ceremonial and subsistence practices by indigenous people.

In the United States, take of marine mammals is prohibited (except under certain circumstances, unless the Secretary of Commerce waives the MMPA take prohibition, adopts regulations and issues permits (Section 1.2.3, Marine Mammal Protection Act). Harvest of whales is prohibited by WCA regulations, except for aboriginal subsistence whaling authorized by paragraph 13 of the IWC Schedule (50 CFR 230.2) (Section 1.2.4.2, National Whaling Governance under the WCA). This section reviews past waivers and requests for waiver of the MMPA take prohibition.

Internationally, harvest of whales is regulated by the ICRW (Section 1.2.4.1., International Whaling Governance under the ICRW), which established the IWC as the regulatory body governing whaling (Section 1.2.4.1.1, Functions and Operating Procedures of the IWC). While the IWC initially focused on regulating commercial harvest, from 1982 to 1986 the body phased in a moratorium on commercial whaling to be in effect pending adoption of a revised management scheme. Since that time the parties to the ICRW have attempted to adopt a regulatory regime that would govern commercial harvest; these attempts have been unsuccessful, so the moratorium remains in effect. The ICRW also governs aboriginal subsistence whaling but does not set limits on lethal research on whales. This section examines the whaling that has occurred worldwide since the IWC moratorium, the debates within the IWC over the different types of whaling, the United States' role in those debates, and the potential relationships between the positions and actions of the United States and whaling worldwide.

The ability of indigenous people to pursue ceremonial and subsistence practices has also emerged in recent decades as an international issue. This section examines the pursuit of ceremonial and subsistence practices by indigenous people internationally.

3.17.2 Regulatory Overview

3.17.2.1 Marine Mammal Protection Act

The MMPA take moratorium and the process for waiving the moratorium are described in detail in Section 1.2.3., Marine Mammal Protection Act. In addition to those provisions, Section 109 of the Act preempts state authority governing marine mammals, but includes provisions for the Secretary to waive the take moratorium and return management authority to a state if certain conditions are met.

3.17.2.2 Whaling Convention Act

The WCA is described in detail in Section 1.2.4., Whaling Convention Act.

3.17.2.3 International Convention for the Regulation of Whaling

The ICRW is described in detail in Section 1.2.4.1., International Whaling Governance under the ICRW, in particular its provisions regarding commercial and aboriginal subsistence whaling. In addition, Article VIII of the ICRW authorizes parties to permit scientific whaling, subject to conditions the contracting government thinks fit. Any killing or taking of whales under Article VIII is exempt from the operation of the convention. Article VIII also specifies requirements for reporting on and utilizing (processing and distributing) whales after they are killed for scientific research. While contracting governments must submit scientific research permits to the IWC and its Scientific Committee for review, it is the contracting government that ultimately decides whether to issue a permit.

3.17.2.4 Pelly Amendment

Under the Pelly Amendment (22 USC 1978) to the Fishermen's Protective Act of 1954, when the Secretary of Commerce determines that the nationals of a foreign country are diminishing the effectiveness of an international fishery conservation program (including the IWC's program), the Secretary certifies this fact to the President. The President then has the discretion to ban imports of any products from the offending country “to the extent such prohibition is sanctioned by the World Trade Organization” (22 USC 1978). After making a certification, the Pelly Amendment requires the Secretary of Commerce to periodically review the activities of nationals of the offending country to determine if the reasons for which the certification was made no longer prevail. If so, the Secretary shall terminate the certification. If not, the certification remains

active. (22 U.S.C 1978 (d). A "Pelly Certification" has the potential to dissuade foreign governments from particular activities through a public announcement of their certification and the possibility of trade or non-trade sanctions. As of October 28, 2003, the Secretary had made 36 certifications under the Pelly Amendment, with trade sanctions invoked four times (House Report 108-327, October 28, 2003). Fifteen of the certifications were for whaling activities; no trade sanctions have been imposed based on certifications for whaling activities. Currently Norway, Iceland and Japan remain under active certifications under the Pelly Amendment

3.17.2.5 Packwood-Magnuson Amendment

In 1979 Congress passed the Packwood-Magnuson Amendment to the Magnuson Act of 1976. It requires the Secretary of Commerce to "periodically monitor the activities of foreign nationals that may affect [international fishery conservation programs]," (22 USC 1978(a)(3)(A)) "promptly investigate any activity by foreign nationals that, in the opinion of the Secretary, may be cause for certification," (22 USC1978(a)(3)(B)); and "promptly conclude; and reach a decision with respect to; [that] investigation" (22 USC 1978(a)(3)(C)). If the Secretary of Commerce certifies that "nationals of a foreign country, directly or indirectly, are conducting fishing operations or engaging in trade or taking which diminishes the effectiveness of the International Convention for the Regulation of Whaling," (16 U.S.C. 1821(e)(2)(A)(i)), the Secretary of State must reduce, by at least 50 percent, the offending nation's fishery allocation within the United States' fishery conservation zone (16 USC 1821(e)(2)(B)). Although the Amendment requires the imposition of sanctions when the Secretary of Commerce certifies a nation, it did not alter the initial certification process, except for requiring expedition. It also provided that a certification under the Packwood-Magnuson Amendment also serves as a certification for the purposes of the Pelly Amendment (16 USC 1821(e)(2)(A)(i).

The Packwood-Magnuson Amendment is no longer influential, since no foreign whaling nation currently fishes in United States waters (Buck 1998).

3.17.2.6 International Law Regarding Indigenous People

The United States is not a party to a treaty on indigenous practices. International Labour Organization Convention 169 contains provisions relevant to the rights of indigenous people to use subsistence resources. Article 2 of the Convention provides that governments that are parties are responsible for protecting rights of indigenous people, including actions to promote their cultural rights and "respect for their social and cultural identity, their customs and traditions and their institutions." Article 8 provides that indigenous people shall have the right to retain their

own customs . . . where these are not incompatible with fundamental rights defined by the national legal system." Article 8 further provides that "[p]rocedures shall be established . . . to resolve conflicts which may arise in the application of this principle." This Convention, however, does not govern United States practice. The Convention has only 12 parties, and the United States is not one of them.

The United Nations Draft Declaration on the Rights of Indigenous People also has several relevant provisions. Article 3 provides that "[i]ndigenous people have the right of self-determination" and that "[b]y virtue of that right they freely determine their political status and freely pursue their economic, social and cultural development." Article 21 provides that indigenous people "have the right to maintain and develop their political, economic and social systems, to be secure in the enjoyment of their own means of subsistence and development, and to engage freely in all their traditional and other economic activities." Article 26 provides that indigenous people

> have the right to own, develop, control and use the lands and territories, including to total environment of the lands, air, waters, coastal seas, sea-ice, flora and fauna and other resources which they have traditionally owned or otherwise occupied or used. This includes the right to the full recognition of their laws, traditions and customs, land-tenure systems and institutions for the development and management of resources.

