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Critical Human Dimensions of Maritime Oil Spills

As Identified through Examination of the *Selendang Ayu* Incident

Photo Courtesy of the United States Coast Guard

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by

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- Final Report -

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Table of Contents

List of Acronyms and Abbreviations vi

Summary Overview vii

1.0 Introduction 1
- Overview 1
- Purpose of the Research 2
- Administrative and Policy Background 2
- Study Background 3
- Project Rationale 5
- Research Methods 6
- Study Area Primer 7
  - Location and Overview 7
  - Brief History 7
  - Current Conditions and Trends 8
- Organization of the Report 11

2.0 The *Selendang Ayu* Accident, Spill, and Associated Response Efforts 12
- Loss of Power and Subsequent Repair and Rescue Attempts 13
- The Determinative Nature of Alaska Weather and Sea Conditions 17
- Spill Assessment and Response Work 20

3.0 Effects on Commercial Fisheries and Subsistence Activities 27
- Commercial Fishery Effects and Seafood Monitoring Strategies 28
  - Overview 28
  - Effects on the Dutch Harbor Small-Boat Crab Fleet 29
  - Positive Contamination Sampling Results in a Highly Sensitive Zone 32
- Effects on Non-Commercial Natural Resource Harvesting in the Spill-Affected Area 36
  - Background – Past and Present 36
  - Recent Subsistence Trends 40
  - Use of the Spill-Affected Area for Subsistence and Related Cultural Purposes 44
  - Species of Local Importance 45
  - Subsistence Foods and Contamination Concerns 47

4.0 Social Change and Response-Related Costs 51
- An Urgent Rescue and Loss of Human Life 52
- Cultural Interface between Responding Agencies and the Host Community 53
- Near-Term Sociodemographic Effects 54
- Allocation of Government Resources to the Response 56

5.0 Resolution 59
- Adjudication 59
- NPFC Rejection of the Tribal Claim 60
- Natural Resource Damage Assessment (NRDA) 63
- Attendant Outcomes 66

6.0 Summary Findings and Conclusions ... 68
The Critical Challenges of Weather and Sea ... 69
Commercial Fisheries Dimensions ... 69
Subsistence Dimensions ... 71
Social, Sociodemographic, and Economic Dimensions ... 72
Conclusions ... 73

Cited References ... 75

List of Tables

Table 1. Unalaska Population by Decade ... 8
Table 2. Recent Population Trends, Unalaska ... 8
Table 3. Select Demographic Conditions in Unalaska/Dutch Harbor 1990-2010 ... 9
Table 4. Unalaska Subsistence Salmon Harvest Data: 1994 and 2002 ... 41
Table 5. Unalaska Subsistence Halibut Harvest Data: 1994, 2003-2007 ... 42
Table 6. Culturally Significant Marine Resources Found along the Spill-Affected Coastline ... 45
Table 7. Culturally Significant Plant Resources Found along the Spill-Affected Coastline ... 46
Table 8. U.S. Coast Guard Billing to the Responsible Party ... 56
Table 9. Tribal Claim for Subsistence Trips Lost Due to the Spill ... 61
Figure 4-6b Reiterated Monthly Employment in Seafood Mnfrg: 2006-2010 ... 58
Figure 4-7a Monthly Employment by Major Sector: January 2000–December 2004 ... 59
Figure 4-7b Monthly Employment by Major Sector: January 2005–December 2010 ... 59

List of Figures

Figure 1. Overview of Unalaska and Dutch Harbor ... 10
Figure 2. View of Makushin Volcano with Dutch Harbor Processing Facilities in Foreground ... 11
Figure 3. USCG Cutter *Alex Haley* at Moorings in Dutch Harbor ... 14
Figure 4. Large Seas and Rescue Tug as Seen from Deck of the *USS Alex Haley* ... 15
Figure 5. Delivering *Selendang Ayu* Crew Members to Safety on the *USS Alex Haley* ... 16
Figure 6. Wreck of the *Selendang Ayu* on Rocky Reef at Skan Bay, Unalaska Island ... 17
Figure 7. Lowering Lightered Oil to Repository in Dutch Harbor, 2005 ... 24
Figure 8. Manual Tilling of Affected Soil near Wreck Site, Winter 2005 ... 25
Figure 9. Freighter Superstructure in Fair Weather: Removal Challenge for Salvage Experts ... 26
Figure 10. Processor Lodging Facilities, Dutch Harbor, Winter 2006 ... 27
Figure 11. Small Boat Harbor, Unalaska, Early Spring 2006 ... 30
Figure 12. High Winds Buffet Ballyhoo Mountain near Tom Madsen Airport ... 35
Figure 13. Top Ten Wild Food Resources Consumed in Unalaska in 2003 ... 43
Figure 14. Oiled Harlequin Ducks near *Selendang Ayu* Spill Site, Winter 2005 ... 48
Figure 15. Northwestern Portion of Unalaska, Spring 2008 ... 50
Figure 16. Remembering those Lost During the Rescue, Unalaska Town Hall, December 2004 ... 52
Figure 17. Workers Removing Contaminated Grass and Soil at the Spill Site in 2005 ... 58

List of Maps

Map 1. The Spill-Affected Region ... 3
Map 2. Wreck Site and Spill-Affected Areas on Unalaska Island ... 19
Map 3. Aerial View of the Potentially Affected Seafood Processing District in Dutch Harbor ... 34

List of Acronyms and Abbreviations

AAC	Alaska Administrative Code
ADF&G	Alaska Department of Fish and Game
ADEC	Alaska Department of Environmental Conservation
ANCSA	Alaska Native Claims Settlement Act of 1971
API	American Petroleum Institute
BOEM	Bureau of Ocean Energy Management, U.S. Department of the Interior
C	Celsius
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act 1980
cf.	confer
CFR	Code of Federal Regulations
et al.	and others
ETS	Emergency Towing Systems
EA	Environmental Assessment
EIS	Environmental Impact Statement
et seq.	and the following
EUR	Euros
EVOS	*Exxon Valdez* Oil Spill
FY	Fiscal Year
GTRs	Government Transport Requests
H.R.	House of Representatives
IAI	Impact Assessment, Inc.
IFO	Intermediate Fuel Oil
mm	millimeter
MMS	Minerals Management Service
NTSB	National Transportation Safety Board
NEPA	National Environmental Policy Act of 1969
NOAA	National Oceanic and Atmospheric Administration
NOIT	New Oil Investigation Team
NPFC	National Pollution Funds Center, United States Coast Guard
NRDA	Natural Resource Damage Assessment
NTSB	National Transportation Safety Board
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act of 1953
OSLTF	Oil Spill Liability Trust Fund
OPA	Oil Pollution Act of 1990
PAH	Polycyclic Aromatic Hydrocarbon
PSP	Paralytic Shellfish Poisoning
PRFAs	Pollution Removal Funding Authorizations
SCAT	Shoreline Clean-up and Assessment Team
SHARCs	Subsistence Halibut Registration Certificates
SSP	Shipping Safety Partnership
TWBF	Threatened Water Body Finding
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service

Summary Overview

This report describes the results of a BOEM-funded ethnographic study of Alaska's second largest maritime oil spill– that of the Malaysian-flagged freighter, the *Selendang Ayu*. Because the human effects of significant maritime oil spills tend to manifest not only in the near-term but also years after the initial spillage and response, this study underscores the utility of examining social and economic aspects of such events over the course of time.

The *Selendang Ayu* incident began in December 2004 during storm force conditions in the south-central Bering Sea. Despite initial attempts to secure the foundering vessel, it ran aground along the coastline of Skan Bay on Unalaska Island. Six lives were lost during a heroic rescue effort by the U.S. Coast Guard. The freighter spilled its cargo of soybeans; 321,052 gallons of viscous fuel oil (IFO 380); and 14,680 gallons of diesel fuel and other oils.

Response and cleanup efforts continued until June 2006 under the guidance of an effective interagency incident command system. Rugged topography precluded remediation of certain segments of the oiled shoreline. Given travel distances to and from Unalaska/Dutch Harbor, and the remote location of the grounding, the response was particularly challenging and costly for state and federal government agencies. Formalized response resulted in known expenditures of over $100 million and detraction of many government personnel from their normal duties.

The accident also led to challenges in the region's commercial fishing sectors. A costly seafood testing program was undertaken in Dutch Harbor; vessels were re-routed to avoid contact with oil around Unalaska Island; and the local Tanner crab fishery was closed during 2005. Closure of the local crab fishery induced interpersonal conflicts among members of the fleet. Notably, by submitting claims for the lost season, litigation options were forfeited. A collective decision not to litigate was made in part because of the fishermen's direct and indirect familiarity with the protracted litigation and settlement processes associated with the *Exxon Valdez* oil spill.

Spill-related challenges also occurred among the general population of Unalaska. During the early phase of response, residents experienced spill-related shortages of local goods and services, unwanted changes to daily routines, crowding, and social tensions with first responders. Such problems were temporary in nature, gradually abating as weather conditions limited initial response during the winter months of 2005, and as residents came to appreciate the level of dedication of the responding agencies.

The spill generated more persistent effects among Alaska Native subsistence practitioners. Although the state-sponsored subsistence foods testing program revealed no significant threat from polycyclic aromatic hydrocarbons in 2006, certain residents continue to express uncertainty about the safety of foods from the affected area. This is significant since many Alaska Natives residing on Unalaska Island are descendents of indigenous peoples who have relied on the region's natural resources for many millennia. The Qawalangin tribe of Unalaska submitted a claim for lost subsistence opportunities and related cultural losses totaling $1 million. The claim was rejected by the National Pollution Funds Center in 2009.

The *Selendang Ayu* incident led to establishment of the Aleutian Islands Risk Assessment, which is currently functioning to enhance the capacity of spill response entities to meet the demands of prospective future groundings and spill situations in Alaska, with lessons for other regions. Natural Resource Damage Assessment (NRDA) trustees continue to work toward restoration of and/or compensation for public trust resources affected by the spill.

Critical Human Dimensions of Maritime Oil Spills

As Identified through Examination of the *Selendang Ayu* Incident

1.0 Introduction

This technical report summarizes oil spill research sponsored by the U.S. Department of the Interior, Minerals Management Service (MMS), now known as the Bureau of Ocean Energy Management (BOEM). The project was administered through the BOEM Alaska Outer Continental Shelf (OCS) Region, Environmental Studies Section, under Contract No. M03PC00008, and was undertaken by Impact Assessment, Inc. (IAI). IAI specializes in research of issues associated with management of oil and natural gas and living marine resources along the coastal zone of the United States and abroad.

Overview

The following pages provide a descriptive account and analysis of response to the grounding and spill of the *M/V Selendang Ayu*. The incident began when an engine cylinder failed while the freighter was northbound in the Great Circle shipping route northwest of Unalaska Island during mounting storm force conditions in early winter 2004. Despite efforts to secure the vessel, it ran aground between Spray Cape and Skan Bay along the Bering Sea coastline of Unalaska Island on December 8, 2004. Twenty-eight crew members were rescued and six drowned.

The accident occurred some 30 air miles from the City of Unalaska, the eleventh-largest municipality in Alaska,[1] and the principal population area on the 1,051-square-mile Unalaska Island (see Map 1). Dutch Harbor is the adjacent port and principal harbor for the most productive fishing fleet in the nation. The area lies roughly 60 nautical miles west of Unimak Pass, which is part of the shipping route between the Pacific Coast of North America and Asia. The entire region lies within the BOEM Aleutian Arc/St. George Basin Planning Areas.

At the time of the grounding, the Malaysian-flagged *Selendang Ayu* was making an innocent passage en route to China, carrying some 60,000 pounds of soybeans, 430,000 gallons of intermediate fuel oil (IFO 380), and 21,000 gallons of diesel fuel. The grounding resulted in: loss of the cargo; spillage of an estimated 321,052 gallons of IFO 380 and 14,680 gallons of marine diesel and miscellaneous oils (Alaska Department of Environmental Conservation 2006); an intense and dangerous early response effort; significant social and economic impacts; and a

[1] The area was home to some 4,000 persons in 2000 (U.S. Census Bureau), and an estimated 4,366 persons in 2003, some 15 percent of whom were Alaska Natives (per estimates by the Alaska Department of Department of Commerce, Community and Economic Development). The year 2010 population was 4,376 (U.S. Census Bureau). Numerous transient workers participate in the harvest and processing sectors of the region's commercial fisheries and may reside in Unalaska for weeks or months at a time. According to Nuka Research and Planning Group (2005), the population may increase to as many as 10,000 persons during peak fishing seasons.

cleanup process that lasted until June 2006. The federal government's Natural Resource Damage Assessment (NRDA) process is likely to continue well into 2012.

Most tragically, six crew members of the *Selendang Ayu* perished during the crash of a United States Coast Guard (USCG) HH-60 helicopter, which was implementing a rescue attempt above the grounded freighter in extreme winter conditions. The lost crewmen were Chief Engineer Narendra Yadav, 52; Second Engineer Durg Singh, 55; Chief Officer Z. M. Vaz, 46; Third Officer Blaise Mascarenhas, 33; Electrical Officer Didlar Singh, 44; and Boatswain Carlos Flores Santiago, 45 (Nalder 2004).

Purpose of the Research

BOEM maintains a keen interest in documentation and analysis of the sociocultural effects of maritime accidents and oil spill events affecting coastal communities along the nation's OCS. The *Selendang Ayu* incident is informative of the manner in which maritime transportation interests, government agencies, and small coastal communities are involved in and affected by significant oil spill events. This technical paper disseminates findings from investigation of an accident and spill in a high latitude maritime environment in the Aleutian Islands region of southwest Alaska.

Administrative and Policy Background

As specified in the Outer Continental Shelf Lands Act of 1953[2] (OCSLA), the BOEM is responsible for administering oil and gas exploration and development on the OCS. An important provision of the OCSLA authorizes the bureau to conduct and/or sponsor scientific investigation of coastal and marine environments potentially or actually affected by oil and gas industry activities occurring on the OCS.

BOEM and other federal agencies also operate in accordance with stipulations in the National Environmental Policy Act of 1969 (NEPA). NEPA requires that major environmental policy decisions be informed by natural and social science research. As such, federal agencies- including the BOEM- must acquire, analyze, and use environmental, economic, and social information that is pertinent to decisions regarding management and use of natural resources on the OCS.

The BOEM Alaska OCS Region is responsible for managing and regulating oil and gas exploration and development activities on the OCS throughout Alaska. This includes industry activities potentially occurring in the North Aleutian Basin, an area of extensive fisheries production, shipping traffic, and oil and gas resources.

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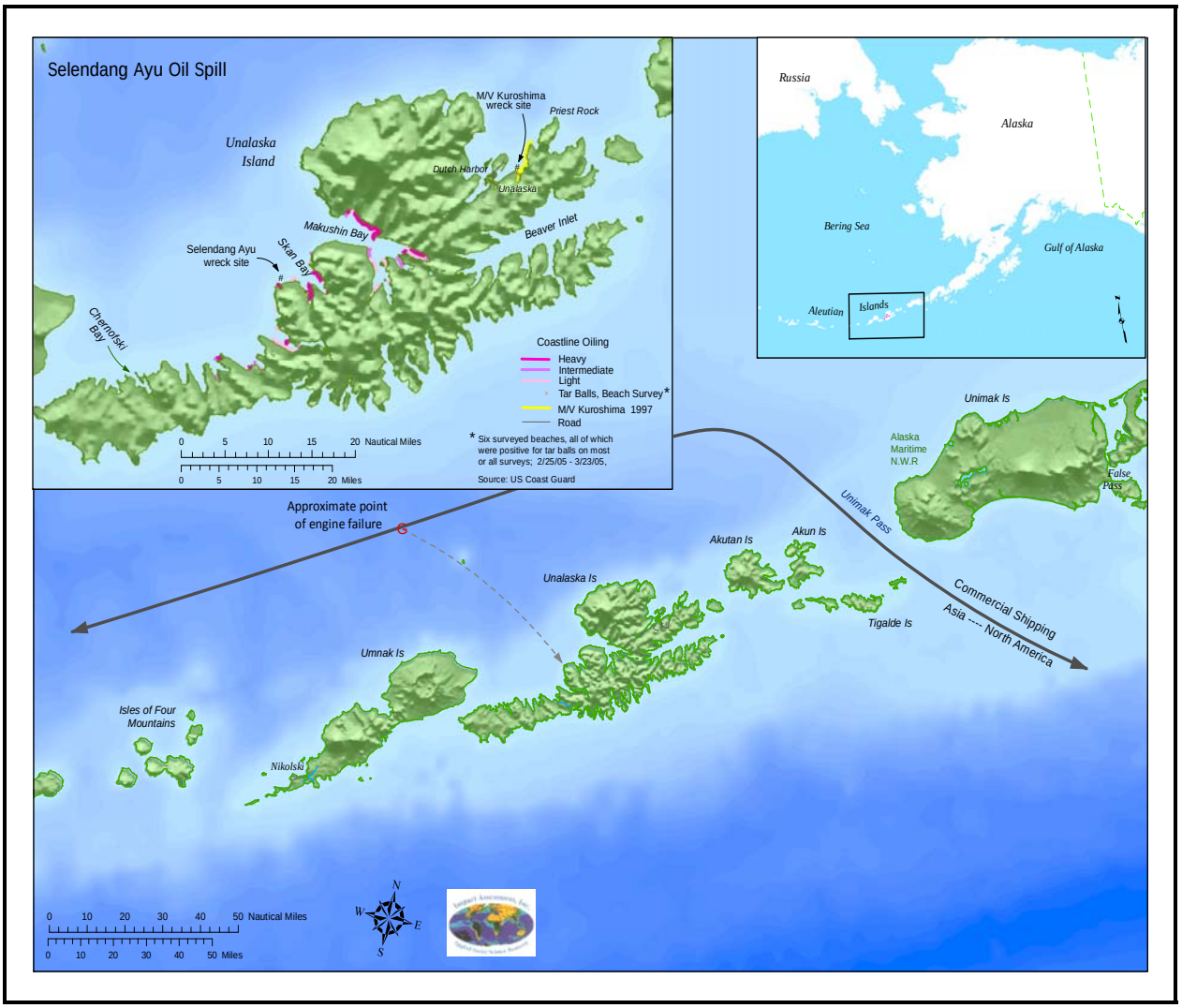
[2] As amended through P. L. 105-580, December 29, 2000



Map 1. The Spill-Affected Region

As part of its functions under OCSLA and NEPA, the BOEM administers the an Environmental Studies Program, the purpose of which is to "define information needs and implement studies to assist in predicting, projecting, assessing, and managing potential effects on the human, marine, and coastal environments of OCS and coastal areas that may be affected by gas and oil development" (MMS 2002:1). Information from BOEM studies is used in Environmental Assessment (EA) and Environmental Impact Statement (EIS) documentation, and various federal agency planning and decision-making processes.

Study Background

Examination of the *Selendang Ayu* incident was specified through a modification to parent MMS Contract No. M03PC00008. This was awarded to IAI in 2004 to conduct systematic long-term analysis of the effects of major oil spill litigation settlement, as indicated by punitive damages litigation and settlement following the *Exxon Valdez* oil spill in South-central Alaska. IAI is using a case study approach to examine litigation and settlement effects on residents of select

Kodiak Island communities and for Kodiak Borough as a whole. Kodiak was chosen for the study because: (1) many residents of fishing-oriented communities on Kodiak Island had been affected by the *Exxon Valdez* oil spill and clean-up; (2) IAI had worked extensively to document the spill's human effects on Kodiak Island and throughout the spill-affected region;[3] and (3) many Native and non-Native Kodiak fishermen eventually became plaintiffs in the punitive damages case against Exxon Corporation.[4]

The rationale and research methods for the Kodiak project are described in detail in the BOEM technical report titled "Social and Economic Assessment of Major Oil Spill Litigation Settlement - Final Baseline Report" (IAI 2010). In sum, extensive fieldwork and archival research was undertaken to document social, economic, and demographic trends and conditions on Kodiak prior to disbursement of settlement monies from the *Exxon Valdez* punitive damages case, with the resulting data serving as a baseline against which hypotheses regarding social-behavioral response to the litigation and settlement processes could be systematically tested and examined in relation to the original spill event. The end objectives of the project include documentation and analysis of the settlement and formulation of policy recommendations for mitigating deleterious long-term social effects of future spills and spill litigation.

The *Selendang Ayu* accident and spill occurred during the initial data collection and database development phases of the parent oil spill litigation settlement project. Recognizing the potential for the *Selendang Ayu* incident to help inform BOEM's understanding of near- and long-term spill effects in one of its planning areas, IAI deployed an applied social scientist to Unalaska Island soon after the accident in order to initiate long-term documentation and analysis of the event. A research design was developed and implemented to enable ongoing archival and field research similar to that being conducted on Kodiak Island, and aid in testing dimensions of the same basic research hypotheses used to guide elements of IAI's original spill research in Prince William Sound.

Although formal assessment of the environmental impacts of the *Selendang Ayu* spill continue to date under the NRDA process and will ultimately lead to implementation of important spill remediation measures, the current analysis has been expedited so as to provide useful information to agencies and entities planning optimal long-term response to current and potential spills elsewhere. Of note, legal counsel involved in the phased disbursement process for the protracted *Exxon Valdez* punitive damages settlement now predict that full closure will not occur until at least mid-2011. Disbursement of settlement funds to claimants has been continually

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[3] The IAI study involved comprehensive analysis of the spill's social, psychological, and economic effects in 22 communities throughout the affected region. This was by far the most extensive study of the human effects of the event and one of the largest social-environmental impact analyses undertaken in North America (cf. Impact Assessment, Inc. 1990a, 1990b, 1990c, 1990d, 2001).

[4] Grant Baker; Seahawk Seafoods, Inc.; Cook Inlet Processors, Inc.; Sagaya Corp.; William McMurren; Patrick L. McMurren; William W. King; George Norris; Hunter Cranz; Richard Feenstra; Wilderness Sailing Safaris; Seafood Sales, Inc.; Rapid Systems Pacific Ltd.; Nautilus Marine Enterprises Inc.; William Findlay Abbott, Jr., *Plaintiffs-Appellees* ***vs.*** Exxon Mobil Corporation; Exxon Shipping Company, Defendants, *Defendants-Appellants.* Signatory plaintiff categories include: aquaculture associations, area businesses, cannery workers, municipalities, Alaska Natives, Native corporations, personal injury, personal property, processor, real property, recreational use, subsistence, [seine] tender, and "oiled" and "unoiled" fishermen.

delayed: especially by due process, and also by the phased nature of the awards disbursement plan and the complexities inherent in addressing the various categories of claims and the life situations of claimants residing in Alaska and elsewhere in the U.S.[5]

Project Rationale

Natural disasters and large-scale anthropogenic impacts on the physical environment tend to be well-covered in the media. In the case of maritime oil spills, such coverage often indicates much initial uncertainty regarding: factors that led up to the event; the extent and likely course of the slick and its potential impacts to wildlife and marine fisheries; and effective spill response strategies. Initial human effects often involve constraints on livelihood and subsistence opportunities, employment opportunities associated with the clean-up, attribution of blame to potentially responsible parties, and pending claims and lawsuits.