The United States, through the representative of New Zealand, expressed serious reservations to the draft declaration:

> The representative of New Zealand, speaking also on behalf of Australia and the United States, said those countries could not accept the adoption of a text that was confusing, unworkable, contradictory and deeply flawed. For example, the Declaration's reference to self-determination could be misrepresented as conferring a unilateral right of self-determination and possible secession, thus threatening the political unity, territorial integrity and stability of existing Member States, she said. . . . The Declaration's provisions on lands and resources would be "unworkable and unacceptable." (United Nations 2007)

The declaration remains a draft and has not been adopted by the United Nations General Assembly.

3.17.3 Existing Conditions

3.17.3.1 Waivers of the MMPA Take Moratorium

There have been few waivers of the MMPA take moratorium since passage of the MMPA (Bean 1997). This section examines past instances in which waiver of the MMPA take moratorium has been considered.

With passage of the MMPA and preemption of state management authority, the State of Alaska sought a return of management authority for 10 marine mammal species under Section 109 of the MMPA. In 1976 the Secretary of Interior returned management authority for walruses to Alaska (41 FR 14373, April 5, 1976). The Secretaries of Interior and Commerce conditionally approved Alaska's request for the other nine species in 1979 (44 FR 2540 and 2547, January 11, 1979). Alaska Natives challenged the state's ability to regulate their hunts for these species under the returned authority and prevailed in district court (*People of Togiak v. United States* 1979). In response to the court's decision Alaska returned authority for walruses to the federal government and stated its intention not to pursue management authority over the remaining species (44 FR 45565, August 2, 1979). Congress reacted by revising Section 109 to, among other things, allow financial assistance for states to develop management programs, as well as implement them. No state has sought management authority over marine mammals since Alaska's request.

In 1975 a fur importer, the Fouke Company, sought a waiver and permit to allow importation of baby fur seal skins from South Africa. NMFS granted the waiver in 1976 conditioned on harvest of the seals in South Africa not exceeding a certain level for the year. While Fouke's application for a permit was pending, it became known that the harvest level had been exceeded, so no permit was issued. Fouke applied for a permit to import skins from the following year's harvest, which NMFS granted. A federal circuit court ultimately invalidated the waiver and regulations because NMFS' decision did not meet MMPA requirements (the skins were from seals that were less than eight months old and nursing at the time of taking) (*Animal Welfare Institute v. Kreps*, 1977).

In 1985 the Safari Club International petitioned the Secretary of Commerce to adopt a rule regarding waiver of the moratorium that would include, among other provisions, a requirement that NMFS review the status of marine mammals every five years, and whenever a waiver was proposed would make a final determination within two years of the proposal. In denying this petition, NMFS stated its belief that "administrative resources can best be utilized if waiver proceedings are initiated only when there is an indication that a waiver may be appropriate or when a specific proposal is under consideration" (51 FR 16085, April 30, 1986).

NMFS waived the moratorium and published regulations governing the take of Dall's porpoise in the Japanese fishery in the Bering Sea and North Pacific in 1987 (52 FR 19,874, May 28, 1987). NMFS did not waive the moratorium and publish regulations, however, for fur seals and other marine mammals that would be taken in the fishery because of insufficient information. In invalidating NMFS' waiver and regulations, the court found that NMFS could not authorize a

fishery it knew would take marine mammals not covered by the waiver and regulations (*Kokechik Fisherman's Association v. Secretary of Commerce,* 1988).

3.17.3.2 Worldwide Whaling

The following discussion describes commercial, scientific, and aboriginal subsistence whaling worldwide within the IWC context, focusing in particular on the United States' position and role in the international debates. Tables 3-47 to 3-49 and Figures 3-15 to 3-17 depict the harvest in commercial, scientific and aboriginal subsistence whaling conducted under IWC auspices since the commercial whaling moratorium became effective. Commercial whaling declined dramatically then ceased following the moratorium, and has grown steadily since the 1993/1994 season. Scientific whaling has increased steadily since 1985. Aboriginal subsistence whaling has remained fairly steady, increasing slightly since 1987.

TABLE 3-47. COMMERCIAL WHALING CATCHES SINCE 1985 (TAKEN UNDER OBJECTION TO THE MORATORIUM)

	Nation	Area	Sperm	Brydes	Minke	Total
1985/86	USSR (pelagic)	SH	0	0	3,028	3,028
	Japan (pelagic)	SH	0	0	1,941	1,941
	Total		0	0	4,969	4,969
1986 (86/87)	Norway (small type)	NA	0	0	379	379
	Japan (coastal)	NP	200	2	311	513
	Japan (Bonin Islands)	NP	0	315	0	315
	USSR (pelagic)	SH	0	0	3,028	3,028
	Japan (pelagic)	SH	0	0	1,941	1,941
	Total		200	317	5659	6,176
1987 (87/88)	Norway (small type)	NA	0	0	373	373
	Japan (coastal)	NP	188	11	304	503
	Japan (Bonin Islands)	NP	0	306	0	306
	Total		188	317	677	1,182
1993 (93/94)	Norway (small type)	NA	0	0	157	157
1994 (1994/95)	Norway (small type)	NA	0	0	206	206
1995 (1995/96)	Norway (small type)	NA	0	0	218	218
1996 (1996/97)	Norway (small type)	NA	0	0	388	388
1997 (1997/98)	Norway (small type)	NA	0	0	503	503
1998 (1998/99)	Norway (small type)	NA	0	0	625	625
1999 (1999/00)	Norway (small type)	NA	0	0	591	591
2000 (2000/01)	Norway (small type)	NA	0	0	487	487
2001 (2001/02)	Norway (small type)	NA	0	0	552	552
2002 (2002/03)	Norway (small type)	NA	0	0	634	634
2003 (2003/04)	Norway (small type)	NA	0	0	647	647
2004 (2004/05)	Norway (small type)	NA	0	0	544	544
2005 (2005/06)	Norway (small type)	NA	0	0	639	639

Source: IWC available at http://www.iwcoffice.org/_documents/table_objection.htm

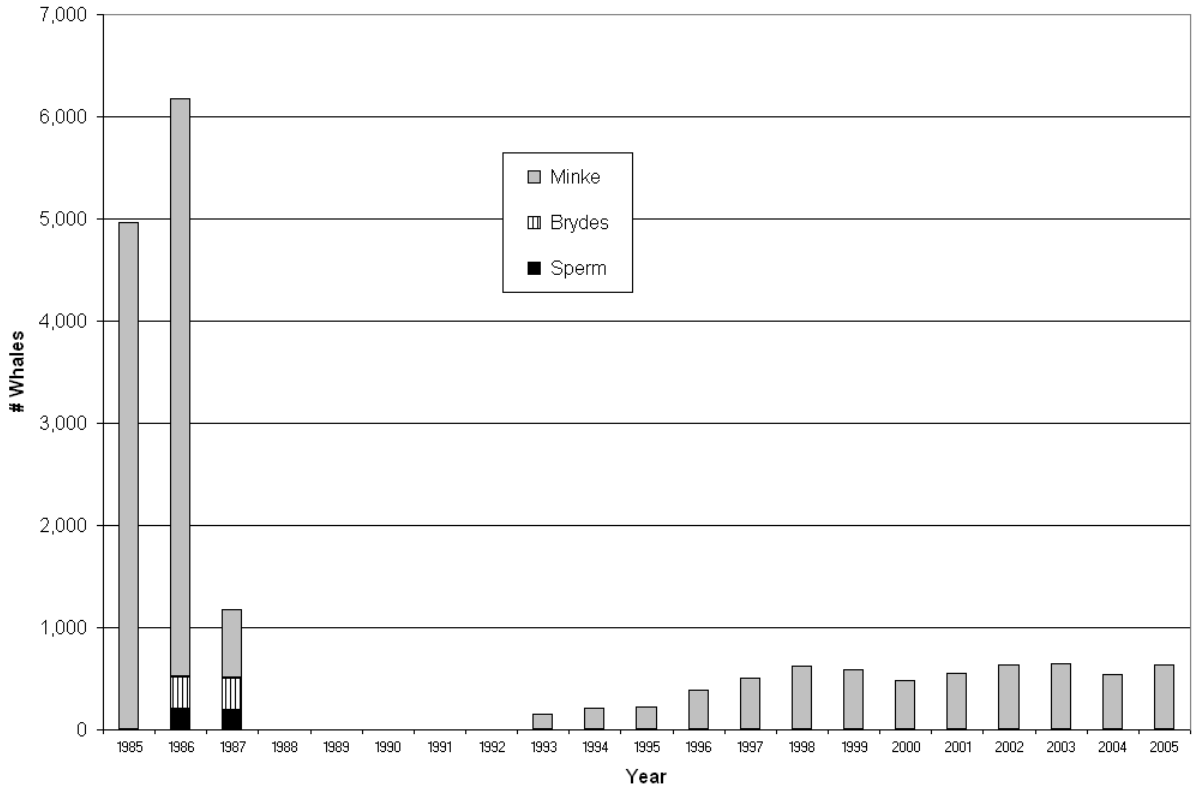


Figure 3-15. Commercial Whaling Catches by Species Since 1985

TABLE 3-48. SCIENTIFIC WHALING CATCHES SINCE 1985 (TAKEN UNDER SPECIAL PERMIT)

	Nation	Fin	Sperm	Sei	Brydes	Minke	Total
1986 (86/87)	**Iceland**	76	0	40	0	0	116
	Republic of Korea	0	0	0	0	69	69
	Total	76	0	40	0	69	185
1987 (87/88)	**Iceland**	80	0	20	0	0	100
	Japan (pelagic)	0	0	0	0	273	273
	Total	80	0	20	0	273	373
1988 (88/89)	**Iceland**	68	0	10	0	0	78

TABLE 3-48. SCIENTIFIC WHALING CATCHES SINCE 1985 (TAKEN UNDER SPECIAL PERMIT)

(CONTINUED)

	Nation	Fin	Sperm	Sei	Brydes	Minke	Total
	Japan (pelagic)	0	0	0	0	241	241
	Norway (small type)	0	0	0	0	29	29
	Total	68	0	10	0	270	348
1989 (89/90)	**Iceland**	68	0	0	0	0	68
	Japan (pelagic)	0	0	0	0	330	330
	Norway (small type)	0	0	0	0	17	17
	Total	68	0	0	0	347	415
1990 (90/91)	**Norway (small type)**	0	0	0	0	5	5
	Japan (pelagic)	0	0	0	0	327	327
	Total	0	0	0	0	332	332
1991 (91/92)	**Japan (pelagic)**	0	0	0	0	288	288
	Total	0	0	0	0	288	288
1992 (92/93)	**Norway (small type)**	0	0	0	0	95	95
	Japan (pelagic)	0	0	0	0	330	330
	Total	0	0	0	0	425	425
1993 (93/94)	**Norway (small type)**	0	0	0	0	69	69
	Japan (pelagic)	0	0	0	0	330	330
	Total	0	0	0	0	399	399
1994 (1994/95)	**Norway (small type)**	0	0	0	0	74	74
	Japan	0	0	0	0	21	21
	Japan (pelagic)	0	0	0	0	330	330
	Total	0	0	0	0	425	425
1995 (1995/96)	**Japan**	0	0	0	0	100	100
	Japan (pelagic)	0	0	0	0	440	440
	Total	0	0	0	0	540	540

TABLE 3-48. SCIENTIFIC WHALING CATCHES SINCE 1985 (TAKEN UNDER SPECIAL PERMIT)

(CONTINUED)

	Nation	Fin	Sperm	Sei	Brydes	Minke	Total
1996 (1996/97)	**Japan**	0	0	0	0	77	77
	Japan (pelagic)	0	0	0	0	440	440
	Total	0	0	0	0	517	517
1997 (1997/98)	**Japan**	0	0	0	0	100	100
	Japan (pelagic)	0	0	0	0	438	438
	Total	0	0	0	0	538	538
1998 (1998/99)	**Japan**	0	0	0	1	100	101
	Japan (pelagic)	0	0	0	0	389	389
	Total	0	0	0	1	489	490
1999 (1999/2000)	**Japan**	0	0	0	0	100	100
	Japan (pelagic)	0	0	0	0	439	439
	Total	0	0	0	0	539	539
2000 (2000/01)	**Japan**	0	5	0	43	40	88
	Japan(pelagic)	0	0	0	0	440	440
	Total	0	5	0	43	480	528
2001 (2001/02)	**Japan**	0	8	1	50	100	159
	Japan(pelagic)	0	0	0	0	440	440
	Total	0	8	1	50	540	599
2002 (2002/03)	**Japan (pelagic)**	0	5	40	50	102	197
	Japan (coastal)	0	0	0	0	50	50
	Japan (pelagic)	0	0	0	0	441	441
	Total	0	5	40	50	593	688
2003 (2003/04)	**Iceland**	0	0	0	0	37	37
	Japan (pelagic)	0	10	50	50	101	211