As a given, oil slick is ultimately attenuated through emulsification, evaporation, weathering, natural dispersion, and/or deposition on the ocean bottom or coastline, and/or through burning, lightering, containment, chemically induced dispersion, absorption, or other mitigation and clean-up strategies; so also do media reports about the event begin to diminish. Subsequent to initial and near-term threats and physical impacts to the environment, the urgency initially associated with oil spills and spill response tends to fade into a static marker in the popular history of environmental disasters.

This report and IAI's report regarding major oil spill litigation settlement seek to extend attention to and understanding of the near- and long-term human effects and implications of oil spills occurring along or adjacent to the nation's OCS. The current report describes key elements of: the grounding of the freighter, the resulting spill of fuel oil and cargo, the nature of the formal response effort, and select social effects of the event manifesting initially and over a longer period of time. The discussion is organized in relation to the principal hypotheses that have been used to guide the parent oil spill litigation settlement project.

The *Exxon Valdez* oil spill generated a variety of human impacts throughout each phase of the incident. These phases now span almost 22 years. With regard to the most enduring phase- that of litigation and settlement- we hypothesized that the *Exxon Valdez* punitive damages settlement would affect: (1) the manner and degree of local participation in Kodiak's commercial fishing harvest sector; (2) the extent and nature of participation in subsistence fishing, hunting, and related cultural activities on the part of Alaska Natives; (3) the demographic structure of the Alaska Native and mixed ethnicity of study communities; and (4) socio-political relationships within and across groups of residents in the study area.

Of note, each of these hypothetical outcomes is conditioned not only by the settlement but also by years of litigation and, further back in time, by the spill and cleanup. Indeed, the grounding

[5] Disbursement of awards has been conditioned by lien and tax issues. On February 23, 2011, lead counsel filed its eighteenth application for distribution of awards, totaling some $9.76 million across 8,366 claimants. The 18th application addressed disbursement among claimants with tax liens and other legal impediments.

of the *Exxon Valdez*, the resulting spill, and the clean-up phase of the event may be seen as causal in a long series of social and economic conditions and changes that continue today.

Because spill outcomes are often determined in part by initial formal and informal responses to the event, documentation of response-related decision-making is pivotal to valid and meaningful analysis of the event over the long term. Further, because oil spills occurring in the U.S. and other developed nations involve long-term response, assessment, and litigation, persistent research is needed to understand the many ways in which people are involved in and affected by such events over time.

While the scope of the spill resulting from the grounding of the *Exxon Valdez* was orders of magnitude greater than that of the *Selendang Ayu*, it was clear that the latter could provide a useful case for examining important human dimensions of a smaller spill event. Despite major differences in scope, it was hypothesized that, like the *Exxon Valdez* oil spill, the *Selendang Ayu* incident would also lead to social change in the spill-affected region.

More specifically, for the purpose of guiding the current study in relation to the parent oil litigation settlement study, it was hypothesized that the early events would shape the course of the incident and subsequent response, and that the *Selendang Ayu* event would ultimately affect: (1) the nature of participation in the region's commercial fisheries; (2) the subsistence practices of members of the federally recognized Qawalangin tribe of Unalaska Island; (3) economic and demographic conditions in the region; and (4) the nature of socio-political relationships within and across groups of people involved in or affected by the spill and spill response.

The truth value of each hypothesis was borne out to various extents in the near-term and less so in the longer-term. The spill and cleanup did result in long-term regional macro-social change, as described further along in this paper. Significantly, early predictions that persons in the seafood harvest and distribution sectors would enter into litigation as a result of the *Selendang Ayu* spill did not come to fruition for reasons that are also discussed herein.

Research Methods

The description and analysis provided in this report are based upon data gathered through: four ethnographic field visits to Unalaska following the *Selendang Ayu* accident; ongoing research interaction with public officials involved in spill response and damage assessment; archival research; and real-time monitoring of the event. The on-site ethnographic work involved direct observation and scores of in-depth interviews with: knowledgeable fishery participants affected by the spill; leaders from federal, state, and local government agencies responding to the event; representatives of the Qawalangin tribe of Alaska Natives; representatives of the Ounalashka Native Corporation; representatives of firms in the local commercial fishing support sector and seafood processing industry; fishing association leaders; subsistence practitioners; village elders; and emergent key informants. A social network sampling approach was used to identify and interact with persons particularly knowledgeable of specific fisheries and the nature of effects on the fleets and persons engaged in those fisheries. Small focus group meetings were conducted to elicit perspectives on specific topics such as: resource use patterns in the areas affected by the spill; subsistence foods and harvesting practices; and effects on local businesses.

Study Area Primer

Location and Overview. Unalaska/Dutch Harbor is located along the Bering Sea on the northeast side of Unalaska Island in the Fox Islands group. The town is approximately 800 miles southwest of Anchorage and 1,700 miles northwest of Seattle. The year-round population averages around 4,000 persons. The municipal boundaries of Unalaska encompass 116 square miles of land and 99 square miles of water. The town is not part of an organized borough, but it is part of the Aleutians West Census Area (Impact Assessment, Inc. 1987).

Unalaska has long served as the administrative center for the larger region. It is also the only developed deepwater port along the Aleutian Chain, and it has the advantage of being ice-free year-round. As such, it serves as a place of refuge and re-supply for shipping interests, and many seafood processing firms and supporting businesses are located here.

Brief History. Indigenous maritime peoples have long occupied portions of the 1,400-mile span of islands, island passes, and ocean depths that encompass the Aleutian Islands region of Alaska. Archaeological evidence of ancient settlement and extensive reliance on living marine resources is abundant throughout much of the region (Veltre and Smith 2010).

Svarny-Carlson (1995) asserts that as many as nine distinct tribal groups inhabited the Aleutian Islands over the millenia, including the Qawalangin tribe. Its members lived and live on Nawan-Alaxsxa, or Unalaska Island. Russian explorers and traders called the indigenous people of the region Aleuts. The appropriate indigenous term is *Unangan*, meaning people of the seaside (Svarny-Carlson 1995) or people of the [ocean] passes (Parman 2007).[6]

More than 3,000 Unangans were living in 24 settlements around Unalaska and Amaknak Islands in 1759. Russian fur traders established a permanent post in the Unalaska area in 1777. Russian orthodoxy gradually became syncretized with various indigenous beliefs and customs, and a fully indigenous economic system of kin- and village-based reciprocity and customary trade eventually incorporated elements of a cash-based economy (Impact Assessment 1985).

The purchase of Alaska by the United States led to new forms of maritime commerce and a growing population of persons from the Lower-48. Unalaska was strategically important during World War II. In keeping with unsubstantiated concerns among U.S. military advisors that Alaska Natives would be sympathetic to the Japanese, indigenous persons from Makushin, Unalaska, Biorka, Kashega, and other villages were taken to internment camps in Southeast Alaska (Schlung 2003). Unalaskans were interned at Killisnoo, an abandoned Tlingit village on Kootznoowoo or Admiralty Island (Veltre 1999). Such persons were required to rebuild their lives in Unalaska when the town was repatriated in 1945. Interviews conducted during past IAI research projects on Unalaska Island (IAI 1985, 1987), and during the current project, make clear that bitter memories persist among families who returned to Unalaska at war's end.

Many residents of Unalaska prospered significantly from the king crab fishery in the 1970s and 1980s. The fishery subsequently declined and fishermen and processors have since diversified their businesses to pursue additional species (Impact Assessment, Inc. 1987; 2006).

[6] Parman (2007) uses the definition provided by local Unangan linguist, Moses Dirks.

Current Conditions and Trends. Today, Unalaska/Dutch Harbor is the center of the Bering Sea groundfish and crab fisheries. Given the nature of labor associated with commercial fisheries in rural Alaska, transient and ethnically diverse populations live immediately adjacent to a more permanent population of Alaska Natives and non-Native residents. The growth of an Asian/Pacific Islander population has been observed in recent years.

Persons of Unangan ancestry enact an important sociopolitical presence in the region. Many continue to pursue and value subsistence foods and related traditions. According to the U.S. Census (2000), nearly 400 of the 4,283 permanent residents in 2000 were Alaska Natives; an unknown number were members of the Qawalangin Tribe. *Unangam Tunuu* is spoken among some Native residents, and basic aspects of the language are taught in the local school system.

Commercial fisheries provide job opportunities for resident and transient workers. Six large seafood processing and distribution firms are based in Dutch Harbor. The municipality also provides jobs, as do local shipping firms. Unimak Pass, a major shipping route is located some 70 miles northeast. Unalaska Island is within the Aleutian Islands Unit of the Alaska Maritime National Wildlife Refuge, managed by the U.S. Fish and Wildlife Service (USFWS).

With due caveats on interpretation of historic population figures for Unalaska (IAI 1985:81), the population of Unalaska has grown significantly since demographic information was first recorded in 1890 (Table 1). Particularly significant increases in the resident population occurred between decennial censuses conducted in 1970, 1980, 1990, and 2000. More recent data indicate an additional net increase in the size of the permanent population (Table 2).

Table 1. Unalaska Population by Decade: 1890-2010

Year	Population
1890	317
1900	428
1910	281
1920	299
1930	226
1940	298
1950	173
1960	218
1970	178
1980	1,322
1990	3,089
2000	4,283
2010	4,376

Sources: Alaska Department of Community and Economic Development; U. S. Census Bureau.

Table 2. Recent Population Trends, Unalaska

Census Area	Population Trend Years								% Change
	1990	2000	2001	2002	2003	2004	2005	2010	1990-2010
Unalaska	3,089	4,283	4,249	4,035	4,413	4,366	4,297	4,376	+ 41.6

Source: U. S. Census Bureau

Table 3. Select Demographic Conditions in Unalaska/Dutch Harbor: 1990-2010

Factor	1990	2000	2010
Total population	3,089	4,283	4,376
Gender Ratio M/F (Number)	2,194/895	2,830/1,453	2,995/1,381
Age (Percent of total population)			
Under 18 years of age	11.6	14.6	14.0
18 to 64 years of age	87.6	83.8	83.3
65 years and over	0.8	1.6	2.7
Ethnicity or Race (Percent)			
White	62.0	44.2	39.2
Black or African American	2.0	3.7	6.8
American Indian and Alaskan Native	8.4	7.7	6.1
- Aleut	7.2	4.7	*
- Eskimo	0.2	3.0	*
Asian	19.2	30.6	32.6
- Filipino	9.1	20.4	*
- Vietnamese	2.5	4.4	*
Native Hawaiian and other Pacific Islander	NA	0.6	2.2
Other race	8.3	9.3	7.4
Two or more races	NA	3.9	5.6
Hispanic or Latino (any race)	12.7	12.9	15.2
Educational Attainment (Population 25 and over)			
Percent with less than 9th grade	54.9	9.9	*
Percent high school graduate or higher	78.3	78.1	*
Percent with a Bachelor's degree or higher	13.8	11.2	*
Language Spoken at Home (Population 5 years and over)			
Percent who speak a language other than English at home	30.1	42.1	*
And Percent who speak English less than very well	20.4	26.8	*
Household income (Median $)	56,215	69,539	*
Poverty Status (Percent of population with income below poverty line)	15.3	12.5	*
Percent female head of household	8.4	4.8	7.6
Home Ownership (Percent)			
Owner occupied	25.7	21.9	20.5
Renter occupied	74.3	78.1	63.3
Value Owner-occupied Housing (Median $)	91,500	189,800	*
Monthly Contract Rent (Median $)	741	961	*
Employment Status (Population 16 yrs and over)			
Percent in the labor force	93.2	83.0	*
Percent of civilian labor force unemployed	1.0	11.1	*
Occupation (Percent in workforce)**			
Management, professional, and related occupations	NA	17.0	*
Service occupations	NA	11.1	*
Sales and office occupations	NA	16.3	*
Farming, fishing, and forestry occupations	3.7	13.5	*
Construction, extraction, and maintenance occupations	NA	8.9	*
Production, transportation, and material moving occupations	NA	33.2	*
Industry (Percent in workforce)**			
Agriculture, forestry, fishing and hunting	5.9	15.7	*
Manufacturing	29.6	36.8	*
Percent government workers	24.4	12.9	*

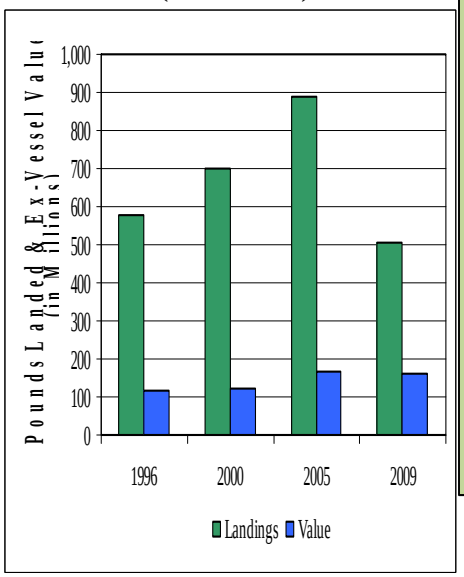
Source: U. S. Census Bureau; * Year 2010 data for these variables were not available at the time of this writing.

Figure 1. Overview of Unalaska and Dutch Harbor

Geography and Geology. The Aleutian Islands extend some 1,200 miles between mainland Alaska and Russia's Kamchatka Peninsula. Over 300 islands and 57 volcanoes comprise the archipelago. The landscape is dominated by volcanic mountains, moist tundra lowlands, and rocky coastlines. Interactions between the warm Kuroshio Current, the cold waters of the Bering Sea, and steep mountains make for intense storms, strong winds, and fog. Navigable inter-island passes are particularly treacherous. Unimak Pass is situated along the Great Circle Route between North America and Asia; over 4,500 large vessels transit the pass each year (National Academies of Science, Transportation Research Board 2008)

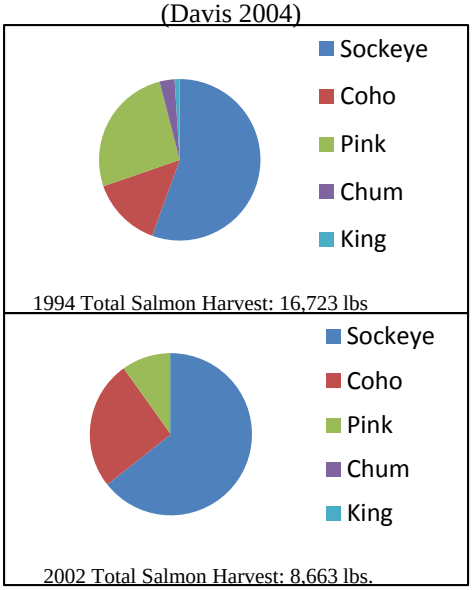
History. The Aleutian Islands were settled over 9,000 years ago by ancestors of contemporary Unangan people. The ancient Unangans traveled in swift kayak-like baidarkas, subsisting on birds, sea mammals, fish, intertidal species, and plants. European explorers described the village of Iliuliuk, now known as Unalaska (Ounalashka) in 1741. The United States purchased the Territory of Alaska in 1867, with interests in gold, seafood, and oil. The Aleutians Islands held great strategic potential during World War II. Important battles were fought on Unalaska, Attu, Kiska, Komandorsky and other islands. Thousands of native residents were forcibly relocated to Southeast Alaska during the war. Unalaska was incorporated in 1942 (Morgan 1980).

Commercial Fishery Trends
(NMFS 2010)



Today. Dutch Harbor consistently leads the nation's ports in seafood landings (cf. NMFS 2011). Vessel transit and seafood processing are enabled by a natural deepwater harbor. The local population swells during fishing seasons when processing plant workers arrive in the area. In recent years, the permanent population has been around 4,000 persons (U.S. Census 2010). Many residents fish, hunt, and gather for consumptive, recreational, and cultural purposes. Subsistence related activities remain particularly important in Unalaska's Native households.

Subsistence Harvest Salmon*
(Davis 2004)



* Methods varied; data not directly comparable

Select Fisheries Indicators : Year 2000
(Sepez et al. 2005)

- 50 residents held 103 commercial fishing permits
- 16 residents held crab permits, 13 were fished
- 4 other shellfish permits were issued, none were fished
- 25 halibut fishery permits were issued, 13 were fished
- 40 groundfish permits were issued, 18 were fished
- 7 sablefish fishery permits were issued, 5 were fished

- 8 salmon fishery permits were issued, 5 were fished
- 9 firms processed over 316,000 tons of seafood
- 4+ charter boat companies offered sportfishing
- 833 sport fishing permits were sold in Unalaska
- 485 Alaska residents purchased sportfishing permits
- 17 local captains held federal permits - 6 state only

Organization of the Report

The following sections of this report are organized in terms of the research hypotheses discussed above. Background description of the grounding, spill, and response efforts provide necessary context for subsequent description of complex human behavior and social interaction in a challenging emergency response setting. This is followed by discussion of direct and indirect effects and implications of the incident in relation to: (1) local and regional commercial fishing interests; (2) subsistence fishing and gathering activities; (3) local socio-demographic conditions; and (4) social interaction between persons and groups of persons affected by or involved in response to the grounding and spill. A concluding section summarizes project findings. References follow.

Figure 2. View of Makushin Volcano with Dutch Harbor Seafood Processing Plants in Foreground

2.0 The *Selendang Ayu* Accident, Spill, and Associated Response

The *Selendang Ayu* accident resulted from an initial problem-solving decision gone awry. In order to mitigate subsequent problems, further portentous decisions were made. Ultimately, the situation required the application of extensive human and fiscal resources to respond to the emergency. This pattern is typical of maritime oil spills, and it is instructive to consider the potential magnitude and array of consequences resulting from specific seminal human actions or inactions in this context. Notably, Rothblum (1999) asserts that human error is a contributing factor in the vast majority of tanker accidents (Transportation Safety Board of Canada 1994).

Poor weather and sea conditions are also often associated with maritime oil spills (cf. Burger 1997). The *Amoco Cadiz* ran aground on Portsall Rocks during storm force conditions in 1978, resulting in a 68.7 million gallon spill of crude oil, portions of which contaminated some 200 miles of the Brittany coastline of France (Hess 1978; Laubier 1980; Conan et al. 1982; U.S. Department of Commerce, NOAA 1983). The *Argo Merchant* spilled some 7.7 million gallons of fuel oil in ten-foot seas in the shallow, difficult-to-navigate waters off Nantucket Island, Massachusetts in 1976; prevailing currents eventually carried much of the spill seaward (Farrington et al. 1977; Winslow 1978). The grounding of the *Exxon Valdez* in 1989 preceded the spillage of some 11 million gallons of crude oil in remote areas of South-central Alaska, and a large winter storm complicated critical early response work (Wells et al. 1995). The *Braer* grounded during a violent storm in 1993, spilling roughly 33 million gallons of crude and heavy bunker oil, portions of which affected Scotland's Shetland Islands (Ritchie 1995; Glegg and Rowland 1996; Goodlad 1996). The integrity of the *Prestige* was compromised in 2002 by heavy seas and high winds, ultimately spilling 20 million gallons of heavy fuel oil and affecting coastal areas of northwest Spain (Perez 2003; Surís-Regueiro 2007; Castenedo et al 2009).[7]

The foundering of the *Selendang Ayu* began with engine problems during a violent early winter storm in the south-central Bering Sea, and the captain's decision to work on the engine without immediately reporting the situation to Alaska-based authorities. A reading of the marine accident brief by the National Transportation Safety Board (NTSB 2006) indicates that delayed reporting to Alaska-based authorities consequently delayed the arrival of available rescue assets. Strategic towing and anchoring efforts failed, largely due to extreme and irregular pressure on the towline and anchor, in a large and chaotic mixture of wind swell, ground swell, and high winds, and with limited time for rescue given the looming Unalaska coastline.

Kurtz (2008:640-642) describes the accident in terms of gaps in maritime transportation policy, specifically a gap in the regulation of foreign-flagged vessels making innocent passage through the Aleutian Islands. Owners of such vessels are not currently required to develop spill contingency plans that would articulate with those of federal or state governments, nor are they required to maintain effective large-vessel towing packages. Kurtz notes that while the Oil Pollution Act of 1990 (OPA) designates the USCG as the lead coastal spill response entity, it does not clearly designate authority during the period of time between the pending and actual spill event. The author asserts (ibid., p. 641) that the legal inability of the USCG to effect federal authority at a time of practical need appears to have played a role in the grounding and spill of the *Selendang Ayu*:

[7] The *Amoco Cadiz* and *Prestige* accidents are discussed in more detail in Impact Assessment, Inc. (2010).

> During the many hours when the *Selendang Ayu* was adrift, the Coast Guard [by law] assumed a consultation role, [necessarily] leaving on-board decision making in the hands of the freighter's captain. This remained the case even as the need for evacuation became more dire and the freighter drifted ever closer to disaster. The narrative reveals an obvious friction between Coast Guard recommendations and the actions of the *Selendang Ayu* captain. Growing desperation on the part of Captain Singh and lack of sleep likely contributed to poor decision making aboard the stricken freighter (Kurtz 2008:641)

Once aground on a rocky reef surrounded by large breaking surf and high winds, efforts to rescue the crew and captain from the *Selendang Ayu* were heroic by any standards (cf. Walker 2010). Containment of spilled oil and cargo were hampered by the remote location of the accident and again by challenging weather and sea conditions. The vessel was truly aground; removal of visible portions of the grounded vessel did not occur until 2008, following extensive effort and solution of numerous logistical problems by the region's marine salvage experts.

All response activities were necessarily conducted with due concern for risk of injury to responders in a remote area. For instance, all recommended precautions against potential earthquakes and tsunamis were undertaken in this tectonically active region. Portions of the affected coastline are difficult to safely access during any typical sea state. Natural attenuation of pockets of unrecoverable bunker oil and marine diesel fuel will continue for an uncertain number of years[1] along small portions of the rugged northwest Unalaska shoreline.

Loss of Power and Subsequent Repair and Rescue Attempts[2]

The Malaysia-flagged *Selendang Ayu* was a 738-foot, double-hulled bulk freighter with a capacity of 72,937 deadweight tons powered by a single 11,542 horsepower diesel engine. The vessel could make 14.5 knots. At the time of the grounding, Captain K. Singh of India was piloting his second transit of the Bering Sea with an unlimited master's license and 32 years of seafaring experience. The vessel was owned by Malaysia-based Ayu Navigation, operated by Singapore-based IMC Shipping of the IMC Group, and insured by the Swedish Club with maximum allowable coverage of roughly $24 million.

According to the NTSB (2006:4), damage to the freighter's number three cylinder preceded initial failure and shutdown of the engine at 1200 hours on December 6, 2004. The ship had been powering through particularly challenging sea conditions for some days and was roughly 120 nautical miles northwest of Dutch Harbor. A deepening low pressure system was approaching from the northwest. The vessel began a drift toward Cape Kovrizhka near Makushin Bay on Unaslaka Island, in the central Aleutian Islands.