TABLE 3-48. SCIENTIFIC WHALING CATCHES SINCE 1985 (TAKEN UNDER SPECIAL PERMIT)

(CONTINUED)

	Nation	Fin	Sperm	Sei	Brydes	Minke	Total
	Japan (coastal)	0	0	0	0	50	50
	Japan (pelagic)	0	0	0	0	443	443
	Total	0	10	50	50	631	741
2004 (2004/05)	**Iceland**	0	0	0	0	25	25
	Japan (pelagic)	0	3	100	51	100	254
	Japan (coastal)	0	0	0	0	60	60
	Japan (pelagic)	0	0	0	0	441	441
	Total	0	3	100	51	626	780
2005 (2005/06)	**Iceland**	0	0	0	0	39	39
	Japan (pelagic)	0	5	100	50	101	256
	Japan (coastal)	0	0	0	0	121	121
	Japan (pelagic)	10	0	0	0	856	866
	Total	10	5	100	50	1,117	1,282

Source: IWC available at http://www.iwcoffice.org/_documents/table_permit.htm

TABLE 3-43. ABORIGINAL SUBSISTENCE WHALING CATCHES SINCE 1985 (CONTINUED)

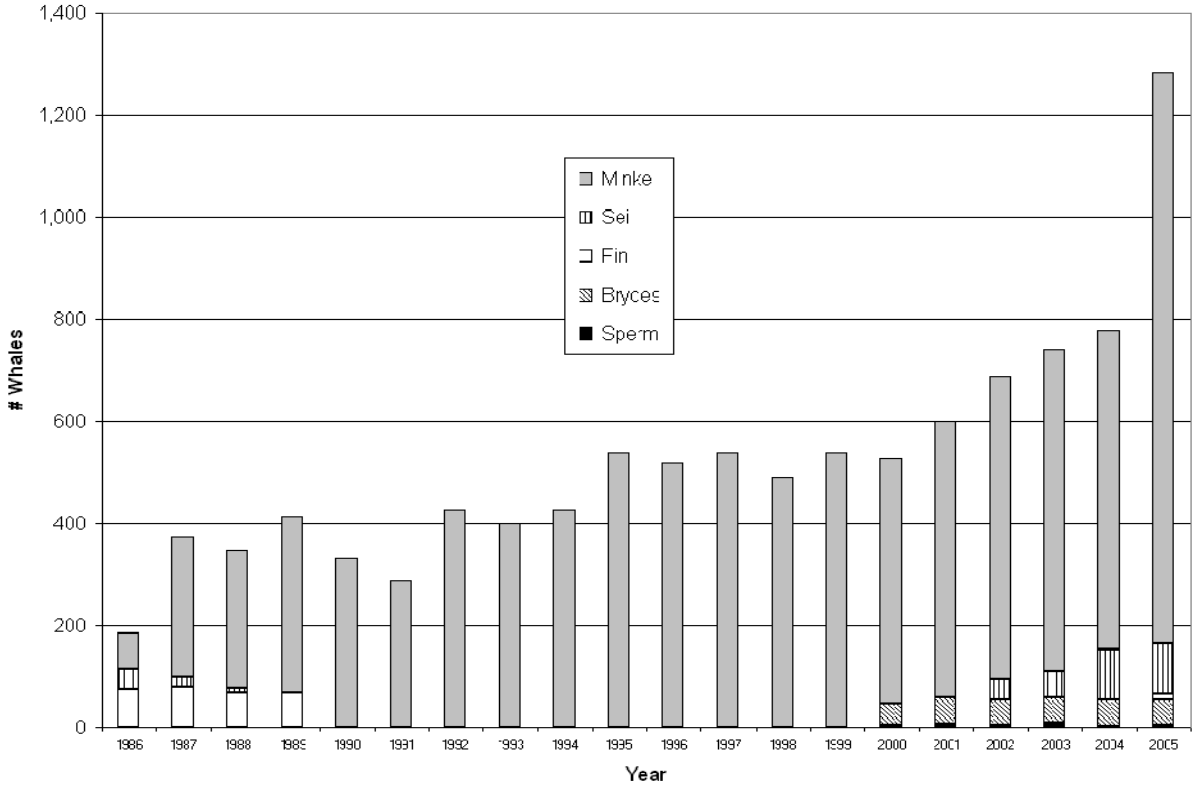


Figure 3-16. Scientific Whaling Catches by Species since 1985

TABLE 3-49. ABORIGINAL SUBSISTENCE WHALING CATCHES SINCE 1985

	Nation	Fin	Humpback	Sei	Gray	Minke	Bowhead	Total
1985	**Denmark: W. Greenland**	9	8	0	0	222	0	239
	Denmark: E. Greenland	0	0	0	0	14	0	14
	USSR	0	0	0	169	0	0	169
	USA	0	0	0	1	0	17	18
	Total	9	8	0	170	236	17	440
1986	**Denmark: W. Greenland**	9	0	0	0	145	0	154
	Denmark:	0	0	0	0	2	0	2

	Nation	Fin	Humpback	Sei	Gray	Minke	Bowhead	Total
	E. Greenland							
	St. Vincent	0	2	0	0	0	0	2
	USSR	0	0	0	169	0	0	169
	USA	0	0	0	2	0	28	30
	Total	9	2	0	171	147	28	357
1987	**Denmark: W. Greenland**	9	0	0	0	86	0	95
	Denmark: E. Greenland	0	0	0	0	4	0	4
	St. Vincent	0	2	0	0	0	0	2
	USSR	0	0	0	158	0	0	158
	USA	0	0	0	0	0	31	31
	Total	9	2	0	158	90	31	290
1988	**Denmark: W. Greenland**	9	1	0	0	109	0	119
	Denmark: E. Greenland	0	0	0	0	10	0	10
	St. Vincent	0	1	0	0	0	0	1
	USSR	0	0	0	150	0	0	150
	USA	0	0	0	1	0	29	30
	Total	9	2	0	151	119	29	310
1989	**Denmark: W. Greenland**	14	2	2	0	63	0	81
	Denmark: E. Greenland	0	0	0	0	10	0	10
	USSR	0	0	0	179	0	0	179
	USA	0	0	0	1	2	26	29
	Total	14	2	2	180	75	26	299