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[1] Although wave action can disperse and therefore quicken degradation of spilled liquid petroleum hydrocarbons (Owens 1978), such substances are known to persist even in highly active littoral zones. Xia et al. (2010) describe hydrodynamic processes that have led to the burial, and hence preservation, of oil from the *Exxon Valdez* spill in variably permeable gravel sediment layers in the lower intertidal zone of Knight Island.

[2] This account is based on real time monitoring of news reports, interviews with USCG and other public officials, and the findings of the NTSB (2006).

Captain Singh notified the Dutch Harbor harbormaster of the situation at 0245 hours on December 7, after many hours of attempted engine repair. The harbormaster notified the USCG Marine Safety Detachment, also in Dutch Harbor, and Coast Guard Command District 17 in Juneau. The USCG subsequently notified the Alaska Department of Environmental Conservation (ADEC).

The USCG Cutter *Alex Haley* was dispatched to assist the distressed freighter. The *Haley*, first commissioned as the USS *Edenton* in 1971, is a 283-foot propulsion diesel cutter home-ported at the USCG Support Center on Kodiak. Four additional vessels were also dispatched. These were: the *Sydney Foss*, a 126-foot, 3,000 horsepower tug; the *Redeemer*, a 124-foot, 1,500 horsepower tug; and USCG Cutters *Sherman* and *Sycamore*.

The *Alex Haley* arrived on scene early on December 7 and waited for the *Sydney Foss*, which had a nine–inch diameter tow line at the ready, rather than the eight-inch line available on the *Alex Haley*. The *Sydney Foss* arrived late in the evening on December 7, and the *Redeemer* arrived at 0200 hours on December 8.

Figure 3. USCG Cutter *Alex Haley* at Moorings in Dutch Harbor
Photo Courtesy of United States Coast Guard

Initial efforts to fasten a tow-line to the *Selendang Ayu* failed in storm-force winds and 25-foot seas. A second attempt was successful and the drifting vessel was brought under tow for 12 hours, slowing speed of drift to one mile per hour, but with little alteration to course of drift to the southeast and towards Unalaska Island. The crew was not able to restart the engine at this time.

At 0732 hours on the 8th, the master of the *Sydney Foss* notified the *Selendang Ayu* and the *Alex Haley* that the towline had parted. At 0945, oil in the outboard tanks was transferred to the inboard tanks, and fuel heaters were turned off to allow the fuel to thicken in the hopes of minimizing the risk of a potential spill. Strategies to tow the freighter to safety continued during the morning hours, but ultimately failed in worsening winds and swells as high as 35 feet (NTSB 2006).

At around 1400 hours, the USCG began the risky endeavor of hoisting nine *Selendang Ayu* crew members into an HH-60 helicopter deployed from Cold Bay. At 1430 hours, a second HH-60 helicopter arrived to evacuate nine more crew members, with six crew members and the captain remaining on board to continue efforts to save the vessel from grounding (Figure 5).

When the vessel was approximately two miles offshore, one of its anchors was set in an attempt to slow the vessel. The anchor held only for a short time. A second anchor temporarily held the *Selendang Ayu* about one mile offshore, between Skan Bay and Spray Cape. Efforts to repair the engine continued even at this time.

Figure 4. Large Seas and Rescue Tug as Seen from Deck of the *Alex Haley* on December 8, 2004
Photo Courtesy of the United States Coast Guard

According to the ship's log, full grounding occurred at 1705 on December 8. A Coast Guard HH-60 Jayhawk helicopter arrived to lift the remaining crewmen from the vessel, accompanied by a smaller HH-65 Dolphin chopper deployed from the *Alex Haley*.

While lifting from the deck of the freighter with six of its crew members onboard, the Jayhawk interacted with back spray from a massive breaking wave, causing the chopper to stall and crash into the sea with seven sailors and three USCG crewmen on board. The Coast Guard personnel, dressed in immersion suits, were rescued by the HH-65, as was a *Selendang Ayu* crew member. The remaining six sailors could not be located and were declared lost at sea despite an intensive search and rescue effort.

At 1913 hours, with the captain and a USCG rescue swimmer still on board, the ship broke in two and began to disgorge oil and soybeans into the sea. The two men were rescued by the HH-65 at 2035 hours (NTSB 2006).

Figure 5. Delivering *Selendang Ayu* Crew Members to Safety on the *USS Alex Haley*, December 8, 2004
Photo Courtesy of the United States Coast Guard

The IFO 380 grade fuel oil carried on the *Selendang Ayu* had an API density of 11.4, with a viscosity measure of 340 mm^2/s at 50° C. The material is heavy and viscous in nature. The National Oceanographic and Atmospheric Administration (NOAA) Hazardous Materials Response Division notes that when spilled in saltwater, such fuel does not readily disperse or evaporate, and in high energy surf it is likely to break into persistent tar balls (NOAA Hazardous Materials Division 2004). Upon break-up of the freighter's hull, black oil and brown emulsion streamers were observed around the wreck, and oil and tar balls began washing up on nearby beaches.

Figure 6. Wreck of the *Selendang Ayu* on Rocky Reef at Skan Bay, Unalaska Island, December 2004
Photo Courtesy of the United States Coast Guard

The Determinative Nature of Alaska Weather and Sea Conditions

Aleutian Island weather is characteristically stormy, particularly during winter when eastward-moving low pressure systems often intensify in the region. But snow, fog, high winds, and rain may occur throughout the year. The sun periodically illuminates the sea surface and adjacent precipitous mountains, but truly sunny days are rare. The captains and crews of fishing, freighter, tug, rescue, and other vessels routinely encounter large seas, high winds, freezing temperatures, and poor visibility in the Bering Sea and Gulf of Alaska, and particularly hazardous conditions in the between-island passes. Fett et al. (1993), of the U.S. Naval Research Laboratory, describe challenges encountered by mariners in and around the Aleutians:

> From the point of view of the Navy sailor or aviator, the Aleutians' reputation for foul weather can hardly be exaggerated. Storms passing the Aleutians usually arrive from the west as deep occluded systems, sometimes as transformed versions of typhoons that have gone extra-tropical. Winds at sea and exposed regions on the islands often exceed hurricane force, sometimes further strengthened as a result of venturi effects through mountain passes or ocean gaps between islands. Visibilities are frequently severely restricted by fog, which can persist for days without improvement and for lesser periods on the islands and at sea through intense precipitation in cyclone activity. The tendency for extended consecutive days of bad conditions can be very frustrating for operations at sea, in the air, and at naval and air installations on the islands.

The *Selendang Ayu* accident occurred during a particularly robust early December storm. At-sea USCG witnesses report "very hazardous" sea and weather conditions during the rescue work. This is confirmed by the NTSB (2006:4) which states that the grounding occurred as a result of the inability of the crew to restart the engine and failed attempts to tow or otherwise arrest the drifting freighter in extreme wind and sea conditions.

Weather conditions continued to impede and temper the assessment, salvage, and clean-up phases of the incident. Moreover, the vessel grounded along a remote stretch of coastline in the Unalaska Island portion of the Alaska Maritime National Wildlife Refuge. Much of the area is exposed to storm-associated winds, and to groundswell and windswell emanating from the southwest, west, and northwest. This made response by sea particularly challenging. Moreover, with the exception of a limited road system in the immediate Unalaska/Dutch Harbor area, there are no modern roadways around Unalaska Island, and thus no overland response could be mounted. Finally, while there are a number of areas suitable for landing helicopters and small planes in the spill-affected area, only a limited number of days were suitable for safe flying.

Other significant accidents and spills have occurred in the Aleutian Islands. The Aleutians Subarea Contingency Plan (2006) reports 23 hazardous materials spills of varying scope in the navigable waters of the Aleutian region between 1981 and 1997.

These incidents include the grounding and spill of the *M/V Kuroshima* in 1997. The *Kuroshima* spilled some 39,000 gallons of bunker fuel just north of Unalaska during an early winter storm in 1997 (ADEC 1998; see Map 2 above). The incident is significant in this analysis since it involved: an expensive and laborious response effort; subsistence food advisories and lingering public uncertainties about the safety of foods in certain areas; areas of persistent contamination (NOAA Damage Assessment Center 2002); and a five-year NRDA process.

The spill from the *Selendang Ayu* threatened or affected numerous species of seabirds and marine mammals, and various fishery resources. Of particular note in terms of fishery impacts, the grounding and spill occurred in the Makushin/Skan Bay portion of the Eastern Aleutian District of Tanner Crab Management Area J. The Makushin/Skan Bay and Unalaska areas were the only allowable Area J nearshore crab grounds during 2005, and were scheduled to open on January 15, 2005.

As discussed below, crab and other fisheries in the Makushin/Skan Bay area were closed by the Alaska Department of Fish and Game (ADF&G) on December 27, 2004 due to spill concerns. Non-commercial harvesting of natural resources was also precluded in spill-affected areas during this time.

Map 2. Wreck Site and Spill-Affected Areas on Unalaska Island

Spill Assessment and Response Work

A centralized response entity that came to be known as Unified Command was established at the largest hotel facility on the island soon after the event began to unfold. Establishment and operation of Unified Command involved the USCG, ADEC, the responsible party, and numerous other agencies and entities. Early and ongoing planning and response coordination was undertaken by Unified Command in adherence to state and federal emergency response policies and in relation to the ever-changing physical and human factors inherent in oil spill response.

This context required that Unified Command leaders coordinate the actions of many agencies and individuals to make timely and permissible decisions and to allocate the appropriate type and level of resources to address a variety of critical needs. These needs included but were not limited to the following:[10]

(1) Rapid-response search and rescue and carefully planned recovery of the missing crew members;

(2) Organization of the incident command system and coordinated response to emerging and anticipated challenges as specified in the Alaska Federal and State Preparedness Plan for Response to Oil and Hazardous Substance Discharges and Releases (Aleutians Subarea Contingency Plan 1999);

(3) Transportation of personnel and procurement and transport of materials from Anchorage, other parts of Alaska, and points in the Lower-48 to Unalaska/Dutch Harbor and to remote locations along the northwest coastline of Unalaska Island;[11]

(4) Development and use of valid and reliable measures for assessing and monitoring the extent and distribution of the spill and drifting tar balls;

(5) Determination and enforcement of area closures along the spill-affected shoreline and adjacent ocean waters;

(6) Ascertainment, validation, documentation, and coordinated dissemination of many kinds of spill and response-related information within and beyond Unified Command;

(7) Interaction with landowners to facilitate site assessment and environmental mitigation activities, and landowner inspection of areas subject to those activities;

[10] The full range of administrative duties and evaluation of USCG performance during the course of the incident through July 2005 are provided in Wood and Associates (2005).

[11] Federal monies will continue to be applied to the Natural Resource Damage Assessment (NRDA) process until it is finalized in an upcoming fiscal year.

(8) Organization and deployment of the shoreline clean-up assessment team (SCAT) to mitigate spilled petroleum products and soybeans and to undertake complex response activities by helicopter and boat;

(9) Effective treatment of injured wildlife, including transportation of injured individuals to rehabilitation facilities;

(10) Consultation with the federally recognized Qawalangin tribe, and identification and appropriate treatment of cultural and natural resources identified in the spill areas; [12]

(11) Development and implementation of strategies for assisting and/or evacuating ill or injured response workers at sea and along the shoreline;

(12) Development of real-time plans for preventing physical transport of oil into seafood processing facilities around Unalaska Bay;

(13) Development and implementation of a waste management plan;

(14) Conduct of assessment and response-related planning within and between federal offices and agencies outside Alaska; and

(15) Coordination of preliminary and ongoing interaction with federal agencies responsible for implementing the NRDA process in the affected areas.

In addition to rescue and recovery work, and organization of the incident command system, various other rapid response activities occurred during the days immediately following the grounding and spill. USCG and state agencies initiated aerial assessment efforts; vessels were deployed and boom material was readied to restrict tidal flow into salmon streams; and salvors formulated emergency response plans. But foul weather quickly precluded the initial assessment and response work, and not for the last time. Winds of 35 to 50 knots and seas between 14 and 24 feet grounded the assessment crews and salvors on December 11th.

Improving conditions on December 12th allowed salvage teams to begin on-board assessment and lightering of oil from the wreck. By December 16th, one week after the spill, floating brown mousse and large tar balls had moved in a northwesterly direction along the rugged rocky coastlines and Skan, Makushin, Portage, and Cannery Bays.

Salvage, cleanup, and wildlife protection measures were actually underway before the *Selendang Ayu* went aground. Gallagher Marine, IMC Shipping's designated emergency response entity,

[12] The USCG response to oil spill events must involve consultation with potentially affected tribal entities, as stipulated in Executive Order 13175: Consultation and Coordination with Indian Tribal Governments, signed by President Clinton in 2000. This requirement was furthered through passage of the Coast Guard Authorization Act of 2010. Practical and legal dimensions of federal-tribal consultation are discussed in Kohberger and Bryant (2010).

and the international salvage firm SMIT, quickly mobilized to address the pending spill event. The Aleutian-based firm known as Magone Marine played key roles in many aspects of the seagoing response and salvage work. Each of the contracted firms is noted for experience in challenging high-latitude spill situations.

In this case, the initial salvage and clean-up involved extensive inspection work and the undertaking of a complex effort to pump the IFO 380 and other contaminants from the grounded vessel's various compartments into a 2,000 gallon steel container for transport by helicopter to Dutch Harbor. Some 70 lightering trips were made during the course of the event (NOAA Ocean Service 2011).

The USCG initially deployed three commercial vessels and crews to lay oil containment booms in the most environmentally sensitive locations. The supporting fleet was eventually expanded, and the process through which captains, crew, and their vessels were chosen to participate in the operation was a topic of some discontent among certain local fishermen who did not qualify for involvement in the response effort.

On December 20th, a powerful storm swept into the Aleutian Islands, with near-hurricane force winds, high seas, and freezing spray. Because chartered cleanup, skimmer, salvage, and support vessel operations were restricted to seas of less than six feet and winds below 30-knots, officials ordered all such vessels to return to, or stay in port. Poor conditions continued for some days.

By January 1st, the NOAA Hazardous Materials Unit had completed an aerial assessment of the areas affected by the spill. NOAA representatives subsequently reported that while oiling was significant in some areas, most of the substance was limited to the vicinity of the wreck.

Although trawl, pot, and other testing methods were eventually used to detect oil in the affected region, the principal initial means of determining the distribution and severity of the spill was aerial and SCAT work. Notably, this too was limited by weather, both in terms of number of possible reconnaissance trips and by the capacity of observers to conduct the work in conditions of poor visibility.

By January 22nd, the majority of the oil and diesel fuel contained in the *Selendang Ayu* had been spilled along the adjacent shorelines or lightered from the grounded vessel. Initial assessment of the overall severity and distribution of contaminants along the coastline indicated that variable tide, wave, and current action had led to profound differences in the distribution of the oil. Some areas were almost devoid of oil residue, while others were described as heavily oiled.

A chemical dispersant known as Corexit 9500 was available for potential application in response to any subsequent release of significant volumes of oil from the grounded vessel. The dispersant and skimmers were evaluated for use but were not implemented since relatively little oil was available for sea surface treatment or recovery after the initial spill event. The clean-up effort was rather focused on lightering of oil from the vessel and physical removal of contaminants from the shoreline using manual cleanup, mechanical tilling, and materials relocation methods (NOAA National Ocean Service 2011).

Shigenaka and Owens (2008:1201-1207) provide useful description of affected environment and the mitigation strategies ultimately employed, including re-deposition of contaminated soil, sand, and gravel to shoreline areas where wave action would be most likely to more rapidly disperse and weather the oil. Re-deposition strategies were deemed necessary since the storm event that led to the grounding and spill was the most significant of the 2004-2005 winter season, resulting in the "stranding" of oil in the supra-tidal zone.

Ocean currents transported tar balls to Unalaska Bay, and sometimes along routes that brought the substance close to important fish processing facilities. For instance, small amounts of tar were found in fjord-like Captain's Bay during the second week of January 2005 (Richardson 2005a). Because the substance would have been transported within short distances of local seafood processing facilities in order to reach Captain's Bay, this was of great concern to commercial fishery interests. Elderly informants who had been living and fishing in the area for many years predicted this eventuality based on traditional knowledge about the movements of currents in the region.

Subsequent sampling work at key points in Unalaska Bay led to the identification of additional tar balls, patties, and sheen. But intensive sampling at the processing plants did not indicate contamination of seawater or seafood (Nuka Research and Planning Group 2005b:45).

Oiled birds were found in and around the spill area and as far south as Chernofski Bay (see Map 2, above). The International Bird Rescue Research Center operated a bird triage and treatment center and rescued 29 birds. By mid-February, over 1,700 bird carcasses and nearly 38,000 bags of oily waste had been collected from accessible areas along the west-central coastline of Unalaska Island, and 144,931 gallons of IFO, diesel fuel, and contaminated water had been lightered from the wreck (USFWS 2008).

Official reports about the initial extent and range of the spill were based on a combination of aerial surveys, fishing gear tests, and clean up-related reconnaissance. But persons involved in the process report that much of the oil appeared to have sunk, rendering accurate assessment difficult. Some 200 public and private sector personnel were involved in the initial response.

Reconnaissance and planning also necessarily addressed the spilled soybean cargo. Early public meetings held by Unified Command often involved extensive discussion of the potential fate of the cargo in the Aleutian environment and possible need for remediation of what some worried could become an alien invasive species or that would otherwise detrimentally affect the coastal ecosystem of Unalaska Island.

Oiled beans were removed from the spill-affected beaches, but it was officially decided that the spilled cargo would very likely degrade and/or become buried under cobbles in the high energy surf zone without significant increase in local biological oxygen demand (ADEC 2005). Thus, unoiled beans were not considered a threat and were not removed.

By April 2005, most of the remaining beans reportedly had split and sunk to the bottom or were in the process of degrading along the shoreline in the warming spring climate. Fears about significant ecosystem impacts resulting from spillage of the soybeans proved unwarranted.

Containment, cleanup, and salvage operations were suspended on February 19, 2005 until winter weather conditions improved. An advance survey team was sent to the affected area in March to identify areas for high priority clean-up work. These included particularly important areas above the high tide zone, such as estuaries and salmon streams. Again, some 200 personnel and 22 vessels were rotated in and out of the affected area from Unalaska/Dutch Harbor beginning in April. Three aircraft were also involved.

Figure 7. Lowering Lightered Oil to Repository in Dutch Harbor, 2005

Numerous environmental firms were contracted to participate in the shoreline cleanup process. Cleanup support barges deployed in Makushin and Skan Bays received oily waste and functioned as storage platforms. Oiled materials were transferred from the beaches to a transport vessel to be off-loaded by crane onto the barges. Five-person crews operated each barge.

Poor weather conditions forced cessation of clean-up activities in September 2005. A three-and-one-half mile stretch of oiled shoreline was the focus of the clean-up effort when operations were undertaken once again during May 2006.

Unified Command issued its final incident briefing on June 24, 2006 (Alaska Department of Environmental Conservation 2006). Over 476 miles (806 specified segments) of shoreline on Unalaska Island, Umnak Island, and Akutan Island were inspected for oiling. Actual cleanup operations had been conducted along 37 miles (123 segments) of impacted shoreline.

Seven shoreline segments did not meet end-point cleanup criteria. Two of the segments were not cleaned since safety issues were deemed to outweigh the potential benefits of further manual clean-up work along a particularly hazardous stretch of coastline. An additional five segments near end-point status were deemed not likely to pose a significant threat to the larger ecosystem. All seven of these segments were left to natural attenuation processes and will not be monitored (Alaska Department of Environmental Conservation 2006).

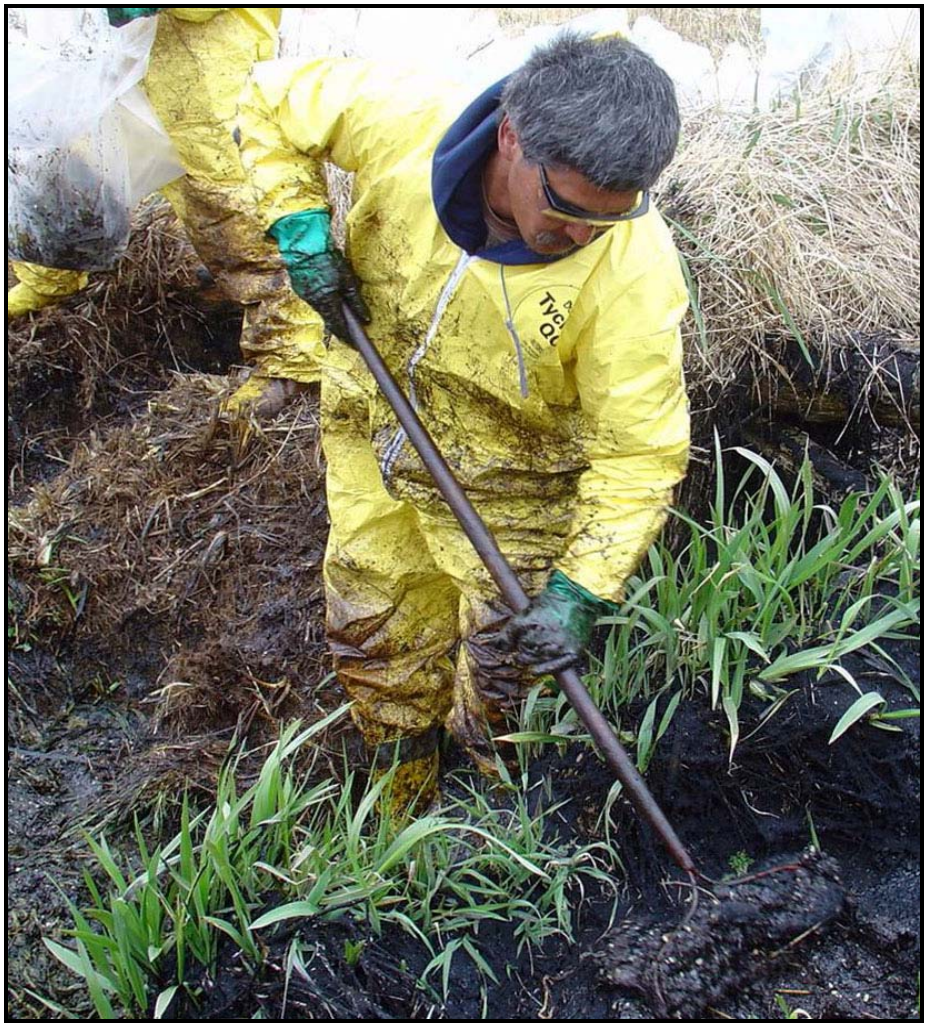


Figure 8. Manual Tilling of Affected Soil near Wreck Site, Winter 2005
Photo Courtesy of U.S. Coast Guard

Because the wrecked freighter fully grounded on rocky reef in eight to ten fathoms of water in a highly active surf zone, subsurface portions of the hull cannot easily be removed and will remain until full disintegration occurs many years hence. Representatives of the Dutch Harbor-based salvage firm that led the operation report that efforts to remove the vessel superstructure to a point below low water sea level were continually complicated by weather, swell, and wind wave activity. The operation was finalized in 2008.

Figure 9. Freighter Superstructure in Fair Weather: Removal Challenge for Local Salvage Experts
Photo Courtesy of U S. Coast Guard

3.0 Effects on Commercial Fisheries and Subsistence Activities

Of all U.S. fishing ports, Dutch Harbor consistently ranks first or second in terms of total pounds of seafood landed, and total ex-vessel value of those landings. The Bering Sea/Aleutian Island distant water crab and groundfish fisheries are now consistently robust, with scores of locally based captains and vessels active in one or more fisheries during the course of the year. Captains and crew of some 25 small-boat commercial fishing operations are also regularly based in the Unalaska area, as are numerous participants in the region's subsistence fisheries.

A variety of firms provide specialized services in support of the fishing fleets and maritime transportation industries based in Dutch Harbor/Unalaska. Large volumes of seafood are distributed from Dutch Harbor to markets throughout the world, including those in: Japan, Korea, Norway, Taiwan, China, Spain, Portugal, Israel, Denmark, Great Britain, and Malaysia. Based on export records for the period 1983 to 2006, Sepez et al. (2007) report that Alaska-caught groundfish was exported to 99 nations on six continents.

Processors receive most seafood from locally based large-vessel operators and from operators of large crab and groundfish vessels based in ports throughout the Bering Sea, Aleutian Islands, Gulf of Alaska, and the Pacific Northwest. The small-boat commercial fishing fleet is active in the nearshore zones around Unalaska and adjacent islands.

Many fishermen are based in Unalaska/Dutch Harbor for relatively short periods of time, as are many hundreds of persons who work on a seasonal basis in one of the local seafood processing or distribution facilities. The planning firm EDAW reports (2005) that business activity in Unalaska is cyclic in nature, tied as it is to seasonal openings and closings of major fisheries.

Figure 10. Processor Lodging Facilities, Dutch Harbor, Winter 2006

Commercial Fishery Effects and Seafood Monitoring Strategies

Overview. Direct effects of the oil spill on commercial fisheries in the Unalaska region were ultimately limited to contamination of waters in and around Skan and Makushin Bays and subsequent closure of the area's small-boat Tanner crab fishery.[13] Tanner crab (*Chionoecetes bairdi)* is also known as bairdi crab. Given concerns about potential contamination, the Pacific cod and black rockfish fisheries were also closed in the spill area, although key informants suggest that existence of productive grounds elsewhere served to minimize impacts of the closure on the local small-boat fleet.

Concerns about closure of additional fisheries and potential contamination of seafood harvested and/or processed in Dutch Harbor were profound and widespread during the months following the spill. It was thought that a number of important fisheries could have been significantly impacted by the spill through: (a) direct oiling of marine resources and/or habitats at certain locations; (b) oiling of vessels or gear in or around affected fishery transit areas; (c) effects of oil on processing facilities or operations; and (d) perceived effects of generalized contamination among members of the seafood-buying public. In addition to the Makushin-area Tanner crab fishery, potentially affected fisheries included the following: (1) the Unalaska Bay Tanner crab fishery; (2) the Bering Sea opilio crab fishery; (3) the Bering Sea/Aleutian Islands Pacific cod fishery involving pot gear; (4) the Bering Sea/Aleutian Islands pollock fishery "A" Season; and (5) the Bering Sea/Aleutian Islands Pacific cod fishery involving trawl gear.

Seafood harvesters, processors, and government agencies allocated extensive resources and coordinated their respective efforts to ensure that the region would not be unduly affected by the event and its potential effects on fishery-specific and fishery-related local and regional economies. An initial strategy for protecting marine resources was to assess the basic nature and extent of the spill on the adjacent water body and its natural resources. This warranted the issuance of a Threatened Water Body Finding (TWBF) by Alaska Department of Environmental Conservation on December 27, 2004.

Further, because 10 of 21 test crab pots retrieved from the general spill area showed signs of oil contamination, the ADF&G closed state jurisdiction waters between Cape Kovrizhka and Spray Cape to commercial fishing activities on January 1, 2005 (under authority of AS 16.05.060). This effectively closed the Tanner crab fishery at Makushin and Skan Bays.

ADF&G officials asserted that Alaska's zero-tolerance policy would preclude any reopening of the fishery as long as there was threat of contamination. It is notable that the zero-tolerance policy was first instituted following the *Exxon Valdez* oil spill as a measure to protect public health, and to preserve the common perception of pure Alaskan seafood.

Given potentially extensive effects of the spill on fisheries in the Dutch Harbor/Unalaska area and across the larger region, the Alaska Department of Environmental Conservation established a Fisheries Work Group late in December 2004. This group would subsequently develop and

[13] The average size of small-class vessels whose captains qualified for participation in the Makushin Bay Tanner crab fishery in 2005 was 39 feet.

implement appropriate assessment, monitoring, and mitigation strategies for threatened or potentially threatened commercial fishery resources, with emphasis on water quality testing at specific locations around northern and western Unalaska Island. Results of fishery planning and assessment efforts undertaken by the Work Group are available in Nuka Research and Planning Group (2005a, 2005b).

Effects on the Dutch Harbor Small-Boat Crab Fleet. Prior to its spill-induced closure**,** the Management Area J Makushin Bay Tanner crab fishery was of importance to certain Dutch Harbor-based small-boat captains. Following extensive production in the 1970s and 1980s, the area was closed to crabbing during much of the 1990s and the early part of the new decade with the intent of enabling stocks to regenerate. Reopened in 2004, the open access, 300-pot individual limit fishery was relatively productive for the captains and crew of 14 vessels. Moreover, the biological assessment work of Bush (2004) indicated that the 2005 season would also be productive. The allocated quota for 2005 was 171,453 pounds (Nuka Research and Planning Group 2005a), with an estimated ex-vessel value of $2.60 per pound (Bauman 2005). Thus, the total estimated value of the fishery for 2005 was approximately $445,000.

Following closure of the fishery, a claims adjuster for the responsible party was sent to Dutch Harbor to discuss the claims process with captains who were planning to set pots in the area in 2005. One potential outcome of the claims process as perceived by members of the affected small-boat fleet was that the projected total value of the fishery for the 2005 season would be assessed and awarded to those who had participated in 2004. However, perceptions were complicated by uncertainty as to which and how many fishermen would in actuality have set pots in and around Makushin and Skan Bays in 2005. Informants who were active in the fishery in 2004 suggested that few if any additional fishermen would likely have been involved in 2005, while the claims adjuster, seeking inclusivity, determined that as many as 15 additional fishermen could potentially have been involved.

At the same time, information about the potential for reimbursement of lost fishery income became known to a larger group of captains that included fishermen who were legally qualified to fish in Management Area J, but who clearly were not likely to do so since they were residing outside of the Aleutian region at the time of the closure. Nevertheless, the claims adjuster necessarily made judgments about whether fishermen living as far away as Seattle would have engaged in the fishery in 2005. The situation led to significant tension among members of the locally based small-boat fleet, who felt that the more transient fishermen were in reality not likely to participate in this small-scale fishery in 2005.

Uncertainty regarding the total number of claimants qualified to split the value of the fishery confounded individual decisions about whether to submit a claim since the claims form specified that in so doing the claimant would forfeit his legal ability to litigate for compensation of lost revenue and/or punitive damages. In the end, it was determined that roughly 30 fishermen would conceivably have participated in the fishery and would be eligible to share the pool of compensatory monies. All fishermen who wished to make a claim were required to submit supporting evidence of past activity in the fishery.

Numerous members of the small-boat fleet ultimately determined that it would be prudent to settle through the claims process rather than to engage in litigation. Many interviewed during the course of this study stated that the protracted nature of the *Exxon Valdez* punitive damages case acted as a disincentive for organizing a lawsuit against the responsible party in the *Selendang Ayu* incident. Some such fishermen were plaintiffs in the *Exxon Valdez* punitive damages suit, and all were aware of the protracted nature of the case and the various frustrations it held for many plaintiffs, including the U.S. Supreme Court decision to significantly reduce the total punitive damages figure previously set by the Ninth Circuit (cf. de Sousa 2009).[14]

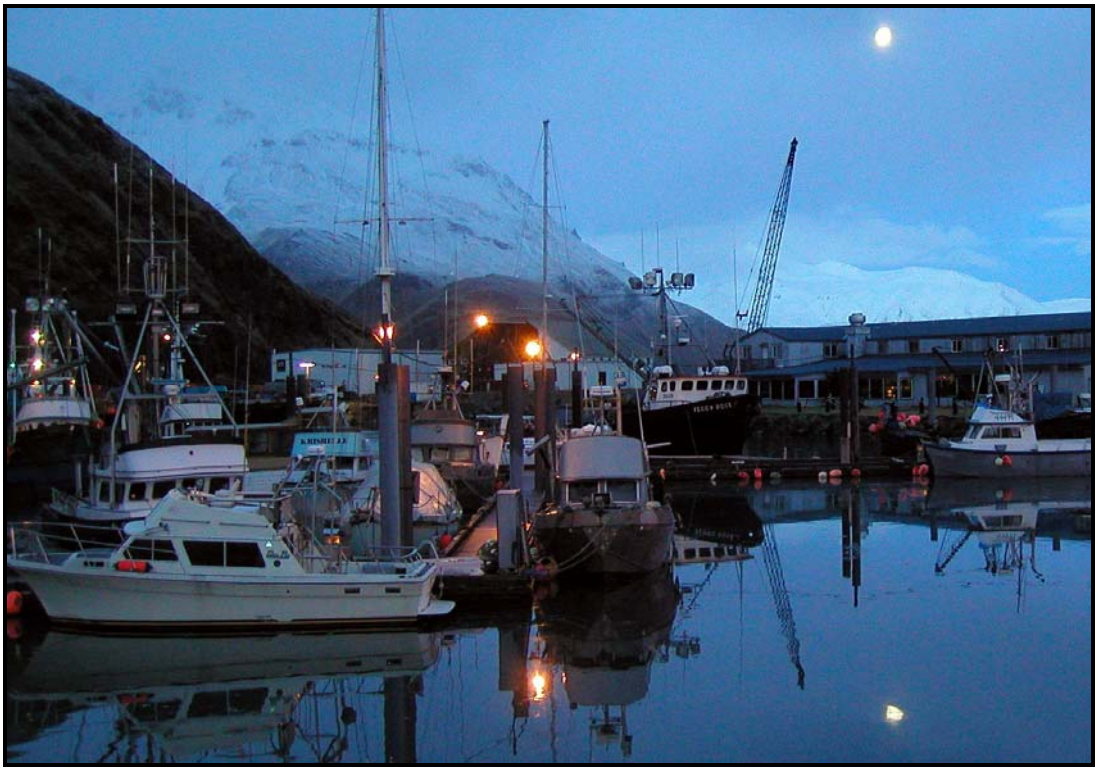


Figure 11. Small-Boat Harbor, Unalaska, Early Spring 2006

Some of the Unalaska-based small-boat crabbers convened to discuss their options and the potential outcomes of settling or litigating. Follow-up interviews made clear that, while numerous participants were dissatisfied with the claims process and with those who unfairly sought compensation, most were reasonably satisfied with, or accepting of the ultimate outcome. That is, the benefits of receiving compensation monies without actually having to undertake the costly and perennially uncertain act of crabbing or fishing (see McGoodwin 1995) were not lost on certain local fishermen, particularly given the exigencies of fishing from small boats in some of the most challenging weather and sea conditions in the Pacific.

On the other hand, some informants described their enjoyment of crabbing and were visibly frustrated by the closure of a fishery that was highly productive and relatively lucrative the

[14] The amount of the punitive damages settlement previously set by the U.S. Court of Appeals Ninth District was ~$2.5 billion before interest. The U.S. Supreme Court reduced the figure to $500 million before interest on the basis that punitive damages should not exceed compensatory damages previously paid to the plaintiffs, the majority of whom were involved in the commercial fishing industry.

previous season. A few captains reportedly had fished for halibut in the affected area in years past, and claimed to experience diminished income due to loss of this opportunity.
A few local small-boat captains became involved in the spill clean-up and/or monitoring activities and reported satisfaction with payment for doing so.

But most captains contacted during the winter following the spill expressed discontent regarding an apparent lack of opportunity to participate in the response. It was repeatedly stated that locally based small-vessel captains were overlooked during the response vessel selection process undertaken by Unified Command, despite the fishermen's knowledge of the spill-affected area and associated conditions and resources. It must be noted, however, that the USCG necessarily must attend to safety and liability issues when addressing the role of local captains and vessels in a response and clean-up operation overseen by the federal government. One captain who did assist in the response did not file a claim for loss of opportunity to participate in the Tanner crab season because he believed this would have constituted a personal conflict of interest.

A variety of problems were noted among small-boat captains who would or might have participated in the Makushin Bay Tanner crab fishery in 2005. Although such problems manifested on a relatively small scale, many are substantively similar to those noted among fleets affected by the *Exxon Valdez* oil spill (IAI 1990d) and may be expected under similar circumstances elsewhere. Problematic issues and concerns included the following:

(a) Claims-related tensions between individual fishermen and groups of fishermen with differing ideas about litigation and rights to compensation;

(b) Disagreements about whether the spill could have contaminated seafood in areas adjacent to but not directly in the spill area;

(c) Concerns about the long-term effects of the spill on the viability of crabbing and fishing in the region;

(d) Concerns about long-term effects on the pricing of crab and other seafood;

(e) Personal moral dilemmas about working on behalf of the responsible party;

(f) Dissatisfaction among captains who did not qualify to participate in the response or clean-up during a lost fishing season; and

(f) Interpersonal tensions between captains who were qualified and did participate in the response or clean-up and those who could not or did not participate for whatever reason.

The Unalaska Bay Tanner crab fishery opened on January 15, and was pursued by some of the captains who were legally prevented from fishing the larger and more valuable Makushin/Skan Bay opening. Although the Unalaska Bay fishery was a relatively smaller and historically less valuable fishery, competition for the 2005 quota of 35,504 pounds was said to be heightened, with 10 crab vessels active in 2004 and 25 active in 2005. The quota was met on January 18.

Interviews conducted among the small-boat fleet in 2006 revealed that four of the captains who would likely have participated in the Makushin Bay Tanner crab fishery in 2005 had sold their vessels or left the region. While the spill was not directly implicated in the attrition of the small-boat fleet, informants made clear that the event was a contributing factor when viewed in conjunction with various economic and operational challenges encountered by resident fishermen during 2005 and 2006. Most notable among the challenges discussed by local captains was the Bering Sea crab rationalization management strategy. This was often described as having presented new economic challenges for small-boat crab fleets throughout the region.

Positive Contamination Sampling Results in a Highly Sensitive Zone. Oiling was evident along portions of the northwest coastline of Unalaska following the grounding of the *Selendang Ayu*. But there was much uncertainty about whether currents could or indeed had transported the substance north and east to Unalaska Bay and its various coves, beaches, and rocky shorelines. Given local knowledge about the movement of currents around Unalaska Island, many felt that this outcome was inevitable. Such an eventuality was much feared, since numerous seafood processors are situated in the area. A specific concern was that oil or contaminated seawater would be pulled through seawater intake valves, thereby polluting entire seafood processing systems.

Concerns were furthered when oil detecting net tows conducted approximately three miles offshore in the Unalaska transit zone during the initial opening of the Unalaska Bay Tanner crab fishery revealed a trace of oil. A tow conducted in Captains Bay also showed a trace of oil. During this sensitive period, however, Unified Command officials reported that although Tanner crab was being harvested in Unalaska Bay, seafood inspections at Dutch Harbor processing plants determined that all products were free of oil contamination.

Sampling tows conducted in the Unalaska transit zone on January 17 again showed only a trace of oil, while tows in Captains Bay showed "several areas of trace amounts of oil." The sampling team reportedly also observed some diesel fuel sheen that day, though again Dutch Harbor processing plant inspectors found all products free of contamination. Unified Command representatives reported that the crab fleets had not reported any encounters with tar balls.

During this time, a meeting was arranged between the Unified Command water quality sampling team and Dutch Harbor seafood processors to discuss appropriate strategies for managing the return of the snow crab fleet from distant locations in the Bering Sea. The snow crab or opilio (*Chinoecetes opilio*) fishery was and remains particularly productive and valuable to the region's commercial fishing industry, and thus there was extensive public and private sector concern about the possibility of oil reaching opilio processing facility intake systems when the harvest reached Dutch Harbor.

Sampling tows conducted on January 20 in the Unalaska and Akutan transit zones, and in Captains Bay and Broad Bay, showed no evidence of oiling. Round-the-clock inspections were undertaken at the docks to inspect incoming crab and groundfish for contamination.

On January 22, Unified Command representatives issued an official advisory for vessels participating in the 2005 opilio crab fishery. The Advisory described how fishermen could best avoid contamination of gear and harvested seafood. Recommendations were developed by the fishermen themselves, in cooperation with processors and technical experts consulting with Unified Command. The focus was on minimizing contact with random tar balls potentially encountered in transit from the crab grounds.

Fishermen were further advised that the ADF&G designated Beaver Inlet and associated bays as a safer opilio landing area. Concerns were extensive, and efforts were made to frame the threat of contamination in proper proportion. As such, the advisory concluded with a statement that informed "the water quality program [had] sampled over 133 million gallons of seawater and recovered a total quantity of tar balls equivalent to two teaspoons."

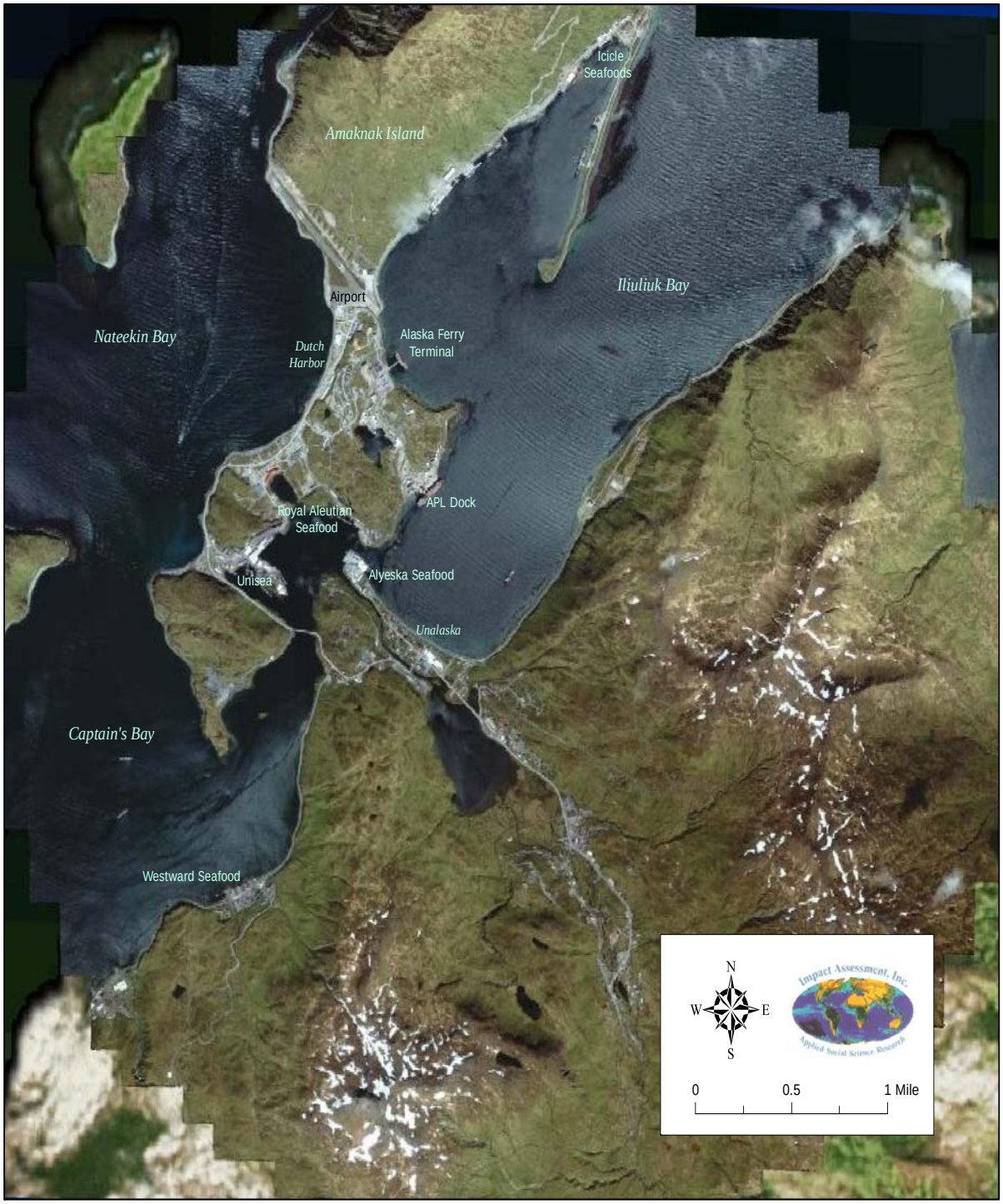
Appropriate routes to and from the opilio grounds were coordinated between the processors and captains. USCG officials provided real-time information about spill, weather, current, and sea conditions. On January 23, the water quality sampling team reportedly encountered two oil smears in the upper three feet of the water column within the transit lane. But Unified Command personnel stated that "since January 18, there has been no evidence of oil in Akutan Bay or east of Priest Rock, in outer Unalaska Bay, or in Broad Bay."

Notably, the 2005 guideline quota of 19.4 million pounds for the Bering Sea commercial opilio crab fishery was met and exceeded by 3.5 million pounds during a short six-day opener (Richardson 2005b). Two accidents occurred during the Bering Sea opener that year, killing a total of six fishermen.

A spokesperson also noted that the pollock fleet was being issued passive oil contamination detection devices. On January 24, 2005, the water quality sampling team pulled 32 passive sampling crab pots, in the process encountering a single oiled snare near Little South America on the southern end of Amaknak Island. A single smear was also found near Hog Island. Unified Command staff noted the formation of a "New Oil Investigation Team" (NOIT) at this time. The NOIT was established to rapidly address any reports of new oil observed in and around Dutch Harbor.

On January 25, the water quality sampling crews pulled a number of passive sampling crab pots, reportedly encountering several smears in Dutch Harbor and near Little South America. On January 26, two vessels working in Unalaska Bay conducted test tows in areas where crab vessels were waiting to deliver to processing facilities. One tar ball was recovered in the tow net between Captains Bay and Hog Island. Other tows failed to reveal indications of oil.