	Nation	Fin	Humpback	Sei	Gray	Minke	Bowhead	Total
1990	**Denmark: W. Greenland**	19	1	0	0	89	0	109
	Denmark: E. Greenland	0	0	0	0	6	0	6
	USSR	0	0	0	162	0	0	162
	USA	0	0	0	0	0	44	44
	Total	19	1	0	162	95	44	321
1991	**Denmark: W. Greenland**	18	0	0	0	99	0	117
	Denmark: E. Greenland	0	1	0	0	7	0	8
	USSR	0	0	0	169	0	0	169
	Canada	0	0	0	0	0	1	1
	USA	0	0	0	0	0	46	46
	Total	18	1	0	169	106	47	341
1992	**Denmark: W. Greenland**	22	1	0	0	103	0	126
	Denmark: E. Greenland	0	0	0	0	11	0	11
	St. Vincent	0	2	0	0	0	0	2
	Russia	0	0	0	0	0	0	0
	USA	0	0	0	0	0	50	50
	Total	22	3	0	0	114	50	189
1993	**Denmark: W. Greenland**	14	0	0	0	107	0	121
	Denmark: E. Greenland	0	0	0	0	9	0	9
	St. Vincent	0	2	0	0	0	0	2
	USA	0	0	0	0	0	52	52

	Nation	Fin	Humpback	Sei	Gray	Minke	Bowhead	Total
	Total	14	2	0	0	116	52	184
1994	**Canada**	0	0	0	0	0	1	1
	Denmark: W. Greenland	22	1	0	0	104	0	127
	Denmark: E. Greenland	0	0	0	0	5	0	5
	Russia	0	0	0	44	0	0	44
	USA	0	0	0	0	0	46	46
	Total	22	1	0	44	109	47	223
1995	**Denmark: W. Greenland**	12	0	0	0	153	0	165
	Denmark: E. Greenland	0	0	0	0	9	0	9
	Russia	0	0	0	90	0	0	90
	USA	0	0	0	2	0	57	59
	Total	12	0	0	92	162	57	323
1996	**Canada**	0	0	0	0	0	1	1
	Denmark: W. Greenland	19	0	0	0	164	0	183
	Denmark: E. Greenland	0	0	0	0	12	0	12
	St. Vincent	0	1	0	0	0	0	1
	Russia	0	0	0	43	0	0	43
	Canada	0	0	0	0	0	1	1
	USA	0	0	0	0	0	44	44
	Total	19	1	0	43	176	46	285
1997	**Denmark: W. Greenland**	13	0	0	0	148	0	161

	Nation	Fin	Humpback	Sei	Gray	Minke	Bowhead	Total
	Denmark: E. Greenland	0	0	0	0	14	0	14
	Russia	0	0	0	79	0	0	79
	USA	0	0	0	0	0	66	66
	Total	13	0	0	79	162	66	320
1998	**Canada**	0	0	0	0	0	1	1
	Denmark: W. Greenland	11	0	0	0	166	0	177
	Denmark: E. Greenland	0	0	0	0	10	0	10
	St. Vincent	0	2	0	0	0	0	2
	Russia	0	0	0	125	0	1	126
	USA	0	0	0	0	0	54	54
	Total	11	2	0	125	176	56	370
1999	**Denmark: W. Greenland**	9	0	0	0	170	0	179
	Denmark: E. Greenland	0	0	0	0	15	0	15
	St. Vincent	0	2	0	0	0	0	2
	Russia	0	0	0	123	0	1	124
	USA	0	0	0	1	0	47	48
	Total	9	2	0	124	185	48	368
2000	**Canada**	0	0	0	0	0	1	1
	Denmark: W. Greenland	7	0	0	0	145	0	152
	Denmark: E. Greenland	0	0	0	0	10	0	10
	St. Vincent	0	2	0	0	0	0	2

	Nation	Fin	Humpback	Sei	Gray	Minke	Bowhead	Total
	Russia	0	0	0	115	0	1	116
	USA	0	0	0	0	0	47	47
	Total	7	2	0	115	155	49	328
2001	**Denmark: W. Greenland**	8	2	0	0	139	0	149
	Denmark: E. Greenland	0	0	0	0	17	0	17
	St. Vincent	0	2	0	0	0	0	2
	Russia	0	0	0	112	0	1	113
	USA	0	0	0	0	0	75	75
	Total	8	4	0	112	156	76	356
2002	**Canada**	0	0	0	0	0	1	1
	Denmark: W. Greenland	13	0	0	0	139	0	152
	Denmark: E. Greenland	0	0	0	0	10	0	10
	St. Vincent	0	2	0	0	0	0	2
	Russia	0	0	0	131	3	0	134
	USA	0	0	0	0	0	50	50
	Total	13	2	0	131	152	51	349
2003	**Denmark: W. Greenland**	9	1	0	0	185	0	195
	Denmark: E. Greenland	0	0	0	0	14	0	14
	St. Vincent	0	1	0	0	0	0	1
	Russia	0	0	0	128	0	3	131
	USA	0	0	0	0	0	48	48
	Total	9	2	0	128	199	51	389

	Nation	Fin	Humpback	Sei	Gray	Minke	Bowhead	Total
2004	**Denmark: W. Greenland**	13	1	0	0	179	0	193
	Denmark: E. Greenland	0	0	0	0	11	0	11
	St. Vincent	0	0	0	0	0	0	0
	Russia	0	0	0	111	0	1	112
	USA	0	0	0	0	0	43	43
	Total	13	1	0	111	190	44	359
	2005	13	0	0	0	176	0	189
	Denmark: E. Greenland	0	0	0	0	4	0	4
	St. Vincent	0	1	0	0	0	0	1
	Russia	0	0	0	124	0	2	126
	USA	0	0	0	0	0	68	68
	Total	13	1	0	124	180	70	388

Source: IWC available at http://www.iwcoffice.org/_documents/table_aboriginal.htm