By January 28, concern had shifted to potential contamination problems for the pollock and Pacific cod fisheries. On February 6, Unified Command reported that inspections were being conducted day and night as crab, pollock, and cod arrived at the docks. Tows conducted on February 3 in the Unalaska Bay area encountered a tar ball approximately 0.5 inches in diameter near Eider Point.



Map 3. Aerial View of the Potentially Affected Seafood Processing District in Dutch Harbor

Unified Command issued a spring-summer response plan on February 2. Of relevance to commercial, recreational, and subsistence fishing interests, the plan called for ongoing monitoring of water quality and marine resources between Unimak Pass and Unalaska Bay through the summer months of 2005. Detailed and summary results of the fisheries monitoring effort are provided in Nuka Research and Planning Group (2005b).

Particularly noteworthy in review of the sampling program is the fact that while tar balls and traces of oil were repeatedly found in parts of Unalaska Bay, no seafood was found to be contaminated. Thus, the state's zero-tolerance policy was never violated and direct effects on the seafood processing and distribution sectors never materialized. ADEC officials lifted the Threatened Water Body status around the spill area in October 2005.

Monitoring of conditions in the spill area and the highly systematic and thorough water quality sampling program were time-consuming, costly, and challenging processes. It is significant in this analysis that such efforts unavoidably detracted public and private sector personnel and significant fiscal resources from application to more routine duties. In the case of responding Coast Guard and certain other federal personnel, the incident detracted resources from routine and other potential or actual emergency situations in Alaska and elsewhere in the nation.

Figure 12. High Winds Buffet Ballyhoo Mountain near Tom Madsen Airport in Dutch Harbor, Spring 2006

Effects on Non-Commercial Natural Resource Harvesting in the Spill-Affected Area

Overview. Marine resources found along the coastline and sea that surround the Aleutian Islands are of dietary importance and cultural significance in Native and non-Native households alike (Lowe 2006). Moreover, sport fishing and hunting are increasingly common forms of recreation, and local guides are available to serve visitors. The *Selendang Ayu* incident led to restrictions on such activities in the spill-affected areas between December 2004 and October 2005.

Given that: (a) subsistence practices are highly significant in contemporary Alaska Native societies; (b) federal-tribal interactions are an important consideration in the current analysis of maritime oil spills; and (c) there is a paucity of data regarding historic and contemporary subsistence activities among non-Native residents – this discussion is focused on consumptive and cultural aspects of marine and coastal resources among Native residents of Unalaska Island. As such, the following sections briefly describe the activities and areas affected by the *Selendang Ayu* oil spill in terms of: (a) the long history of localized pursuit and use of natural resources by the Unangan people of the Aleutian Islands; (b) the nature of the marine and coastal resources that are of known importance to Alaska Natives residing in Unalaska and that were considered by tribal representatives to be jeopardized by the oil spill; and (c) the implications of the spill for those who might otherwise have used the closed areas to pursue, harvest, consume, share, or teach others about wild foods, fabrication materials, plant medicines, and associated aspects of Unangan culture.

Background – Past and Present. Archaeological evidence indicates extensive human use of marine resources in the Aleutian Islands beginning at least 9,000 years before present (Dumond and Knecht 2001; Knecht and Davis 2008; Rogers et al. 2009). Moreover, Davis and Knecht (2010) assert a fundamental continuity of social adaptation to the maritime environment in this remote island region, from the earliest period of occupation through the better-known cultural sequence of the last several thousand years (Veltre and Smith 2010). As such, certain areas in the Aleutian Islands are among the oldest continuously occupied sites on earth.

This particularly long tenure speaks to the capacity of small human societies to adapt to a high latitude maritime environment, and to the associated utility of cross-generational communication of knowledge about marine resources and associated ecosystems. Indeed, early tribal groups in the Aleutian Islands ordered their societies around the exploitation and distribution of marine resources despite some of the most consistently extreme weather and sea conditions known (McCartney and Veltre 1999:488).

Ongoing environmental perturbations and social changes forced adaptive strategies over the course of time. Analyses of lithic assemblages and changes in these and other forms of material cultural expression found at sites throughout the archipelago support the position that the islands were colonized from east to west, and that early island-based societies were not isolated from each other or from societies on the Alaska mainland (Hatfield 2010).

With due caveats regarding interpretation of available data regarding the size and social organization of early populations, Veltre (1999:2) asserts that as many as 15,000 Unangans may have been residing in the Aleutian Islands during the late pre-contact period. Oral traditions and ethnohistoric data suggest Unangan kin groups were organized matrilineally, and that villages ranged in size from one or two extended families to over 200 residents.

Cooperative pursuit of marine resources for food and materials was normative in an economic context of direct subsistence, customary trade, and reciprocal exchange. Early societies appear to have been ranked, and Townsend (1980) suggests that one important indicator of social status was close proximity to sites where important subsistence resources could be found. Ethnographic sources suggest that a successful life, good health, and productive hunting and fishing trips were predicated upon living in harmony with spiritual [maritime-animistic] forces, and that the Unangans "followed specific protocol to maintain this balance" (Veltre 1999:4).

Environmental changes, in- and out-migration of people and ideas, and developing technologies are associated with the evolution of all human societies. Exogenous factors can force rapid adaptive responses, but core cultural factors often evolve more slowly. This appears to typify social life among pre-contact societies in the Aleutian Islands. Davis and Knecht (2010:509) assert that human populations maintained basic cultural continuity while successfully adapting to changing environmental conditions "despite good evidence of contact with peoples as far away as Kodiak beginning early in the sequence."

The beginning of the Russian fur trade period in our 18th century was especially problematic for indigenous residents of the Aleutian Islands. But core elements of Unangan culture continued to be retained regardless of exogenous social and economic forces. For instance, Bundy et al. (2003) describe mid-18th century interactions between the Russian traders and indigenous residents of the Aleutian Islands, noting that Unangans continued to organize their societies around the pursuit and use of marine resources– despite forced labor, forced changes in settlement patterns, involvement in a new economy, and diseases brought from the Russian Far East. This perspective is furthered by Veltre (1999:5), who states that:

> Aleuts [Unangans] were compelled to labor for furs for the trading companies and were often removed from their villages and were therefore unavailable for subsistence activities. Because of this, it is likely that proportions of traditional subsistence foods changed during this time (e.g., Turner 1981). [However] since introduced foreign foodstuffs were expensive and limited in quantity, they did not assume a significant portion of the Aleut [Unangan] diet. Instead, throughout the Russian period and well into the American period, most Aleuts [Unangans] continued to be highly dependent on traditional resources, procured largely by traditional means.

As discussed in Impact Assessment (1985, 1987), Veltre (1999), Lowe (2006), and Sepez et al. (2007), Unangans have in recent centuries experienced: the introduction of Russian Orthodoxy; development of a cash-based economy and capitalist ethos originating in the fur trade; decline of the fur trade and ascendance of early fisheries and shipping firms; physical displacement during World War II; rebuilding of lives upon return to the ancestral villages; development and change in the nation's most productive fishing fleets and seafood processing firms; and developments in communications and other technologies. Given linkages between subsistence activities and

commercial fishing, fishing regulations have also affected contemporary Unangan societies (cf. Lowe 2006). The tangible activities and products of subsistence fishing, hunting, and gathering are components of household economies that now also involve wage work, Native Corporation dividends, and store-bought foods (cf. Wolfe 1987; Usher et al. 2003).

Unangans sought reparation for problems suffered as a result of displacement during World War II. Veltre (1999:7) notes that the Alaska Native Claims Settlement Act of 1971 (ANCSA) and the associated formation of regional and local Native corporations, led to a specific agenda in this regard, in which the aggrieved parties sought amends for: (a) forced and racially motivated evacuation of Native villages; (b) unnecessarily protracted internment in deplorable conditions in the internment camps in Southeast Alaska; and (c) theft and/or damage to personal property left behind during the evacuation.[15]

The federal government responded to these claims in 1988 via Public Law 100-383, Title II. Reparations include: establishment of group-level restitution and trust funds; compensation for damaged church property; and total individual compensation of $12,000 to persons interned during the war.

Notably, ANCSA also led to the positioning of Unangan Native corporations and individuals in a globalizing political economy. Veltre (1999:8) states that "it is undeniable that as recipients of cash and land under ANCSA, Alaska's Native peoples became politically and economically empowered to an extent not previously experienced." Moreover, an increasing number of youth have attained degrees and acquired jobs elsewhere, some eventually returning home, some sending earnings home from afar. As such, Native residents of Unalaska have in recent decades engaged options beyond those available in the seafood harvesting and processing sectors, without necessarily losing interest in or the capacity to practice or support traditional forms of Unangan culture.

The contemporary nexus of traditional and modern economies on Unalaska Island is such that it is possible for Unangans holding corporate positions during the work week to return to a subsistence-oriented lifestyle during the weekends and to consume wild foods on a daily basis. Veltre (1999:9) notes some tension here in that typical cultural expectations regarding a standard 40-hour work week are not necessarily in keeping with the demands of subsistence hunting, fishing, and gathering. That is, rather than the computer and wall clock, effective hunting and fishing involve attention to the phase of moon, indications of low tide, the behavior of sentinel species, and so forth. But again, actors rationally meld traditional activities with "land work" by figuratively nudging the clock to a more flexible cultural standard, and/or as Veltre (ibid.) notes, by "postponing or rescheduling subsistence activities to fit job constraints [and] financially or otherwise supporting the hunting and fishing activities of a relative or friend, from whom they receive subsistence foods."

Damage to Unangan archaeological sites occurred as a direct if unintentional result of military operations on the island during World War II. Stein (1977:12) states that "the World War II period is easy to characterize in terms of its effects on Aleutian archaeology: it was destructive."

Macro-social and economic forces of change and associated stresses notwithstanding, Unangans such as those in the Qawalangin tribe of Unalaska Island do continue to avidly undertake age-old wild food harvesting activities, and the foods so gathered remain culturally significant. The number of participants and the ways in which patterns of pursuit and distribution of resources have changed or are currently changing will require in-depth contemporary research.

However, it can confidently be said that although dependence on wild foods is most extensive in the more remote villages and islands where shipping and food purchase options are limited, subsistence activities and wild foods remain central in the lives of many Unangan (and non-Native) residents throughout the region, including Unalaska. This perspective is advanced by Veltre (1999:9), who states that:

> In spite of the many changes that have occurred over the past 250 years, some pre-contact cultural traditions endure. Perhaps the strongest tie of today's Aleuts [Unangans] to their traditional past lies in the realm of subsistence [Veltre 1985]. In Aleut [Unangan] communities today, almost all families still use many of the same resources obtained by their ancestors in pre-contact times [Veltre and Veltre 1981, 1982, 1983]. Subject to environmental limitations, it is significant that Aleuts [Unangans] continue to procure all of the major categories of food resources, including birds and eggs, marine mammals, fish, marine invertebrates, and plants. Similarly, two closely related tenets of pre-contact hunting, fishing, and gathering – cooperation and sharing – are very much a part of resource use by Aleuts [Unangans] today.

Ancient and modern aspects of life have been and continue to be intertwined by the Unangan people,[16] and certain elders reinforce in Unalaska's Native youth knowledge from the past and lessons learned in their own lifetimes. Being indigenous in America is not without significant problems, however, as the literature regarding social change among Alaska Natives, Native Americans, and Native Hawaiians makes clear. For instance, death from alcoholism at the turn of the new century was 627 percent higher for American Indians than for other Americans. The rate for Alaska Natives was 976 percent higher (Maas and Boudreau 2001).[17] Inter-generational lessons therefore often involve discussion by elders of what to avoid and how to carry forward cultural values and practical wisdom from the past, as in: "Iĝayuux̂txin, anaĝim atxaĝingin agachan madada, and "Tunuun ugunux̂talakan anĝaĝiix̂txin."[18]

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[16] A reading of social change among indigenous peoples makes clear that when opportunities are available and when persons in the groups in question retain the agency to make choices regarding the perpetuation of tradition and the adoption of modern elements of life, the two are often creatively syncretized – in ways and extents deemed rational and appropriate by the actors involved (Haviland et al. 2008). For instance, Svarny-Carlson (1995) recommends the "cooperative marriage of indigenous information with modern technology [which] can help retrieve indigenous information – in basketry, design, carved works, literature, medicinal plants, science, humor, subsistence, or similarly valuable things – for the benefit of all."

[17] The final report of the Alaska Natives Commission (Irwin 2004) describes this and other social problems as a consequence of historic ethnocentrically-based disruption of the indigenous cultures and societies of Alaska.

[18] In the Eastern Unangan dialect, the translations are "*do the things you know are right*," and "*do not forget your Unangan language*," as provided by Unalaska linguist Moses Dirks (available online at http://unalaska.wordpress.com/unangan-values-or-the-right-way-to-live-as-a-human-being/).

Non-Native youth living on Unalaska Island are now also being exposed to the history and traditional knowledge of their indigenous classmates, and some are assimilating aspects of *Unangan* language and culture. In this respect, the contemporary situation is quite obviously a significant departure from ethnocentric colonialist attempts to suppress expression of Unangan customs, cosmology, language, and other aspects of indigenous life. Notably, in-depth discussions with Qawalangin tribal members make clear that certain traditional elements of Unangan culture are being maintained and even revitalized in contemporary Unalaska.[19] Subsistence activities, traditional knowledge, and the Unangan language are the principal subjects of cultural revitalization in the region.

Recent Subsistence Trends. Given the institutional costs and logistical challenges involved in formally assessing and monitoring non-commercial hunting, fishing, and coastline gathering in rural Alaska, only limited state and federal data are available to describe such activities on Unalaska Island. Moreover, information about harvesting of natural resources and associated traditional ecological knowledge are not necessarily readily shared with outsiders. While sustained ethnographic interaction can serve to alleviate this and other problems inherent in periodic survey work and/or in interpretation of survey data (Bernard 1988; General Accounting Office 2003), subsistence-focused research of this nature has not been undertaken in Unalaska for some time.[20]

In any event, the intent of the present work is not a study of historic or contemporary subsistence activities on Unalaska Island *per se*. Rather, it is intended to provide: (a) sufficient background for understanding the importance of living marine and coastal resources to contemporary indigenous residents of Unalaska Island; (b) brief analysis of the effects of the *Selendang Ayu* oil spill on those activities and persons; and ultimately, in the final section of this report, (c) prospective means for maximizing the benefits of tribal-government consultation regarding maritime oil spill incidents.

As such, the following background data discussion is based on existing information regarding subsistence foods and activities on Unalaska Island, and a series of interviews with local subsistence practitioners, tribal representatives, private consultants, and public officials. The formal claim for lost subsistence opportunities submitted by the Qawalangin tribe of Unalaska to the USCG National Pollution Funds Center (NPFC), and formal rejection of that claim, also inform discussion of the spill's effects on this aspect of life on Unalaska.

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[19] For instance, the Qawalangin tribe holds an annual youth camp on Unalaska Island. *Camp Qungaayux* facilitates intergenerational communication of traditional knowledge and values, including knowledge and values associated with pursuit and use of wild foods and other natural resources available in remote locations on the island.

[20] Veltre and Veltre (1982) undertook a detailed study of natural resource use patterns in Unalaska in the early 1980s, and Impact Assessment, Inc. (1985, 1987) examined the potential effects of offshore oil and gas industry activities on subsistence practices, commercial fisheries, and related aspects of life in Unalaska in the mid-1980s.

Marine mammals continue to be important resources for Alaska Native residents.[21] Nearly 70 sea lions and 42 harbor seals reportedly were harvested by Unalaska-based subsistence hunters in 1993, while 16 sea lions and 16 harbor seals reportedly were taken in 2003 (ADF&G 2005). Inter-annual harvest levels tend to fluctuate and thus the figures above are not necessarily valid indicators of long-term trends in abundance or harvest effort.

Table 4 below depicts key quantitative findings from the 1994 and 2002 subsistence salmon seasons in Unalaska. Data are not directly comparable between years because: (a) the 1992 figures derive from a door-to-door "community baseline harvest study of [128] individual households regardless of whether or not they used an ADF&G subsistence permit" (Davis 2004:82), and (b) the 2002 data derive from analysis of archived catch records for the 180 persons who held subsistence salmon permits that year. Subsistence salmon permits are available to all permanent residents of the Aleutian Islands management area.

Table 4. Unalaska Subsistence Salmon Harvest Data: 1994 and 2002 (data not directly comparable)

Harvest Characteristics	**Year Analyzed**	
	1994	**2002**
Total Salmon Harvest in Pounds	16,723	6,757
Number of Surveys or Records	128	180
Number of Households in Study Year	700	834
Avg. Number Salmon Harvested/Household	24	8
Percentage of Each Species Harvested		
Sockeye	55	64
Coho	14	27
Pink	26	9
Chum	3	0
King	1	0

Source: Alaska Department of Fish and Game, Division of Subsistence (Davis 2004)

Methodological differences also preclude direct comparison of data available to describe recent trends in the Unalaska subsistence halibut fishery. As provided Table 5 below, data for the 1994 halibut harvest derive from an ADF&G household survey of subsistence activities on Unalaska Island, while later figures represent the number of persons holding Subsistence Halibut Registration Certificates (SHARCs).

The SHARC program was first implemented by NOAA's National Marine Fisheries Service in 2003. Those eligible to purchase SHARCs include: (a) residents of rural communities which use halibut for customary and traditional purposes; (b) individuals domiciled in a rural area (Unalaska qualified as a rural area under original program stipulation); and (c) members of federally recognized Alaska Native tribes that use halibut for customary and traditional purposes. Thus, since 2003, both Native and non-Native residents have been able to participate in the Unalaska subsistence halibut fishery.[22]

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[21] This was a basic finding of IAI's assessment of the human environment potentially affected by the Alaska Maritime National Wildlife Refuge in the Aleutian Islands (IAI 1985).

However, because only a portion of active Unalaska subsistence fishermen acquired the certificates during the first year of the program, available data likely significantly under-represent the number of persons who were actually harvesting halibut that year for purposes of subsistence. Thus, the figures also likely under-represent the actual harvest. Fall and Koster (2008:31) further suggest that the 1994 harvest may have been overestimated, and/or that more recent harvest levels may have declined in association with diminished abundance of halibut in the region.

The total number of Unalaskans holding SHARCs increased steadily following initiation of the program, and a consistent proportion of the certificates were held by Qawalangin tribal members. For instance, during 2005, 31 of the 150 locally held SHARCs were held by Qawalangin tribal members, and in 2007, 46 of 176 SHARCs were held by Qawalangin tribal members (Fall and Koster 2008).

Some Unalaska residents fish for halibut under a sport fishing license. In 2004, 81 Unalaskans participated in the subsistence fishery, 34 participated in the sport fishery, and 93 participated in either fishery. In 2005, 88 Unalaskans participated in the subsistence fishery, 28 participated in the sport fishery, and again, 93 participated in either fishery (Fall and Koster 2008).

Table 5. Unalaska Subsistence Halibut Harvest Data: 1994, 2003-2007 (data not directly comparable)

Year	Total Subsistence Halibut Harvest in Pounds*	Participants or SHARC Holders
1994 †	97,601 †	391 †
2003	16,379	92
2004	17,695	131
2005	20,547	150
2006	20,100	171
2007	15,537	176

Source: Alaska Department of Fish and Game, Division of Subsistence (Fall and Koster. 2008) *Includes halibut landed under sport fishing licenses for the years 2003-2007; † Household survey year

Finally, Figure 14 below depicts a ranking of the leading wild fish and game items consumed by 65 Alaska Native residents of Unalaska in 2002 (Institute for Circumpolar Health 2003). The rankings are expressed in terms of the number of three-ounce portions consumed by survey participants during the year prior to the survey. Rather than providing a measure of extent of the harvest or harvest-related effort, the data merely indicate which species are preferred for purposes of consumption, sharing, and customary trade.

[22] The North Pacific Fishery Management Council (the Council) develops management plans for halibut fisheries occurring in state and territorial waters in keeping with the Northern Pacific Halibut Act of 1982 and with approval from the Secretary of the Department of Commerce. In October 2000, the Council adopted a management program for the Alaska subsistence halibut fishery. This was implemented in 2003. Regulations were amended in 2009 to better define participation by members of rural communities (see 50 CFR 300.60-300.66 Subpart E, and 74 FR 57105, November 4, 2009).

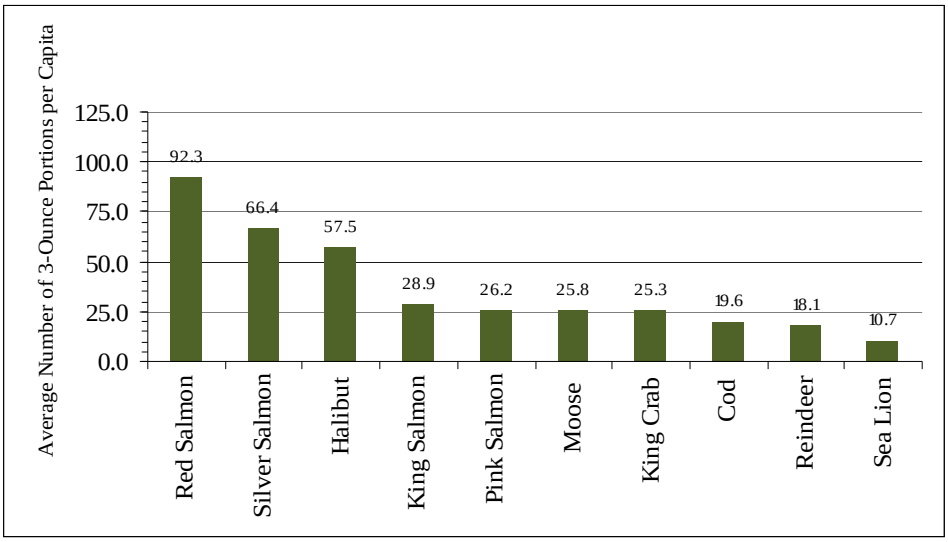


Figure 13. Top Ten Wild Food Resources Consumed in Unalaska in 2003
Source: Institute for Circumpolar Health Studies (2003)

Notable in the graph is the relative importance of wild-caught salmon and halibut, and the fact that moose and reindeer were valued as food items during the survey year. Because neither moose nor reindeer are available on Unalaska Island, [23] the data elucidate the continuing importance of trade and sharing of wild foods between Native residents of Unalaska Island and nuclear and extended family members and friends living elsewhere in the region and state. The importance of inter-village trade of wild foods and other natural resources also is discussed by Veltre (1999:9), who states that:

> Sharing also extends to the exchange of foods between distantly separated villages. For example, salted fur seal flippers from the Pribilofs are often sent to relatives in the Aleutian Islands in exchange for salmon, which is not found in the Pribilofs . . . Thus, exchange of subsistence foods is an important means of maintaining ties to family and friends elsewhere.

In sum, Unangan residents of Unalaska Island are descendants of high latitude island societies that have adapted to regional environmental and social changes for some 9,000 years. Life among indigenous societies in the Aleutian Islands has been conditioned by a variety of social and environmental changes, as is the case for human societies across the globe. In this case, core cultural attributes such as emphasis on traditional ecological knowledge and the cooperative pursuit and shared use of marine and coastal resources have been retained to the present day.

The prehistory of the indigenous people of the Aleutian Islands region suggests that exogenous sources of disruption have tended to result in effective long-term adaptive response. Historical analysis makes clear that adaptive responses were often coupled with hardship. The contemporary situation is one of ongoing attention to subsistence activities and cultural revitalization. This is occurring with the aid of rapid developments in communications technology and various other social and economic changes in 21st century Unalaska.

[23] Moose are not generally found on the Alaska Peninsula west of Port Moller. Reindeer were introduced to Atka, Umnak, and certain of the Pribilof Islands and continue to be hunted in those areas.

Use of the Spill-Affected Area for Subsistence and Related Cultural Purposes. Although Makushin village was not reoccupied after World War II, elderly informants report that west-central and northwest Unalaska continued to be used by Qawalangin people and that the general area remains important to certain contemporary fishermen, hunters, and gatherers of plant foods and medicines. The Portage Bay portion of the area can still be reached by foot from Captain's Bay, a round-trip of approximately 22 miles.

Steep topographic relief characterizes much of the region. But as McCartney (1984) notes, ". . . bays and inlets increase the amount of coastline available and provide sheltered landings for both humans and their prey." Today such areas are most typically accessed by boat, float plane, and/or other small planes equipped to negotiate sand and gravel beaches and other suitable landing zones.

Marine and terrestrial resources are said to be abundant along accessible portions of west-central and northwest Unalaska Island. Native residents make trips to the area to harvest certain species or otherwise interact with the natural environments of sea, coastline, marsh, meadow, and mountain. Some non-Native residents reportedly also travel to the region on occasion. Trips occur during the appropriate fishing or gathering seasons and as weather and sea conditions allow. As such, most trips are made during the late spring, summer, and early autumn months.

As discussed later in this report, the Qawalangin tribe's claim for lost subsistence activities indicates that some 128-person trips would have been made to the spill-affected region during 2005. The details of these trips are proprietary in nature, but discussions with tribal members make clear that the affected area remains important to the Unangan people.

Subsistence practitioners state that a range of activities may occur in the spill-affected area during any given year, and that these activities should be considered in terms of their relationship to Unangan culture in general. The activities in question include: hunting; ocean and stream fishing; berry-picking; shoreline gathering of a variety of edible plant species and/or species with medicinal or fabrication value; honing of one's subsistence-related skills; camping; educating youth about subsistence activities and Unangan culture; experiencing a spiritual connection with the forces of nature; recreation; relaxation; and wildlife-viewing.

Kohout and Meade (2008) report findings from archival and primary source research undertaken as part of the NRDA process. The authors note that butter clams are harvested in the Cannery Bay area, razor clams in the Makushin Bay area, sockeye salmon in the Reese Bay area, and sea lions and harbor seals around Koriga Point.

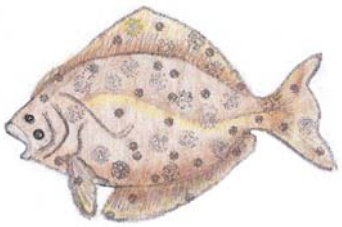
One Unalaska-based family operates a specialized hunting and fishing guide service around Volcano Bay, which is immediately northwest of Makushin Bay. The guide uses adjacent portions of the larger region at times, depending on the availability of certain species and the varying interests of his clientele. Other charter operators use the general area on an occasional basis. The details of the affected charter and guide services cannot be discussed here given the proprietary nature of data regarding this small group of competing businesses and the potential for damage to individual business owners should such information be made public.

Species of Local Importance. According to locally respected tribal representatives, culturally significant marine resources permanently or seasonally present along the northwest coast of Unalaska Island include those depicted in Table 6 below. These are provided to indicate the range of species that are valued as potential food resources, and which, at the time of the grounding and cleanup, were subjects of concern in terms of potential contamination.

Table 6. Culturally Significant Marine Resources Found along the Spill-Affected Coast of Unalaska Island

Unangan	English	Scientific
qawax̂	sea lion	*Eumetopias jubatus*
isux̂	hair seal	*Phoca vitulina*
aanux̂	red or sockeye salmon	*Oncorhynchus nerka*
qungaayux̂	pink salmon	*Oncorhynchus gorbuscha*
adgayux̂	new pink salmon	*Oncorhynchus gorbuscha*
qakiidax̂	silver salmon	*Oncorhynchus kisutch*
chavichax̂	king salmon	*Oncorhynchus tshawytscha*
sadgunix̂	steelhead trout	*Oncorhynchus mykiss*
atxidax̂	Pacific cod	*Gadus macrocephalus*
tmadgix̂	Pacific ocean perch	*Sebastes allutis*
kalagax̂	yellow sculpin	*Hemilepidotus jordani*
araamusax̂	bullhead	*Ictalurus punctatus*
miikaayax̂	red sculpin	*Ictalurus punctatus*
sildix̂	herring	*Ictalurus punctatus*
llgaaĝux̂	octopus	*Sasakiopus salebrosus*
chagix̂	halibut	*Hippoglossus stenolepis*
chiknan	limpets	*Patella vulgate*
wayĝin	blue mussels	*Mytilus trossulus*
aguĝaadan	sea urchins	*Strongylocentrotus spp.*
qasiikun	chitons	*Cryptochiton stelleri*
chuxlan	clams	*Saxidomus gigantean*
qimgiitax̂	crab	e.g., *Chionoecetes bairdi*
khangadgin	seaweed	*Laminaria spp.*

Source: Qawalangin Tribe of Unalaska



Portions of the affected area are known for productive clam (*chuxlan)* beds, and informants reported a particular concern regarding the potential effects of the oil on razor clams (*Siliqua patula*) and butter clams (*Saximdomus giganteus*). Various crab (qimgiitax̂) species, including Tanner crab (*Chionoecetes bairdi)*, Dungeness crab (*Cancer magister*), and red king crab (*Paralithodes camtschaticus)* are also present along the northwest coast of Unalaska and were natural subjects of concern during the first months of the spill and cleanup.

Avian species are also used for food resources and were feared to have been affected by incident. These include: emperor geese (qdmgan; *Philacte canagica*), Canadian geese (lagix; *Branta Canadensis*); mallard ducks (agich; *Anas platyrhynchos platyrhynchos*), and harlequin ducks (kangarich; *Histrionicus histrionicus*).

Finally, certain plants found along the coastline are of importance to Qawalangin tribal members and other residents of Unalaska Island for food, medicinal, or fabrication uses, and were considered to be at potential risk from the spill or associated clean-up activities on land (Table 7). Individual specimens of some species were damaged during the spill and cleanup, and informants reported uncertainty about the long-term effects of oil where such plants grow.

Table 7. Culturally Significant Plant Resources Found along the Spill-Affected Coast of Unalaska Island

Unangan	English	Scientific
Qanisan	beach lovage	*Ligusticum scoticum*
saaqudax̂; taaĝan'ĝix̂	cow parsnip	*Heracleum lanatum*
Sixsiqa	artemsia or wormwood	*Artemisia unalaskensis*
saaqudiigamax; saaqudax̂	angelica	*Angelica lucida*
tix̂yux̂	wild rye grass	*Leymus mollis*
isuĝim anungim	beach greens	*Honckenya peploides*
--	Sitka burnet	*Sanguisorba stipulate*
chngaatudax̂; saahmikaadax̂	yarrow	*Achillea borealis*
--	sweetgrass	*Hierochloe odorata*
alagnax̂	salmonberry	*Rubus spectabilis*
uĝiidgin	blueberry	*Vaccinium alaskaense*
qaayum qaxchikluu	crowberry or mossberry	*Empetrum nigrum*
kiikax̂	cranberry	*Vaccinium vitis-idaea*
--	dock	*Rumex beringensis*
--	sundew	*Drosera rotundifolia*
--	sphagnum moss	*Sphagnum* spp.

Source: Qawalangin Tribe of Unalaska (see also Matthews 2002)

Subsistence Foods and Contamination Concerns. As is the case in many Alaska towns and villages, certain Native and non-Native residents of Unalaska regularly pursue marine and terrestrial resources for purposes of routine consumption and/or to fulfill other important non-commercial objectives described above.[24] Such activities assume cultural importance and meaning for Natives and non-Natives alike.

As discussed above, when pursuing, consuming, and sharing wild foods in village and extended family settings, Alaska Natives are perpetuating very long-standing traditions and traditional ecological knowledge, and often in the same physical settings as their forebears. Hence, loss or perceived loss of natural resources and/or the loss or potential loss of opportunities to pursue and consume such resources due to an oil spill were special concerns among indigenous residents during and after the grounding of the freighter.

Given the often negative effects of historical sources of change on indigenous societies of the Aleutian Islands, some residents described the *Selendang Ayu* oil spill as another case of infringement on their lives. In this sense, periodic vessel accidents and oil spills; the subsequent arrival of public and private sector response entities; and ensuing assessment, clean-up, and monitoring processes have the potential to affect sociopolitical relationships between tribes and non-indigenous governance entities in this and other coastal regions of the U.S.

Native residents of Unalaska who were contacted to discuss the potential effects of the spill on wild foods were concerned that such resources could have been contaminated. This concern was expressed both prior to and after formal proclamation that seafood in the affected area was safe to consume (discussed below). Although some individuals expressed a lack of trust in the government agencies for more general reasons, the concerns in this case were not framed in terms of distrust, but rather as sensible assertions that anyone with common sense would do well to avoid the oil-affected areas and the resources found there. The discussants made clear that uncertainties about contamination will persist until it has been patently clear for some time that no oil remains and thus there is no possible threat to human health.

Generally speaking, public uncertainty about the effects of offshore oil spills on natural resources tends to persist when pockets of oil are known to remain along the shoreline, if sheen is observed on the surface,[25] or if oil is known or thought to remain on the ocean floor. Concerns are heightened when seasoned hunters, fishermen, or long-time observers of the natural environment communicate such observations or suspicions to others in their home communities.

Uncertainty in this case also relates to a general understanding about the persistence of oil in the natural environment in other areas where spills have occurred. Unalaska residents interviewed after the *Selendang Ayu* spill tended to conceptually link the current event and its long-term implications with lingering local concerns about contamination resulting from the spill of the

[24]Typological "lines" between commercial, subsistence, and recreation-oriented fishing are often blurred by the realities of human behavior. For instance, a recreational experience is often part of subsistence-oriented fishing, and it is often the case that a portion captured while fishing commercially or for sport is consumed by the fisherman's family and/or extended family and friends (cf. Shuman and Macinko 2007; Glazier 2007; and Glass et al. 1990).

[25] Sheen or tar from *any* source can tend to heighten public uncertainties during and after maritime oil spill events.

M/V Kuroshima in the Summer Bay area in 1997 (cf. Davis 2004:61), and with understanding that mousse from the *Exxon Valdez* still persists in certain areas of Prince William Sound. Although official proclamations hold that wild foods in Summer Bay and Prince William Sound are safe to eat, some subsistence practitioners find these logically contrary to findings that oil persists in both locations (NOAA 2002; Exxon Valdez Oil Spill Trustee Council 2010).

The Exxon Valdez Oil Spill Trustee Council recently termed subsistence resources in the affected regions of south-central Alaska as "recovering" rather than recovered (Exxon Valdez Oil Spill Trustee Council 2010). Of note in terms of stated public perspectives about the long-term effects of oil in the marine environment, Fall (2006) states that 39 percent of participants in a 544-household survey conducted by ADF&G 14 years after the grounding reported diminished use of at least one food resource due to the effects of the spill, and that 72 percent of respondents believed that "the traditional way of life has not recovered since the spill."

Figure 14. Oiled Harlequin Ducks near *Selendang Ayu* Spill Site, Winter 2005
Photo Courtesy of U.S. Coast Guard

Oil and other petroleum products contain polycyclic aromatic hydrocarbons (PAHs). These compounds are potentially carcinogenic and can accumulate in the food chain. Thus, ingestion of PAH-contaminated seafood is a principal health-related concern during spill events. Because shellfish especially tend to accumulate bioactive compounds, they are effective indicators of the

presence of PAHs (Law et al. 2002). In the case the *Selendang Ayu* spill, potential contamination of subsistence food resources in the oil-affected areas was addressed through a subsistence foods testing program. This was implemented by the State of Alaska's Department of Health and Social Services, Section of Epidemiology, in conjunction with Unified Command and its Fishery Advisory Group.

The Fishery Advisory Group was novel in its collaborative attention to threats to subsistence food resources. The group involved representatives of the following organizations and agencies: the Qawalangin Tribe; the Ounalashka Corporation (the local Native village corporation established through ANCSA); Polaris Applied Sciences (oil spill consultants); Alaska Department of Environmental Conservation; ADF&G; USFWS; Chumis Cultural Resources (cultural resource consultant); U.S. Department of Commerce, NOAA; University of Alaska Marine Advisory Program; and the Aleutian Pribilof Islands Association (Arnold 2006).

The Fishery Advisory Group collaborated to assess potential risks to persons who pursue and use living marine and terrestrial resources on Unalaska Island. A subsistence resource sampling plan was implemented during the summer and autumn months of 2005. A total of 17 black chitons, 30 blue mussels, and 12 green sea urchin samples were collected and studied for indications of contamination. Samples of salmon, cod, and harbor seal tissue were also collected from various locations.

Although PAH levels were highest in close proximity to the spill site, these did not meet the standardized criteria for significant risk to human health.[26] Arnold (2006) asserts that PAH levels tend to diminish over time via natural attenuation and that this would likely have occurred in the case of fuels spilled from the *Selendang Ayu*.

Despite findings of no significant risk, the 2006 report concludes with recommendations that lend to a sense of uncertainty about the presence of oil and the safety of subsistence food resources in the affected areas. The recommendations recapitulate the common-sense approach already assumed by persons involved in subsistence food gathering activities on Unalaska Island:

> To err on the side of safety, consumption advice should be issued similar to that given following the *Exxon Valdez* oil spill and the *M/V Kuroshima* oil spill. Specifically, statements that subsistence gatherers should avoid consumption of foods on which oil can be seen, smelled, or tasted would be appropriate. These recommendations, developed by the *Exxon Valdez* oil spill task force, present a common sense and conservative approach and are appropriate for the protection of public health (Arnold 2006:11).

Follow-up testing in the *Selendang Ayu* spill area during spring of 2006 revealed that PAH levels had dropped significantly among sampled subsistence resources (Alaska Department of Health and Social Services 2008). Negative test results notwithstanding, as noted above, some residents continue to express concerns about resources in and around the site of the grounding and spill.

[26] Two of the shellfish samples from the Skan Bay area contained particularly high levels of the neurotoxin associated with Paralytic Shellfish Poisoning (PSP). Consuming PSP-affected shellfish can cause illness or death. The presence of the PSP toxins in shellfish is related to natural ecological processes (cf. RaLonde 1996) rather than to the presence of oil.

Again, local concerns about subsistence food resources in the vicinity of the *Kuroshima* wreck site also linger, despite the findings of Helton et al. (2004) which indicate that, by 2004, previously hazardous levels of PAHs had diminished to a point well below human health risk criteria.

Figure 15. Northwestern Portion of Unalaska, Spring 2008

4.0 Social Effects and Response-Related Costs

During its social scientific inquiry into the effects of the *Exxon Valdez* oil spill, IAI (1990a,b,c,d) identified a variety of social, psychological, and economic changes in each of the small Alaska cities, towns, and villages that were affected by various phases of the accident.[27] The work clearly indicates extensive near-term spill-induced changes among persons involved in commercial fisheries and subsistence practices, and it describes shifting demographic conditions and shifting sociopolitical relationships within and between groups in the spill affected region. Etkin (2000) reports that cleanup costs were particularly high given the complexity of the operations, and ExxonMobil (2011) reports that the firm spent over $4.3 billion as a result of the accident, meeting costs associated with response and clean-up, compensatory payments, settlements, and fines.

Significant social and economic effects have been noted of other large oil spills as well, such as that of the *Amoco Cadiz* and the *Prestige*. For instance, the U.S. Department of Commerce (1983) describes near-term social changes and economic losses following the *Amoco Cadiz* event, including those occurring among oyster-culturing firms and commercial and non-commercial fishing fleets. The authors report that costs to a variety of key economic sectors approached $1 billion. Similarly, Surís-Regueiro et al. (2007) describe social and economic impacts resulting from the *Prestige* spill and report that, as of December 2003, losses in the Galicean fishing sector were estimated at EUR 76 million.

The volume of oil spilled from the *Selendang Ayu* incident was much smaller than that of the *Exxon Valdez*, *Amoco Cadiz*, *Prestige*, and other large-scale events. Thus, the fact that many of the same kinds of social and economic effects that were associated with the large spills were also observed in Unalaska and Dutch Harbor following the spill of the *Selendang Ayu*, suggests that even disparately sized spills share important attributes. For instance, oil spills of even a moderate scale require the mobilization of many first responders, agency representatives, media representatives, and other persons to the spill area and, significantly, to the adjacent population centers where necessary services are available. Even the rudimentary food and lodging needs of newly arriving first responders can induce local social changes and economic costs and benefits. Of particular relevance in the case of Unalaska Island and much of the region affected by the *Exxon Valdez* spill, response costs can increase significantly when the affected area is geographically remote and/or topographically rugged.

Here we discuss some of the locally significant social and economic changes that occurred in Unalaska and Dutch Harbor following the grounding of the *Selendang Ayu*. In addition to the marine fisheries- and subsistence-specific effects described in preceding sections of this report, we also describe: crowding and strain on local service infrastructure and public services; tense social interactions in the near-term; and costly allocation of human and fiscal resources to search and rescue work, spill assessment, spill response, and spill monitoring activities.

[27] The study was conducted in 22 municipalities and villages affected by the spill and response: Valdez, Cordova, Whittier, Soldotna, Kenai, Homer, Seldovia, Seward, Kodiak, Akhiok, Karluk, Larsen Bay, Old Harbor, Ouzinkie, Port Lions, Chignik Bay, Chignik Lagoon, Chignik Lake, Port Graham, English Bay, Chenega Bay, and Tatilek. Work was also conducted in two control communities: Angoon and Petersburg in Southeast Alaska.

An Urgent Rescue and Loss of Human Life

The efforts of captain and crew to repair the engine of the *Selendang Ayu*, and the attempts of Coast Guard personnel to secure the drifting vessel and rescue its crew were conducted with limited time for response and in very hazardous conditions. Early media reports about the foundering vessel reflected concerns about potentially grave outcomes in this challenging context.

Initial reports about the rescue efforts were positive as 18 crew members were airlifted to safety. News turned tragic upon the loss of the six crew members who continued to work on the freighter's engine until the last possible moment. Loss of the men generated a series of profound effects as family, friends, and surviving seamen restructured their lives in the absence of husband, father, friend, or fellow worker. The value of human life and the value of personnel prepared to risk their own lives to save others are not readily calculable.

Of the Coast Guard personnel who performed their duties despite the forces of nature they faced while rescuing and attempting to rescue crew members from the grounded vessel, the popular Alaskan writer Spike Walker writes:

> Short of missions in Iraq, or Special Forces action behind enemy lines in Afghanistan, there was probably not another cadre of helicopter pilots and their crews anywhere in the armed services that year who faced dangers and challenges comparable to those who flew on the *Selendang Ayu* mission in the Bering Sea in December of 2004. The H-60 flight crew of Dave Neel, Doug Watson, Brian Lickfield, and Greg Gibbons, as well as Doug Cameron and his crew, and Cdr. Matt Bell and his people on the *Alex Haley*, had ventured with daring to the very edge of the precipice, launched into the abyss, and returned from their odysseys with vivid tales of the living and the dead (Walker 2010: 254).

Figure 16. Remembering those Lost During the Rescue, Unalaska Town Hall, December 2004

Cultural Interface between Responding Agencies and the Host Community

Effective oil spill response requires extensive public sector outlay of human, physical, and fiscal resources. These are applied to pre-event planning, initial assessment, physical response, and post-event monitoring actions. In the case of the grounding and spill of the *Selendang Ayu*, the ongoing challenges of weather and sea and the forbidding nature of the winter landscape[28] of Unalaska Island required additional time, effort, and expertise during all phases of response.

In the case of the *Selendang Ayu* incident, the participation of numerous federal, state, and local government agencies and various private sector entities under the federally guided command entity required under the OPA served to consolidate communication and coordination of response efforts in a challenging environmental setting. By all accounts, Incident Command was in this case highly effective in responding to the incident. A successful mission notwithstanding, IAI field staff observed situations of tense social interaction upon the arrival of many outside agencies and individuals during the early weeks of the spill event. Certain residents of Unalaska were initially angry about a situation they believed was the combined result of negligence on the part of the responsible party and insufficient governmental response capacity at sea.

Some residents of Unalaska initially reported that the spill and response were major impositions on their lives. It was often stated and readily observable that it was difficult for residents to "get away" from the situation in the geographically isolated town of Unalaska. This experience was also regularly reported by persons in rural villages and towns affected by the *Exxon Valdez* spill and response operations in 1989 and 1990 (IAI 1990c, 1990d).

It should be kept in mind that oil spill events typically interrupt ongoing daily patterns of community life in an abrupt manner. That is, there often is little warning that the village, town, or city in question is about to become a "different place" upon the arrival of many strangers and their associated needs for space, services, and basic amenities. There is little advance notice that typical patterns of social interaction will unavoidably be disrupted for a time as family and friends participate in emergency response work or are otherwise distracted or displaced by the spill from typical activities at work and school. Persons who typically engage in subsistence harvesting or commercial fishing activities may be unable to do so because the resources are or may be affected by oiling. Individuals in spill-affected communities often report loss of control over the course of daily activities as emerging spill-related problems and uncertainties overtake routine (IAI 1990d).

The daily routines of many Unalaskans were necessarily altered for a period of time during the *Selendang Ayu* incident. Anger and anxiety were detectable on the faces and in the discourse of many who attended public meetings that were held to inform the public about the status of the spill and response. As noted above, some fishermen and other residents who wanted to be involved in the response and/or clean-up were frustrated by a system that did not allow for the participation of unqualified responders. Again, the agencies involved necessarily must address a variety of safety and liability issues associated with spill response and clean-up.

[28] The volcanic origins and tectonically active nature of the Aleutian Islands has led to a characteristically vertical landscape, even at the margins of land and sea.

But as time passed and solutions to emerging problems were discussed and implemented in conjunction with regular media updates and daily opportunities for public comment, critical residents gradually tended to agree that Unified Command was effective in coordinating response work among many agencies and entities. The accident and spill could not be reversed, of course, and acceptance of the resulting challenges was ultimately unavoidable.

Field observations and discussions with residents and officials in 2005 did indeed reveal a tenuous period of mutual cultural assimilation between visiting responders and local residents. However, data from interviews undertaken in subsequent months and years makes clear that local perspectives changed over time. Residents contacted for purposes of this study gradually reported their belief that the constituents of the centralized command process were working in the interest of the community. The level of dedication of the response team had become obvious.