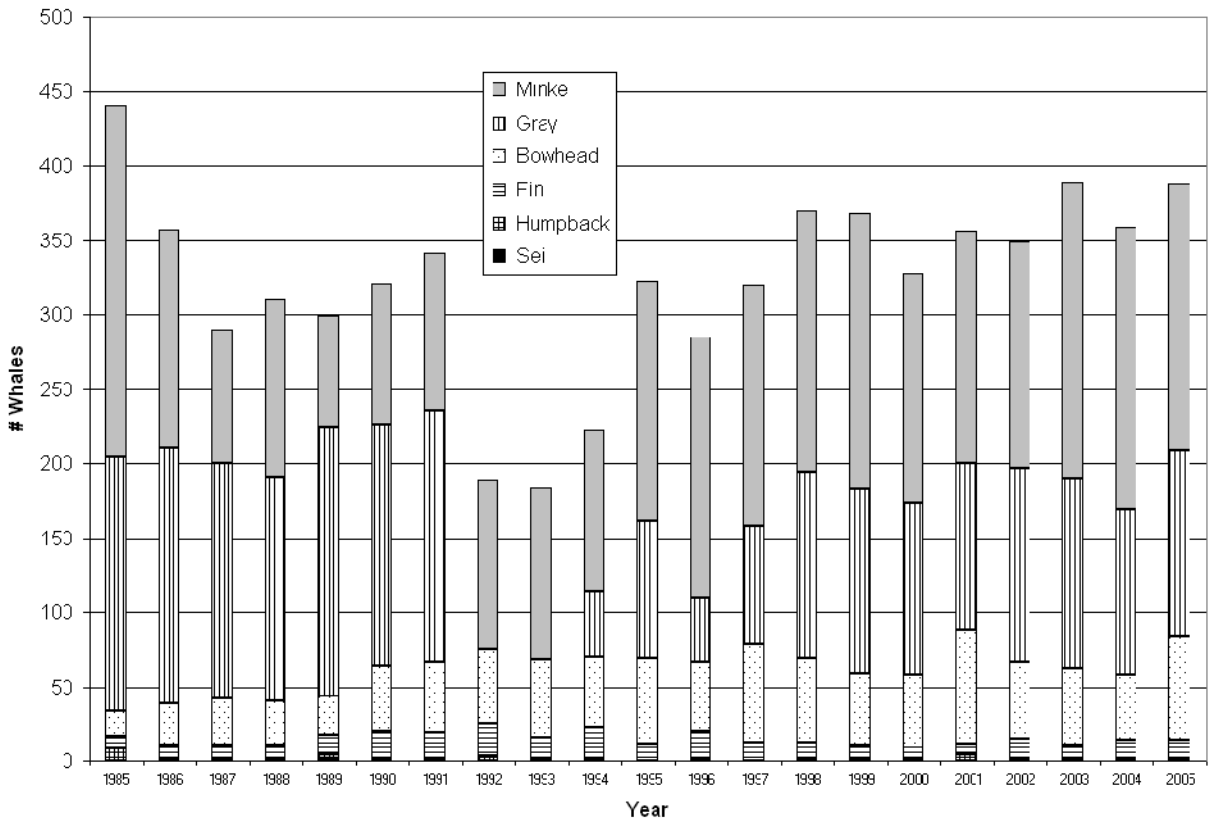


Figure 3-17. Aboriginal Subsistence Whaling Catches by species since 1985

3.17.3.2.2 Commercial and Scientific Whaling

The United States was a leader in establishing the 1982 moratorium on commercial whaling (Stoett 1997:65). In 1949, the United States passed the WCA, banning all commercial whaling by United States nationals. Congress adopted resolutions requesting the Secretary of State to negotiate a ten-year moratorium on the commercial killing of whales in the international arena (16 USC 916 note, Public Law 96-60, August 15, 1979, 93 Stat. 403). In 1972, the first United Nations Conference on the Human Environment in Stockholm adopted a resolution calling for such a moratorium. The United States lobbied at each subsequent IWC annual meeting for incorporation of the moratorium into IWC regulations, until its eventual adoption.

Prior to adoption of the moratorium, the Secretary of Commerce certified a number of countries under the Pelly Amendment finding their whaling activities diminished the effectiveness of the ICRW. In 1974, the Secretary of Commerce issued the first certifications under the Pelly Amendment directed at Japan and the Soviet Union for whaling in excess of IWC quotas. In

1978, the Secretary of Commerce certified Chile, Peru and the Republic of Korea under the Pelly Amendment for their whaling practices.

In 1982, when the commercial whaling moratorium was adopted, Japan, Peru, Norway, and the Soviet Union all lodged objections. In response to Japan's objection to the moratorium and continued commercial whaling, the United States threatened to end Japanese access to fishing in United States waters under the Packwood-Magnuson Amendment. Japan withdrew its objection to the moratorium by 1988, and Peru withdrew its objection in 1983. The Soviet Union conducted pelagic commercial whaling of minke whales in the southern hemisphere through the 1985/1986 season. The Soviet Union never withdrew its objection, but stopped harvesting whales commercially since 1986. The Russian Federation, successor state to the Soviet Union, has not engaged in commercial whale harvest.

When Norway objected to the moratorium and conducted small type coastal whaling in the 1986 and 1987 seasons, the Secretary of Commerce certified Norway under the Pelly Amendment; in 1987 Norway suspended its whaling. The Secretary of Commerce also certified Norway in 1990 and 1992 for its research whaling program. Norway then resumed commercial whaling in 1993, and was again certified by the Secretary of Commerce under the Pelly Amendment (Clinton 1993; Ek 1996). President Clinton did not impose trade sanctions, and explained in a letter to Congress that while "[t]he United States is deeply opposed to commercial whaling . . . [there is] an equally strong commitment to science-based international solutions to global conservation problems" (Clinton 1993). Clinton acknowledged that "not every country agrees with our position against commercial whaling," and initiated preparations for sanctions, but ultimately concluded that "the primary interest of the United States [is in] protecting the integrity of the IWC and its conservation regime," which could best be achieved through diplomatic measures (Clinton 1993). Norway remains certified under the Pelly Amendment Norway is the only original objecting party that still conducts commercial whaling under objector status. The IWC has passed numerous resolutions asking the government to reconsider its objection and immediately halt all whaling under its jurisdiction (see e.g., IWC Resolutions 1995-5, 1996-5, 1997-3, and 2001-5).

The Secretary of Commerce certified Japan's scientific whaling program in 1988, when Japan initiated its Antarctic program to harvest minke whales, in 1995, after Japan extended its minke whale program to the North Pacific, and in 2000 when Japan expanded its scientific whaling operations to include protected Bryde's and sperm whales. The Secretary stated that the United States government was "deeply concerned that the real aim of this large hunt is to pave the way

for an outright resumption of commercial whaling (Mineta 2000)". Japan remains certified under the Pelly Amendment.

Iceland did not lodge an objection to the commercial whaling moratorium in 1982, but subsequently disagreed with maintenance of the ban and withdrew from the IWC in 1992. In 2002 Iceland was successful in obtaining re-admission to the IWC but lodged a reservation to the moratorium. The reservation language provides that Iceland will not authorize whaling for commercial purposes before 2006, after which it will not authorize whaling while progress is being made in negotiations on the management of commercial whaling. Iceland announced its intent on October 17, 2006 to resume commercial whaling for minke and fin whales (Black 2006a; Fenner 2006). As of November 3, 2006, Icelandic whalers had killed seven fin whales and one minke whale (NOAA Public Affairs 2006). The United States, along with 17 other countries, objected to Iceland's reservation to the moratorium when it was re-admitted to the IWC in 1992. When Iceland resumed commercial whaling in 2006, the United States joined 24 other countries in lodging formal objections with the government of Iceland. The Secretary of Commerce also certified Iceland under the Pelly Amendment in 2004, and the certification remains in effect, though no trade sanctions have been imposed. In August 2007, Iceland announced it would not issue new whale-hunting quotas until market demand increased and it received an export license from Japan (Oafsdottir 2007)

The future of the moratorium on commercial whaling remains uncertain. The consistent position of the United States has been that the moratorium should not be lifted at least until a revised management scheme is in place (Department of State 2003), and has participated in good faith in negotiating such a scheme. At the same time, the IWC confirmed its view as recently as the annual meeting in St. Kitts and Nevis in 2006 that discussions on the revised management scheme remain at an impasse (IWC 2006b). At that meeting a slight majority of IWC member nations adopted a resolution declaring the commercial whaling moratorium no longer necessary (IWC Resolution 2006-1, 'St Kitts and Nevis Declaration'). Yet at the 2007 IWC meeting in Anchorage, 37 countries adopted a resolution stating that the whaling ban "remains valid" (IWC 2007b). While slight majorities within the IWC have thus succeeded in adopting contradictory resolutions regarding the commercial whaling moratorium, (resolutions are nonbinding) definitive action on the commercial moratorium (or the revised management scheme) is uncertain because neither the pro-commercial-whaling or anti-commercial-whaling sides of the debate have the three-fourths majority necessary for action (Henderson 2005; Hogarth 2006). Intensive

discussions at a recent intersessional meeting of the IWC identified a number of issues that may help improve discussions, negotiations, and trust within the IWC (Hogarth 2008).

3.17.3.2.3 Aboriginal Subsistence Whaling

Although aboriginal subsistence whaling was not controversial in the IWC through the mid-1970s, since that time several issues have arisen. One debate has focused on the sustainability of aboriginal subsistence harvests. Examples of harvests that have generated controversy include bowheads by Alaska Natives and harvest of minke and fin whales by Native Greenlanders. Bowheads are listed as endangered under the ESA and listed in Appendix I of CITES (Section 1.4.1.2.1, Relevant Overview of Requests for Bowhead Whales on Behalf of Alaska Eskimos). In the early 1970s, the IWC Scientific Committee expressed concern about the status of the bowhead whale stock, and at the 1977 annual meeting of the IWC, recommended that the catch limit for aboriginal subsistence harvest of bowheads be set at zero (accepted by the IWC with a vote of 16-0, with the United States abstaining). In a subsequent special meeting in 1977, the United States and the Alaska Eskimo Whaling Commission presented a request to modify the ban and allow for a take of bowhead by Alaska Eskimos. Although the Scientific Committee rejected the proposal, the IWC plenary session allowed for a limited and strictly controlled hunt for 1978. Work on the bowhead aboriginal subsistence hunts continued in workshops and working groups following the special meeting. Some argued that the United States, by supporting an aboriginal hunt contrary to scientific advice regarding the conservation status of the stock, undermined the conservation arguments the United States and the IWC used to maintain the commercial moratorium (Hankins 1990). Continuous research since then has addressed questions regarding sustainability of a bowhead harvest.

Native Greenlanders harvest North Atlantic minke and fin whales, which are classified as protection stocks under the IWC Schedule. For a number of years, the IWC Scientific Committee has been unable to provide scientific advice to the IWC on safe catch limits because of lack of information regarding stock structure and minimum stock level, although this changed in 2007 with more solid data and advice on sustainable catch limits. (IWC 2007b).

Commercial whaling proponents have pointed to the IWC's approval of aboriginal subsistence whaling in support of commercial whaling, arguing the same conservation standards should apply to both. The High North Alliance, a group of nations that support resumption of commercial whaling, points to the Greenlander hunt, arguing that the IWC process with respect to aboriginal subsistence whaling is flawed. According to their website, they urge that all whaling be managed

under the same management objectives (High North Alliance 2007). Debate in the IWC over aboriginal subsistence whaling also centers on what groups of people qualify as aboriginal subsistence whalers, what manner of hunting qualifies as aboriginal subsistence hunting, and what use of the products of the hunt qualifies as subsistence use. Criticisms come from those who support commercial whaling and argue for equal consideration, and from animal rights groups opposed to all forms of whaling or concerned that aboriginal hunting methods result in inhumane killing. Criticisms have been leveled at the Greenlander, Bequian, Chukotkan, Alaska Native and Makah hunts based on arguments that the hunters are not aborigines, that the manner of hunting is not aboriginal, or that the use of the products is not subsistence use.

Some critics have noted that the hunts of Greenlanders are particularly difficult to distinguish from commercial whaling due to the close integration of hunting and fishing activities and waged employment (Dahl 1989; Stevenson et al. 1997), plus the sale of *mattak* and other surplus whale products on the Greenland market (Dahl 1989; Heide-Jørgensen 1994; Australian National Task Force on Whaling 1997:29; Johansen 1997; High North Alliance 2007).

The Bequian harvest is an offshoot of New England-based whale fisheries that operated in the West Indies in the mid-1700s (Reeves 2002). Meat from humpbacks is still considered highly palatable by the Afro-Caribbean population of St. Vincent and the Grenadines, and meat for local consumption appears to be the principal incentive for whaling, although products from the hunts (especially oil) are also sold on the wider regional market (Caldwell and Caldwell 1975; Australian National Task Force on Whaling 1997:29; Reeves 2002). The Bequian harvest of humpback whales was limited to a few whales by primarily one person for several years, and was originally intended to be phased out. At the IWC annual meeting in 1996, however, St. Vincent and the Grenadines reported that a new whaler had taken up humpback whaling, causing concern on the part of some delegates (IWC 1997).

The Chukotkan hunt has raised concerns about the use of products from the hunt, since the blubber and some other gray whale components were being used as food in fox fur farms (IWC 1996; Australian National Task Force on Whaling 1997).

The ‘subsistence use’ definition formally adopted by the IWC includes the barter, trade or sharing of whale products primarily within the local community, and allows for the sale of handicrafts made from whale products. Commercial whaling proponents argue that this creates a double standard and that sharing, bartering and trading meat amounts to commerce (Stoett 1997). Alaska Eskimos are allowed to sell native articles of handicraft from bowhead whales within the borders

of the United States under the provisions of the MMPA, and the restrictions were similar for the 1998 through 2000 Makah hunts, as well as the current proposed action. In the past questions have been raised about whether the Makah harvest was a subsistence harvest because their original 1995 formal request to resume hunting of ENP gray whales stated that the Makah were reserving what they consider their treaty-secured right to whale for commercial purposes. They classified their ceremonial and subsistence request as 'interim.' The present request does not include such a statement.