While initial interactions between first responders and locals were- in this and similar cases- problematic, such problems may be hard to avoid. This may particularly be the case in small rural towns, where an established social order and cultural norms do not necessarily readily accommodate the authority of newly arriving persons, who themselves cannot or may not immediately understand or appreciate localized socio-cultural conditions.

On the other hand, persons fulfilling official response roles typically operate under the culturally influenced expectations of their own agencies, which can call for an authoritative and official demeanor, regardless of local social and cultural conditions. The urgency of the situation at hand and emerging crises can serve to escalate emotion or apparent lack of emotion on one side or the other. Further, the distinct cultural and legal needs and interests of indigenous persons residing in the community can further complicate the interaction.

While tribal liaison duties are typically undertaken by representatives of federal spill response agencies, these rarely involve persons fully trained and/or highly experienced as cross-cultural liaisons or communication specialists. In this case, a USCG staff member who was familiar with and maintained ties to persons in Unalaska reportedly served as an effective interface between Unified Command and the community at-large. However, this eventuality was opportunistic rather than a planned component of an ongoing response protocol.

Notably, a full-time Juneau-based tribal liaison position was established by the USCG beginning in 2010 (General Accounting Office 2010). The position was established at the behest of the General Accounting Office following a formal request by representatives of USCG District 17, who were seeking to advance strong working relationships between the Coast Guard and tribal institutions in Alaska. A full-time officer is now responsible for facilitating effective communication across differing cultural domains, such as those typified by first responders and residents of the spill-affected community of Unalaska.

Near-Term Socio-Demographic Effects

While many research participants in Unalaska ultimately reported that the incident command system was an effective organizational mechanism for addressing the *Selendang Ayu* incident, an

objective reading of the overall response effort makes clear that there were unavoidable challenges for local residents. Such is the nature of a large organizational response in a small host community.

Although permanent residents of Unalaska are accustomed to seasonal fluctuations in fishing activity and associated social and economic changes, including increased demand for local goods and services, the crowding and heightened service demand effects of the *Selendang Ayu* response were superimposed on such pre-existing population and business patterns. This made certain aspects of life in the community significantly more challenging than would typically be the case regardless of cyclical changes in the fishing industry.

For instance, the incident brought hundreds of first responders to Unalaska from various government agencies, private sector response firms, and the media. This made it difficult for transiting residents to acquire seats on incoming and outgoing flights during the first few months of the event.[29] Because the principal hotel on the island functioned as the information and operational center for Unified Command, the facility was booked to capacity for many months.[30]

Small businesses of all sorts were very busy accommodating a steady influx of visitors during this period. Certain businesses prospered, but periodic shortages of various goods and services were reported, and in some cases, the pressing needs of oil spill responders superseded those of regular customers who subsequently became frustrated with the situation. Moreover, some local business employees reported an increase in job-related stresses and detraction from normal duties at work and home. Notably, such effects were also documented in each of the communities directly affected by the *Exxon Valdez* spill in 1989 and 1990 (e.g., IAI 1990d).

Research participants described emotional changes as they tracked the incident through a promising rescue to a tragic accident and loss of life. Loss of personal routine and stress were reported in association with loss of the small boat fishing season, with the arrival of so many people in a small town, and with the demands of attending daily public meetings and communicating with others about the incident. Local and visiting public officials reported an unavoidable shift of attention away from normal duties. This strained agency resources.

Significant increases in local business activity occurred again during the latter part of 2005 and periodically during 2006, as scientists, government officials, spill workers, and others came to and departed from Unalaska to participate in spill assessment and clean-up activities. A professional conference was held in Unalaska during August 2005 to identify lessons that had thus far been learned from the *Selendang Ayu* incident (see Brewer 2006). The event further stimulated local business activity.

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[29] Daily flights are available between Anchorage and Unalaska. No jet service is available due to runway limitations in Dutch Harbor, and thus the 800-mile trip via large prop plane service typically lasts about three hours. Poor weather conditions in the Aleutians often limit availability of flights.

[30] IAI research staff found accommodations on a small houseboat in the local small-boat harbor. This seemingly constraining situation actually facilitated in-depth and ongoing research interaction with key members of the local small-boat fleet.

Such near-term effects persisted in direct relation to the presence and activities of the many individuals and entities responding to the incident. As the bulk of the recoverable oil and cargo was contained by human intervention and/or attenuated by natural forces, the response effort became less urgent and thus, obviously, fewer agency and private sector personnel were required to be present. Field-based observation made clear that this shift led to a direct lessening of the near-term local social effects of the accident in Unalaska.

Allocation of Government Resources to the Response

Response to the *Selendang Ayu* grounding and spill required a significant outlay of personnel and funding. Expenditures were carefully documented by the federal and state agencies responding to the event and were recovered to the extent allowable by law from the responsible party during subsequent litigation. Table 8 below depicts the categories of response expenditures submitted by the U.S. Coast Guard for recovery from IMC Shipping, Inc., the responsible party in this case.

Table 8. U.S. Coast Guard Billing to the Responsible Party

Expenditure Category	Cost ($)
Personnel Costs	1,289,549.45
Aircraft	--
C130	1,040,153.40
H60	329,806.70
H65	373,823.10
Cutters	--
Sycamore	439,416.00
Contractors	1,126,133.14
Credit Card	4,229.80
Purchases (PR)	21,301.75
Travel	548,979.14
Government Transport Requests (GTRs)	22,610.68
Pollution Removal Funding Authorizations (PRFAs)	1,252,307.60
Initial Costs for Natural Resource Damage Assessment	201,130.37
Total Billed to Responsible Party	6,500,000.00
Total Paid by Responsible Party	6,500,000.00

Source: United States Department of Homeland Security, USCG

While State of Alaska agencies have not categorized response expenditure categories in the same manner as the U.S. Coast Guard, the state-level response also involved extensive outlay of personnel and monies for purposes of travel, physical response, communication, administration, contribution to initial phases of the Natural Resource Damage Assessment process, and so forth. Observation of the spill response makes clear that numerous federal agencies incurred costs, including but not limited to: the USFWS, NOAA Fisheries, NOAA Office of Response and Restoration, and the National Transportation and Safety Board.

Officials report that the State of Alaska was reimbursed by the responsible party for its roles in responding to and investigating the incident at a total amount of $2,566,618. Although other state agencies were involved in the response effort, this figure represents recoverable costs

incurred principally by the Department of Environmental Conservation, the Department of Natural Resources, the Department of Fish and Game, and the Department of Law.

Notably, a variety of private sector federal and state government contractors also allocated time and human and fiscal resources in responding to, investigating, monitoring, and documenting the incident. These included: marine salvors, biophysical scientists, insurance and liability specialists, fishery consultants, cultural resource consultations, oil spill consultants, endangered species and other wildlife specialists, water quality specialists, and others.

A full accounting of official response costs would constitute a study in itself. The U.S. Department of Justice (2007) reports that clean-up costs alone were in the range of $100 million. This was predicted by Parker and Associates (2005:4-5), who describe the liability limits in this case and dedicated sources of state and federal funding for responding to this and similar spill incidents:

> The Oil Spill Liability Trust Fund, (OSLTF), is the source of federal funds for area contingency planning, equipment and spill response actions including spill response actions undertaken by the responsible party above set liability limits. The liability limits are variably set for different types of ships, but actual spill costs have greatly exceeded liability limits.
>
> In the case of the *Selendang Ayu*, the liability limit is approximately $24 million, expenditures to date have exceeded $49 million and total oil removal costs are expected to double.
>
> The Fund also pays for spill damage claims when the responsible party is unidentified or unwilling/unable to pay for damages.
>
> The Fund was instituted in 1991 and populated to $1 billion dollars with a 5 cent per barrel tax on domestically produced and imported oil, but this tax sunset at the end of 1994.
>
> The OSLTF assets are rapidly declining with an expected shortfall in Fund commitments to occur in FY 2007 with total depletion expected in FY 2009.
>
> Alaska also has a fund dedicated to providing planning and equipping of regional spill contingency plans, the Oil & Hazardous Substance Release Prevention and Response Fund. This fund is also populated with oil tax monies but has no sunset provisions.

Not all government resources allocated to the *Selendang Ayu* response were, or can be, accounted for. For instance, as noted previously in this report, response to the grounding and spill detracted Coast Guard staff from other duties elsewhere in Alaska and/or the nation. This incurred social and economic costs that cannot be easily documented or recovered. According to key federal officials involved in the response, expanded duties in this and similar situations also typically lead to personal and familial stresses that would not otherwise occur.

Similarly, responding state workers necessarily adjusted normal schedules to accommodate the pressing needs of response to an emerging event. Normal or routine missions and duties that were necessarily put in the background could not be abandoned altogether but were rather given less attention, and/or were delegated to other personnel who, in turn, were forced to shift energy away from their own duties. This also occurred among local government and tribal officials in Unalaska. Routine missions and duties at work and home were significantly affected for a period of time with no mechanism for recovering the associated costs.

In sum, sufficient response to emergency events such as the *Selendang Ayu* grounding and spill require significant outlay of funds and human resources. The costs of reallocating personnel and associated funding to emergency duties are not readily documented, but such situations undoubtedly strain existing resources, and detract from non-emergency duties and the capacity to respond to concurrent emergencies. Moreover, such events affect the personal lives of emergency responders and citizens alike. Again, these problems were noted of the agencies involved in, and the communities affected by the *Exxon Valdez* oil spill.

Figure 17. Workers Removing Contaminated Grass and Soil at the Spill Site in 2005
Photo Courtesy of the U.S. Coast Guard

5.0 Resolution

IAI's recent ethnographic work on Kodiak Island reveals that participants in the commercial fishing and governance sectors continue to be involved in and affected by protracted litigation and settlement processes following the *Exxon Valdez* accident (IAI 2010). Similarly, Picou et al. (2004) have identified persistent social and psychological problems in the spill-affected town of Cordova.[31] The social and economic pathways through which such effects manifest in modern community settings tend to be complex, and analysis requires thorough understanding of social and economic conditions in the affected towns and villages prior to and following the settlement.

In the case of the *Selendang Ayu* spill, significant long-term social effects resulting from protracted litigation will not be observed given that the civil and criminal cases against the responsible party were adjudicated relatively quickly. However, the Qawalangin tribe's claim to the NPFC for lost subsistence opportunities required deliberation and action on the part of the tribe and the federal government through July 2009, and public sector personnel and citizens of Unalaska continue to negotiate the NRDA process at the time of this writing.

Although the outcome of the tribe's claim to the NPFC did not yield a positive outcome, discussions with USFWS representatives suggest that the NRDA process will likely yield social and/or environmental benefits in return for injuries to natural resources and natural resource user groups on Unalaska Island. Here we provide a cursory review of select legal aspects of the *Selendang Ayu* oil spill and restoration processes, keeping in mind lessons that may be learned for policy-makers and analysts elsewhere.

Adjudication

Prior to departure from Seattle, crew members and Coast Guard officials conducted independent inspections of the *Selendang Ayu*. No deficiencies were identified. Thus, at the time of the accident, all recommended inspection and maintenance activities had been carried out according to schedule. The vessel carried a full complement of spare parts when it left Seattle.

But as described above, unusually challenging physical environmental challenges and faulty human decisions were associated with the grounding of the *Selendang Ayu* at Spray Cape. Not long after the incident, a series of allegations were made that the responsible party should be subject to charges of negligence. Pivotal issues involved reporting requirements for foreign-flagged vessels making innocent passage, and various actions that were or should have been taken before the grounding. Walker (2010) asserts that the captain of the foundering vessel was resolute in his belief that the ship could be repaired without outside assistance. Based on a reading of all sources, communication challenges between the non-English speaking captain and crew on one hand, and USCG and State of Alaska officials on the other do appear to have influenced the probability that the vessel and crew could be rescued without incident.

In April 2005, Captain Singh pleaded guilty to making false statements regarding the time the engine was shut down while in the shipping lanes northwest of Unalaska. Department of Justice

[31] Additional sociological discussion of the *Exxon Valdez* oil spill is provided in Picou et al. (1997).

officials and counsel for IMC Shipping Company disagreed as to whether improper maintenance and/or operation of the vessel could have led to a crack in one of the fated engine's cylinder liners. In August 2007, the shipping firm and the U.S. Department of Justice reached a settlement on federal criminal charges related to the accident. Under conditions of the settlement, IMC Shipping Company would plead guilty to violation of the Migratory Bird Treaty Act for the inadvertent but negligent deaths of migratory birds and for violation of the Refuse Act[32] due to discharge of oil and cargo.

As part of the plea agreement, IMC Shipping Company was required to pay a criminal penalty of $10 million (U.S. Department of Justice 2007), including $3 million to fund an assessment of navigational risks in the Aleutian Islands, and $1 million for National Fish and Wildlife Foundation projects in the Alaska Maritime National Wildlife Refuge system. The firm's fleets are now also subject to regular externalized inspection processes. Notably, the U.S. Department of Justice (2007) states that, while the plea agreement between the federal government and the shipping agency addressed the firm's criminal culpability, it did not limit its civil liability for damage to any person or entity, including any federal, state, or local government agency or associated public trust resources.

The State of Alaska subsequently sought legal settlement for damages and costs resulting from the grounding and spill on Unalaska Island. An agreement was reached in April 2009, requiring that IMC Shipping Company pay the state nearly $845,000 for damages resulting from the *Selendang Ayu* grounding and spill, for removal of the hull above the waterline, and for fish taxes lost to the City of Unalaska following the closure of the Makushin/Skan Bay Tanner crab fishery in 2005. The lost fish tax penalty was assessed at $6,318. The settlement also requires that the shipping firm will remove any portion of the hull or superstructure of the grounded freighter that may rise above the ocean's surface before August 30, 2015 (Juneau Empire 2009).

NPFC Rejection of the Tribal Claim

As noted previously, the Qawalangin tribe submitted a formalized claim to the NPFC for subsistence opportunities lost as a result of the *Selendang Ayu* incident. Representatives decided to develop the claim after numerous members of the tribe expressed grievances about lost opportunities and an inability to engage in costly litigation on their own.

According to Kohout (2006:97), "the National Pollution Funds Center (NPFC) is authorized to use the federal Oil Spill Liability Trust Fund (OSLTF) to pay for uncompensated removal costs and damages," wherein claims not paid by the responsible party can be submitted to the NPFC for payment. Preparation of the claim did involve compilation of data regarding the specific nature of subsistence activities likely to have occurred in the spill area, but again, the spatial and quantitative details of the activities are proprietary in nature and cannot be provided here.

[32] The Refuse Act derives from a section of the River and Harbors Act of 1899, which prohibits dumping of refuse into the nation's navigable waterways.

The summarized claim (Table 9) indicates the basic nature and estimated dollar value of the lost opportunities. The tribe holds that 32 trips to the area were obviated by spill-induced area closures, and that each trip would have involved the participation of four persons on average, for a total loss of 128 person-trips, and associated losses calculated at over $1 million.

Table 9. Tribal Claim for Subsistence Trips Lost Due to the Spill

Undiscounted Value of "Direct Loss"			
Number of Person Trips Lost	Fishing Value of Trip/Person	Camping Value of Trip/Person	Base Trip Value (Trips Lost x Fishing Value + Camping Value)
128	$388.56 (6 days x $64.76/day)	$545.05 (5 nights x $109.01/night)	$119,502.08 (128 trips x $388.56 + $545.05)
Notes: [1]Consumer surplus value/person/day in 2007 US $ for fishing recreation in Alaska (Kaval 2006) [2] Consumer surplus value/person/day in 2007 US $ for camping in Pacific Coast Region (Kaval 2006)			
Undiscounted "Cultural Premium" Value			
Cultural Premium Range (1 to 10 x "direct loss")	Total Trip Value Range ("Direct Loss + Cultural Premium)	Total Value of Lost Cultural Trips (Mean Value)	
$119,502 - $1,195,020	$239,999 - $1,314,522	$776,763	
Discounted Estimate of Lost Value*			
Cultural Premium Range (1 to 10 x "direct loss"	Total Trip Value Range ("Direct Loss + Cultural Premium)	Total Value of Lost Cultural Trips (Mean Value)	
$134,500 – 1,344,995	$268,999 – 1,479,494	$874,246	
* Calculated through application of a three percent annual discount rate for four years, based on the claimant's estimate of a four year time lag between injury and restoration			
Cultural Center "Replacement" Costs			
Estimated Renovation/Operating Costs for 2 Years	$936,532		
Assessment Costs			
Contractor Costs for Assessment Development	$108,372		
Summary of Claimed Damages			
Cultural Center Replacement Costs + Past Assessment Costs	$1,044,904		

Source: National Pollution Funds Center (2011)

Notable here is the fact that the Qawalangin tribe defines lost subsistence opportunities in a way that is reflective of the reality of historic and contemporary subsistence trips to remote parts of Unalaska Island. That is, while the trips naturally vary in terms of objectives and outcomes, tribal representatives consider each an important expression of Unangan culture. Thus, the tribe and its consultant logically attempted to assign a dollar value not only to the lost opportunities and resources themselves, but also to the cultural benefits that would have derived from those opportunities and resources had the spill not occurred. Although tribal staff originally believed the claim would be accepted, it was ultimately denied, reportedly in association with NPFC personnel changes and a concomitant shift in the agency's official perspectives on the matter.

The claim was formally rejected by the NPFC on the basis that, as required under OPA (33 U.S.C. 2701 *et seq*.) and its implementing claims regulations (33 C.F.R. 136), it and the supporting materials provided by the Qawalangin tribe did not: "(1) identify and describe an actual subsistence use of specific natural resources for which compensation is being claimed; (2) describe how and to what extent the claimant's subsistence use was affected by injury to or loss of a specific natural resource; (3) describe efforts [undertaken] to mitigate the claimed subsistence use loss; or (4) calculate the reasonable cost to replace the lost subsistence use resources" (NPFC 2009:9). Although there appear to have been grounds for appealing the decision and submitting a revised claim based on proprietary data held by the tribe, Qawalangin tribal representatives did not do so.

Pivotal in the NPFC's rejection of the tribe's claim is the definition it used to define "subsistence" and, subsequently, the criteria used to determine whether the claim was valid. Rather than consulting the broad literature on natural resource use patterns among Alaska Natives to help define the term in a real and contemporary context, the agency used the basic definition provided in the Merriam-Webster dictionary (NPFC 2009:4): "the condition of remaining in existence; means of subsisting; the minimum (as of food and shelter) necessary to support life; a source or means of obtaining the necessities of life."

While Qawalangin tribal members and other Alaska Natives would not likely argue that definition of the term subsistence should address the fundamental importance of harvesting wild foods for purposes of survival, indications are that most would argue that "subsistence" is more than this, and that as described in previous sections of this report, it encompasses a wide range of activities that historically have been and remain important to indigenous cultures in Alaska. Many Alaska Natives have expressed this perspective, including Svarny-Carlson (1995), who envisions the pursuit and consumption of subsistence foods and their shared distribution as basic to contemporary Unangan identity:

> Unangan foods are elemental to our culture. To have Native foods sent to us when we are away is one of the most vitalizing, identify-rich gifts that friends or family can bestow . . . My personal favorite is dried salmon with chadux̂ (seal oil). Qagaasakung (thank you) to my parents, who generously keep me supplied. Without it, I would not be able to feel so strongly who I am!

The many important dimensions of historic and contemporary subsistence practices notwithstanding, there were reasons for anticipating rejection of the tribe's claim for cultural damages, and for preparing a different type of claim for submittal to the NPFC. For instance, the NPFC states that although the value of a trip, whether it be cultural or recreational in nature, may be compensable under the NRDA process, it is "not a compensable loss under the subsistence use provisions of OPA."

Moreover, as discussed by Jorgensen in his (1995) review of arguments advanced by social scientists during litigation of the *Exxon Valdez* oil spill case, the "cultural damages" concept argued by the plaintiffs was not empirically sound inasmuch as culture is not of itself an empirical phenomenon that can be damaged. Rather, culture is simply (and profoundly) a normative way of conceptualizing, speaking, and behaving. The author states that while Alaska

Natives were indeed deprived of opportunities to participate in normative indigenous activities such as hunting and fishing, and consuming and sharing the products of such activities, "the claim that culture is a thing that can be damaged is ontological, enjoying standing neither in social science nor in the courts" (Jorgensen 1995:2).

The author goes on to state (ibid., p.7) that "unlike [loss of or damage to an intangible] culture, natives experienced real, empirical loss of wild resources; real, empirical damage to the areas in which they gain and define their livelihoods; real, empirical alterations to their customs of harvesting, preparing, sharing, and consuming food products and by-products; and real, empirical threats to the future generations of animals on which they rely." Based on this perspective, the most defensible claim for spill-induced subsistence losses among members of the Qawalangin tribe would have specified the nature and extent of damage to specific subsistence use areas and resources, and the nature and extent of spill-induced changes to the ways in which the natural resources in question are traditionally pursued and used by the indigenous people of Unalaska.

Natural Resource Damage Assessment (NRDA)

Three federal laws authorize federal and state agencies and Indian tribes to formally assess the effects of oil spills and other accidents involving the release of hazardous substances into the natural environment. These are: the Oil Pollution Act of 1990 [33 U.SC. 2706 (b), Section 1006 (b)]; the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA); and the Clean Water Act of 1972.

The categories of loss to be addressed by the NRDA process are specified in both the CERCLA and the OPA [CERCLA §§101(6); 107(a)(4)(C); OPA §§1001(5); 1002(b)(2)]. Costs and damages addressed by the OSLTF through NRDA include: (1) uncompensated removal costs; (2) damages to natural resources; (3) damages to real or personal property; (4) loss of subsistence use of natural resources; (5) loss of profits or earning capacity; (6) loss of government revenues; and (7) increased cost of public services.

In order to identify actions needed to undertake restoration of the affected natural resources and human services provided by those resources, the NRDA process requires an understanding of the status of the environment prior to the accident and determination of the effects of the accident in question. Because the grounding and spill of the *Selendang Ayu* occurred within the Alaska Maritime National Wildlife Refuge, the USFWS is directing the NRDA process. Other agencies or entities[33] involved in this case include: NOAA; the State of Alaska Departments of Environmental Conservation, Natural Resources, Fish and Game, and Law; and the Qawalangin Tribe of Unalaska.

Of note in the present examination of the human dimensions of the *Selendang Ayu* incident, the NRDA process has not yet been completed and may continue for some years hence. Significantly, federal officials involved in the *Selendang Ayu* NRDA note that the *Deepwater Horizon* accident has delayed work on Unalaska Island since key personnel involved in the case

[33] These are typically termed "trustees" in the NRDA context.

have been deployed to NRDA duties in the Gulf of Mexico. But the NRDA process is time-consuming in any event, for reasons described by NOAA's Response and Restoration Division (2010):

> The concept of assessing injuries may sound simple, but understanding complex ecosystems, the services they provide, and the impacts caused by oil and hazardous substances takes time—often years. The season during which the resource was injured, the type of oil or hazardous substance, and the amount and duration of the release are among the factors that affect how quickly resources are assessed and restoration and recovery occurs. The rigorous scientific studies necessary to prove injury to resources and services (and withstand scrutiny in a court of law) may also take years to implement and complete. But the NRDA process ensures an objective and cost-effective assessment of injuries—and that the public's resources are fully addressed.