The legitimacy of the Makah request has also been questioned because of the Tribe's 70- to 80-year hiatus in whaling. (Section 1.1.4., Summary of Makah Tribe's Historic Whaling Tradition, describes the reasons for the hiatus.) The 1981 *Ad Hoc* Technical Working Group's working definition of 'aboriginal subsistence whaling' refers to a "continuing traditional dependence" on whale products for subsistence (Section 3.17, Regulatory Overview; Section 1.4.1.2.1., Relevant Overview of Requests for Bowhead Whales on Behalf of Alaska Eskimos; Section 1.4.1.2.2., Overview of Requests for ENP Gray Whales on Behalf of the Makah). While other aboriginal subsistence whalers have had smaller breaks in subsistence tradition (e.g., the Chukotkans stopped whaling for a few years in the 1990s), no other group has had a break lasting for more than a generation.

Additional controversy was generated over the legitimacy of the Makah hunt as an aboriginal subsistence hunt when the IWC adopted Schedule language stating that products from the hunt "were to be used exclusively for local consumption by the aborigines whose traditional aboriginal subsistence and cultural needs have been recognized" (IWC 1997)(Section 1.4.1.2.2., Overview of Requests for ENP Gray Whales on Behalf of the Makah). Some observers asserted that "the more flexible the aboriginal subsistence whaling definitions become, the more susceptible the IWC will be to unyielding pressure by other communities with traditions of harvesting and using whales for commercial purposes" (Jenkins and Romanzo 1998). This issue became moot when the words "whose traditional aboriginal subsistence and cultural needs have been recognized" were deleted from Schedule 13 (Section 1.4.1.2.2., Overview of Requests for ENP Gray Whales on Behalf of the Makah).

Beginning in 1986, Japan argued that its coastal villages should be allowed to whale under the aboriginal subsistence whaling exception, also requesting that the sale of meat from the hunt be allowed on the open market. At the IWC meeting in 2002, Japan and other pro-whaling parties withheld support for the United States' request for a bowhead quota for the years 2003 through

2007, but did not oppose the joint request of the Russian Federation and the United States for gray whales. Later that year at a special meeting, Japan and others approved catch limits for bowheads through 2007, and the United States voted in favor of a resolution regarding Japan's plan for small type coastal whaling if it was non-commercial and based on scientific advice. That resolution did not pass.

At the 2007 IWC meeting in Anchorage, Japan continued to press for an allowance for coastal whaling. In a statement to the press, Japan's Commissioner argued that small type coastal whaling is no different from aboriginal subsistence whaling and accused IWC members of imposing a "double standard" (Hopfinger 2007). Prior to the meeting, the Japanese Commissioner stated that Japan would not oppose the Alaska Eskimo quota, while the United States Commissioner was quoted in the Anchorage papers saying the United States would strike no deals with Japan even if Japan opposed the bowhead quota (deMarban 2007). The United States' request for updated bowhead catch limits and the joint request of the Russian Federation and United States for gray whale catch limits were approved by consensus.

Outside the IWC forum or any international regulatory regime, aboriginal subsistence hunting occurred for hundreds to thousands of years. See Section 3.4.3.6.1, Aboriginal Subsistence Whaling, for a list of tribes engaged in historic aboriginal hunts of ENP gray whales from California to Alaska and Chukotka. More recently, aboriginal subsistence hunts of whales is known to continue, or to have continued until recently, in three tropical areas: (1) humpback whale hunts in Equatorial Guinea, (2) sperm whale and other species in Indonesia, and (3) Bryde's whales in the Philippines. The humpback whale hunt off the island of Pagalu in the Gulf of Guinea is thought to have been introduced by American ship-based whalers in the 18th and 19th centuries (Reeves 2002). Natives target humpback calves, with an estimated catch level of 3 or fewer humpbacks per year (Aguilar 1985; Reeves 2002). Whale hunts for sperm whales and other whales off two Indonesian islands predates the arrival of American and English whalers by at least two centuries (Barnes 1991; Barnes 1996). Fishing, including whaling, is the principal source of sustenance, and whale products, including meat and oil, are sold at local markets (Barnes 1991; Barnes 1996; Reeves 2002). One group of natives has mainly targeted sperm whales in the large whale catch for recent years, totaling a catch of 664 whales from 1959 to 1995, while another group of natives seems to target mostly baleen whales, including fin, sei, and minke whales (Barnes 1969; Reeves 2002). Both groups also hunt small cetaceans. Bryde's whales were the main targeted species in the Philippines until the last documented catch in 1996, when a Philippine administrative order expanded the prohibition on killing dolphins to include all

cetaceans (Reeves 2002). Whale hunting origins among fishermen ranged from 100 years to opportunistic hunting in the last few generations.

Although the United States has consistently supported sustainable aboriginal subsistence whaling, it objected to Canada's authorization of a bowhead hunt by Inuit hunters. In 1996 the Commerce Secretary certified Canada under the Pelly Amendment for allowing Inuit hunters to take two bowhead whales. The Secretary's certification stated that "[t]he United States supports aboriginal whaling when it is managed through the International Whaling Commission, the global body charged with responsibility for the international conservation and management of whale stocks and the regulation of whaling" (NOAA Press Release 96-r194, December 18, 1996). Canada withdrew from the IWC in 1982.

3.17.3.3 Ceremonial and Subsistence Practices of Indigenous People

Indigenous people inhabit large areas of the earth's surface from the Arctic to the South Pacific, numbering roughly 300 million. In a Fact Sheet, the United Nations High Commissioner for Refugees provides the following information:

> [T]hey are the descendants - according to one definition - of those who inhabited a country or a geographical region at the time when people of different cultures or ethnic origins arrived, the new arrivals later becoming dominant through conquest, occupation, settlement or other means. Among many indigenous peoples are the Indians of the Americas (for example, the Mayas of Guatemala or the Aymaras of Bolivia), the Inuit and Aleutians of the circumpolar region, the Saami of northern Europe, the Aborigines and Torres Strait Islanders of Australia, and the Maori of New Zealand. Indigenous people often retain social, cultural, economic and political characteristics that are clearly distinct from those of the other segments of the national populations (UNHCR 1995).

The cultures of indigenous people may be threatened by the dominant society. In many parts of the world indigenous people are actively seeking recognition of their identities and ways of life.

With its history of religious tolerance and protection of individual freedoms through the Constitution, the United States considers itself a world leader in its respect for the practices of native people. It has not, however, supported the broad claims for self-determination often associated with the international indigenous rights movement. For example, the United States has not joined the International Labour Organisation Convention 169 on the Rights of Indigenous Peoples and expressed numerous reservations to the United Nations Declaration on the Rights of Indigenous People (Section 3.17.2.6, International Law Regarding Indigenous People).