The NRDA process involves three basic phases of work: pre-assessment, restoration planning, and restoration implementation. Pre-assessment work, in this case, has involved a series of beach and aerial surveys, determination of habitat exposure and impacts to local biota, and review of relevant scientific literature. The USFWS (2008) reports that beach survey work on Unalaska led to the recovery of six heavily scavenged sea otters and over 1,700 bird carcasses. Data relating to these animals and the ecosystems with which they were associated is being used to estimate the manner and extent of effects on biota in and around the spill-affected area. Aerial surveys have also contributed to baseline understanding of the ecosystem and associated resident and wintering bird and sea mammal species. Finally, the USFWS (ibid., p. 2) reports that:

> NOAA [has] documented the geographic extent of habitat-specific exposure to *Selendang Ayu* oil and collected information on the potential impacts to the biota that depends on those habitats. This included shoreline surveys to collect oil, sediment, and bivalves; benthic surveys of oil in sub-tidal and demersal habitats; and the assessment of anadromous fish streams. This information will help determine whether biota is contaminated at levels harmful to wildlife.

The pre-assessment phase of the NRDA process was still ongoing in 2008 when USFWS officials stated that then-current activities included work to determine whether harlequin ducks were still being exposed to oil, and the extent of oil remaining along a series of beach segments around the site of the grounded freighter.

Regarding restoration planning work associated with the *Selendang Ayu* grounding and spill, Kohout (2006:99) notes that this phase of the NRDA process requires that the trustees quantify natural resources injuries and identify possible restoration projects for remediating them:

> Economic and scientific studies [are being used to] develop a restoration plan that outlines alternative approaches to speed the recovery of injured resources and compensate for their loss or impairment from the time of injury to [point of] recovery.

According to USFWS officials involved in the case, the development of a restoration plan for injuries resulting from the *Selendang Ayu* incident likely will not be completed before 2012. When it is completed, the plan will draw upon the aforementioned biological assessment work,

and pre-assessment information provided by Kohout and Meade (2008:2-6). The latter include data regarding a variety of what are termed "human use services" on Unalaska Island. These include: (a) archaeological resources; (b) cultural resources including wild medicinal plants and subsistence foods, and related consumption and sharing activities; (c) recreational opportunities including sport hunting, fishing, and sightseeing activities undertaken by residents and visitors; and (d) passive uses, such as human knowledge that natural resources exist in a primitive state. Though it is based on "limited information and data gathered to date" (ibid., p. 6), the authors conclude their assessment of human uses of the spill-affected natural environment, asserting that:

> Oil and cleanup activities associated with the *Selendang* spill likely caused a loss of human use of natural resources, with cultural and recreational impacts on residents of Unalaska and possibly those of Umnak Island. Potential visitors to the Island may have also suffered lost recreational opportunities (Kohout and Meade 2008:6).

Based on all available evidence gathered during the current research, including work with tribal officials, subsistence practitioners, commercial fishermen, and others, we would modify this statement to make clear that the *Selendang Ayu* incident *did* cause a loss of local opportunities to pursue and use natural resources for purposes of commerce, subsistence, and recreation.

Although restoration plans developed under the NRDA process would normally be linked directly to the spill-affected area, in the case of the *Selendang Ayu* grounding and spill, an apparent lack of such options has led to preliminary plans for compensating losses by remediating problems elsewhere on the island or larger region. USFWS officials have been selective in terms of the nature and extent of relevant information released to the public and to federal contractors. Information regarding potential restoration planning outcomes is therefore limited. As described in a USFWS handout provided at the most recent public meeting designed to solicit public input regarding additional planning options under the *Selendang Ayu* NRDA process, then-current restoration and remediation possibilities included the following:

> Marine Birds – indications are that mortality to marine birds following the spill was significant. Presently, we are not aware of any primary restoration possibilities (restoration at the spill site that could benefit the affected species), so we are considering projects that would benefit marine birds elsewhere in the Aleutians.
>
> Nearshore resources and services – the spill likely injured a suite of nearshore resources and services. These include invertebrates, sea ducks, marine mammals, and recreational and subsistence activities. We are aware of only limited options in the spill area, so we are considering restoration elsewhere.
>
> One idea is a project that would reduce small-scale oil releases in and around Dutch Harbor. Possible components would be bilge stocks, enhancing small spill response capability, low cost bilge pumping, and public education. Other ideas involve looking for ways to reduce other sources of contamination to Unalaska Bay.
>
> Marine Mammals, Anadromous Fish, Terrestrial Vegetation – it is likely that these resources were injured by the spill but we have limited information at this time as to the magnitude of those injuries. Restoration for these resources might be covered by the projects above or stand-alone projects may be warranted. Ideas here include support for educational efforts, additional fish surveys, and intertidal resource mapping.

Attendant Outcomes

While oil spills resulting from accidents such as that of the *Exxon Valdez*, *Amoco Cadiz*, *Prestige* and others undeniably generated a variety of detrimental human and physical environmental impacts, such events also often induce positive changes. For instance, the *Exxon Valdez* accident led to passage of the OPA in 1990, which required significant changes in the marine transportation industry as conducted in the nation's Exclusive Economic Zone. Such events also tend to heighten public attention to environmental problems. While the spill resulting from the grounding of the *Selendang Ayu* was comparatively much smaller than that of the 1989 event in Prince William Sound and other oil spill events noted in this report, it lead to awareness of problems associated with marine transportation in the Aleutian Islands and to efforts intended to improve safety-related aspects of marine transportation in the region.

For example, the Shipping Safety Partnership (SSP) was established through the Alaska Center of the Environment soon after the *Selendang Ayu* incident. The goal of the SSP was to reduce the risk of groundings, collisions, and spills among local vessels and vessels transiting the Great Circle route between North America and Asia. More specifically, the organization called for dedicated rescue tugs, a region-wide vessel traffic monitoring system, and improved communications capabilities, among other reforms. Enhanced tug response capability was in keeping with the 2006 NTSB report on the *Selendang Ayu* incident, which indicated inadequate maritime accident response capabilities in the Bering Sea and Aleutian Islands.

Most significantly, the criminal settlement following from the *Selendang Ayu* incident required a formalized Aleutian Islands Risk Assessment, which has the potential to reform key aspects of marine transportation in the Bering Sea and Aleutian Islands region of the Gulf of Alaska. The assessment was initiated in 2009 following a series of meetings between officials from the U.S. Coast Guard, the Alaska Department of Environmental Conservation, and the National Academies of Science Transportation Research Board (cf. National Academies of Science Transportation Research Board 2008). The assessment now also involves the participation of the National Fish and Wildlife Foundation. As described in the National Academies of Science Transportation Research Board report (2008:146-147), the risk assessment in this case is defined and is being implemented as follows:

> The committee recommends that a structured risk assessment be performed with two major phases—a Phase A Preliminary Risk Assessment and a Phase B Focused Risk Assessment. This process would include a specific, stepped approach to collecting and categorizing available data; development of a logical sequence of events defining key scenarios; and use of a risk matrix for an initial qualitative evaluation of risk levels.
>
> The Phase A Preliminary Risk Assessment should begin with semi-quantitative studies aimed at traffic characterization and projections, spill estimates, and identification of the highest risks. This information should then be used for a qualitative assessment and prioritization of risk reduction options.
>
> The Phase B Focused Risk Assessment should entail detailed, in-depth assessments of individual risk reduction options in order of priority. The time and resources dedicated to Phase A should be limited to ensure that it is completed in a timely manner and that sufficient resources have been reserved for Phase B. Phase B should be accomplished in

discrete steps as necessary in accordance with the priority of measures to be investigated and the level of risk reduction possible.

Project administrators report that the first phase of the assessment is complete (see Aleutian Islands Risk Assessment Project 2011), and that a series of near-term objectives have been identified to reduce the risk of maritime transportation accidents in the region affected by the grounding and spill of the *Selendang Ayu*. These objectives include the following: (1) develop an enhanced vessel monitoring and reporting program; (2) increase towing capacity on USCG rescue vessels and increase the number of such vessels; (3) establish Particularly Sensitive Sea Areas for adoption by the International Maritime Organization; (4) strengthen the Aleutians Subarea Contingency Plan; (5) increase salvage and spill response capabilities; and (6) stage additional Emergency Towing Systems.

Emergency towing systems (ETS) are now widely recognized as essential components of an effective emergency response strategy in the waters surrounding Alaska. Five such systems have thus far been deployed, including a system for emergencies arising in the immediate vicinity of Dutch Harbor, and a more capable system for deployment in the Aleutian Islands, Bering Sea, and adjacent portions of the Gulf of Alaska.[34] The ETS packages include strong but lightweight towlines, messenger lines, line-launchers, lighted buoys, and chaffing gear. These significantly enhance the capacity of rescue tugs to respond to and tow powerless freighters, tankers, and other vessels which could otherwise drift into danger in challenging sea conditions as in the case of the *Selendang Ayu*. The packages can be hoisted onto rescue vessels at the docks or by helicopter to vessels at sea. For more information about implementation of the ETS program in Alaska, see: http://www.dec.state.ak.us/spar/perp/aiets/home.htm.

[34] The state's ETS program was initiated in 2007 through the collaborative efforts of the City of Unalaska, ADEC, and the USCG. The program was seen as a much needed element of regional response strategy following the *Selendang Ayu* incident, the near-grounding of the cargo carrier *Salica Frigo* in Unalaska Bay in 2007, and other maritime accidents and near-accidents in the Aleutian Islands and Bering Sea.

6.0 Summary Findings and Conclusion

The project described in this report was designed to examine human response to an oil spill event in a high latitude natural resource-rich environment. Findings may be used to help infer and anticipate the likely nature of problems associated with oil spills in similar and other marine environments, and to aid in contingency planning and formulation of effective response strategies among government agencies in other spill-susceptible coastal areas around the nation.

In the case of the *Selendang Ayu* incident, we hypothesized that the event would generate effects among the same basic categories of human activity affected by the *Exxon Valdez* spill and clean-up, and that are being examined in relation to the litigation and punitive damages settlement processes following that spill. These impact categories include: (1) the nature of participation in commercial fisheries in the spill-affected region; (2) subsistence practices undertaken by Alaska Natives in the affected region; (3) local economic and demographic conditions; and (4) socio-political relationships within and across groups of persons involved in or affected by the incident.

The hypotheses are basic and general by design, intended to conceptually guide acquisition of information of practical value to spill planners, analysts, and others with an interest in human aspects of maritime oil spills. We do not engage theoretical discussion about whether the *Selendang Ayu* incident was or was not a disaster or examine local perspectives about what *might* have happened had the spill been larger (see Ritchie and Gill 2008). Rather, we assume the general approach of Kurtz (2008), who describes select aspects of the incident and identifies practical lessons to help improve regional and national spill response in the future.

The rationale underlying the study described here is that social assessment of oil spills can be conducted holistically and over a period of time that is sufficient for improving scientific understanding of key human events and processes related to maritime oil spills and spill response. These events and processes include: (a) the causes and course of the accident or incident in question; (b) emergency response work; (c) environmental damage assessment; (d) clean-up operations; (e) mitigation of threats to human health and safety; (f) near- and long-term effects on adjacent human populations and natural resources used by those populations; (g) litigation, adjudication, and settlement; (h) long-term monitoring of resources and the various groups using those resources; and (i) contingency planning for potential future incidents.

The truth-value of the study hypotheses was borne out in the near-term and less so in the longer-term. The grounding and spill of the *Selendang Ayu* resulted in loss of life and the allocation of extensive human and fiscal resources to the response effort. Incident response was particularly costly, given travel distances to and from Unalaska/Dutch Harbor, and the remote location of the grounding and spill. The accident induced a variety of problematic near-term exigencies in the commercial fishing sectors, and among Unalaska's subsistence practitioners. Because oil is known to persist in pockets along the affected coastline, public uncertainty about the safety of consuming wild foods from the area is likely to continue regardless of formal proclamations that PAH levels do not pose a significant risk to human health. Some such problems have the potential to contribute to sociopolitical tensions in future interactions between resource user groups and governing entities. The ongoing NRDA has the potential to generate social and

economic effects in the future– most likely positive effects as per the remediation objectives of the process. As such, the results of our hypothesis testing may shift over time.

The Critical Challenges of Weather and Sea. Given that the grounding and spill of the *Exxon Valdez* resulted in a variety of detrimental physical-environmental, social, and economic effects, it is natural to review that event when considering the second largest spill in Alaskan history – that following the grounding of the *Selendang Ayu*. Indeed, the 1989 spill and the many challenges it presented to responders as it moved through and beyond Prince William Sound and affected communities provides precedent, experience, and policy considerations for enhancing understanding of the grounding and spill of the *Selendang Ayu*.

As was the case for the *Exxon Valdez*, some fateful on-board decisions were involved in the sequence of events leading up to the grounding of the Malaysian-flagged freighter at Skan Bay. Moreover, in both cases, despite application of available resources to prevent looming calamity once a fateful chain of events had been initiated, large winter storms made early response work highly challenging at best, and early containment efforts periodically impossible. Weather and sea conditions contributed significantly to operational delays and increased costs during both incidents.

These outcomes underscore the need for response planners to thoroughly address the elemental factors of climate and ocean conditions (and worst-case scenarios thereof) when developing strategies for response to maritime transportation and oil and gas industry accidents occurring along the nation's coastline and continental shelf. The Aleutian Islands Risk Assessment is seeking to address climatological and other challenges to maritime transportation interests in the Aleutian Islands region.

Commercial Fisheries Dimensions. The *Selendang Ayu* spill affected Dutch Harbor commercial fisheries in a variety of ways. These included: development and implementation of an intensive seafood testing program, loss of a locally important small-boat crab season, and exacerbation of intra-fleet tensions as a result of the lost-fishery claims process.

With regard to the safety of commercially landed seafood, a dilemma confronting government agencies and industry representatives following the *Exxon Valdez* accident involved early sensationalist reports about the effect of the spill on the region's fish and wildlife. While marine resources in the spill areas were indeed impacted, the national audience was largely unaware of Alaska geography and some believed that the state's fisheries had been affected in their entirety.

In the case of the *Selendang Ayu* spill, it appears that government and private sector leaders benefited from lessons learned during the 1989 spill in Prince William Sound. Public officials and industry representatives were proactive in taking the many steps needed to safeguard Dutch Harbor seafood and the well-being of prospective consumers, and to clarify any potentially spurious reports or misperceptions about seafood that had been landed or processed in the region.

Uncertainties about the fate of the spilled oil were profound in Unalaska during the winter months of 2004 and 2005. While some portions of west-central and northwest Unalaska Island were heavily oiled and covered with soybeans, only small amounts of oil made its way into

Unalaska Bay, with trace amounts detected in the critical inner portions of the bay where the various seafood processing firms are located.

Sampling work at Dutch Harbor processing plants in and around Unalaska Bay did *not* indicate contamination of incoming seawater or seafood. Naturally, this was of great relief to those participating in the harvest, processing, and distribution sectors of the nation's most-productive fishing port. However, the seafood sampling process was time-consuming and costly. Fiscal and human costs related to seafood sampling are significant considerations in this analysis, not to be overlooked despite the fact that the state's zero-tolerance seafood contamination policy (18 AAC 34 Article 6) was never violated.

The *Selendang Ayu* spill and response did impact the region's commercial fisheries harvest sector. For instance, large distant water fishing vessels were routed around the spill-affected area and were subject to ongoing inspections for potential oiling of vessels, gear, and seafood. Given the extent of commercial fishing activity in the region, these actions induced significant but unknown costs to the region's fleets, processors, and governing agencies.

At a micro level of social and economic analysis, only a limited number of captains who would have been involved in the Tanner crab fishery at Makushin and Skan Bays were qualified to participate in and earn income from the at-sea portion of the spill assessment and clean-up operations (e.g., ferrying personnel and supplies). Operators who *were* chosen to participate reportedly earned up to $2,500 per day. Thus, some captains were out of work while others prospered. Conversations with Dutch Harbor-based small-boat commercial fishing captains and crew made clear that viewed in total, the *Selendang Ayu* incident exacerbated differences among certain fishermen, and in some cases this led to interpersonal problems that did not exist prior to the spill. Social problems were most clearly associated with the claims process and perceived inequities thereof.

Similar situations manifested on a larger scale following the *Exxon Valdez* spill. In that case, some fishermen in Prince William Sound and on Kodiak Island earned large sums of money by participating in response operations, while others refused to participate and were also prevented, through official closure of regional fisheries, from earning money through their avowed trade (IAI 1990d). The *Exxon Valdez* oil spill and associated litigation and settlement processes have significantly affected social aspects of life in the affected region since 1989.

Notably, early predictions that persons in the seafood harvest and distribution sectors would enter into litigation as a result of the *Selendang Ayu* spill did not come to fruition– in large part because the crab fishermen in question were either directly or indirectly familiar with the challenges of protracted oil spill litigation exemplified in the *Exxon Valdez* oil spill punitive damages case.[35]

[35] Based on legal correspondence available at http://www.exspill.com/Portals/5/documents/EX_Twenty-Second%20App%20to%20Distribute.pdf, it does not appear that full resolution of the punitive damages case will occur until well into 2013.

Finally, fieldwork conducted during the current study revealed that seasoned Dutch Harbor-based commercial fishermen possessed detailed knowledge of the spill-affected areas and marine resources. Newly arriving first responders cannot possibly possess such knowledge. This leads to the obvious conclusion that the dedicated involvement of knowledgeable fishermen and navigators in contingency planning and real-time response roles could serve to enhance understanding of the likely movement of spilled oil, the nature of the potentially affected physical environment, and possibilities for minimizing effects on commercial, subsistence, and recreational user groups. While Unified Command officials were, in this case, open to advice from local fishermen, a dedicated program for eliciting and incorporating such advice appears to have the potential to enhance spill response in this and other coastal regions of the U.S.

Subsistence Dimensions. With regard to the effects of the *Selendang Ayu* spill on local subsistence fishing, hunting, and gathering activities, these were obviously less extensive in geographic terms than those of the *Exxon Valdez* spill and other large spills. But it cannot be said that the event was without tangible physical effects on marine resources along the affected coastline of Unalaska Island or on associated resource use patterns. Indeed, the evidence indicates damage of subsistence resources and loss of harvesting opportunities during 2005.

Because the history of the Unangan people has involved numerous instances in which non-indigenous groups attempted to oppress the indigenous society– including the instance of forced evacuation and internment of Native Unalaskans in Southeast Alaska beginning in 1942– there is heightened political sensitivity to any potentially detrimental exogenous sources of change in the present. Such sources of change most definitely include maritime oil spills.

Conversations with members of the Qawalangin tribe of Alaska Natives make clear that wild food resources continue to be highly valued in the 21st century, and that the Unangan context of pursuing, using, and merely knowing such resources are available for use in the future is not readily comprehended by non-Natives. There was discussion of the elongated time dimension through which pursuit and use of marine resources are envisioned by the Unangan people, and concerns were expressed about the future status of the spill-affected areas. Although the state-sponsored subsistence foods testing program revealed no carcinogenic threat from PAHs in the oiled areas (Arnold 2008), key informants report lingering uncertainty and reluctance to use marine resources from certain areas affected not only by the *Selendang Ayu* spill, but also by the *M/V Kuroshima* spill, which occurred in 1997.

With regard to seafood safety, there was and is a common-sense tendency among subsistence practitioners to avoid any areas and foods that may have been affected by spilled oil. In this sense, the regulatory closures instituted along the central and northwest coast of Unalaska in 2004 and 2005 were largely perfunctory. Public information about the fate of the spilled oil, common sense, and local and traditional knowledge of the affected ecosystems were the primary determinants of avoidance.

Differential perspectives on contamination are in this case rooted in historical social context. Native and non-Native subsistence practitioners, sport fishing enthusiasts, and guides who would have used the affected areas on Unalaska Island had the spill not occurred, each possess the discretion needed to avoid such areas or the resources found there. But significantly, *Native*

residents *also* possess a direct understanding of how contamination and lost subsistence opportunities relate to the long history, contemporary life ways, and future of the Unangan people on Unalaska Island.[36] The situation has the ongoing potential to complicate relationships between tribal and governance entities in the region, regardless of well-intended spill-mitigating policies such as claims opportunities specified under OPA and CERCLA.

Finally, as was the case for certain commercial fishermen in Dutch Harbor, many Unalaska-based subsistence practitioners possess extensive and detailed knowledge of the spill-affected environment and natural resources. Again, such persons have the potential to make significant contributions to contingency planning and real-time response to maritime accidents and spills affecting the Aleutian Islands. This is true in other coastal zones of Alaska and the remainder of the nation: certain persons use and understand localized environments and natural resources in ways that render them ideal consultants for maritime oil spill planning and response. Programs involving commercial, recreational, or subsistence-oriented fishermen in spill planning or response activities would ideally be standardized so as to equitably maximize the intended benefits while minimizing any unintended effects on participating individuals, fleets, and communities.

Social, Socio-demographic, and Economic Cost Dimensions. Certain near-term social and socio-demographic problems were readily observable in Dutch Harbor and Unalaska after the *Selendang Ayu* incident. Crowding, overextended business and public sector service activity, limited availability of goods and services, detraction from normal duties and ways of life, and problematic cross-cultural interactions were notable in the area during the winter months of 2004 and 2005. There were cases of initial verbal resistance to external authority, arguments between residents of Unalaska, arguments between local fishermen, and other expressions of strained interpersonal relationships during a period of uncertainty and rapid change.[37]

While such problems gradually abated, it should be noted that immediate deployment of a skilled cross-cultural liaison may during future incidents serve to reduce or preclude social conflicts or culturally related miscommunication between first responders and residents in spill-affected communities. Of note, a full-time tribal liaison position was established by the USCG beginning in 2010. The position was established to advance strong working relationships between the Coast Guard and tribal institutions in Alaska, and to facilitate effective communication across differing cultural domains, such as those typified by first responders and residents of the spill-affected community of Unalaska.[38]

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[36] Extensive discussion of seafood contamination in cross-cultural context is available in Field et al. (1999).

[37] This was also the case in the villages, towns, and small cities affected by the *Exxon Valdez* oil spill and clean-up in 1989 and 1990, where crowding, interpersonal stress, inter-group tensions, and shortages of goods and services were particularly troublesome issues for local government agencies and businesses at that time (IAI 1990 a,b,c,d).

[38] Noteworthy in this analysis is the passage of the Coast Guard Authorization Act of 2010 (H.R. 3619), portions of which address challenges inherent in oil spill prevention and response in the Alaska region. Section 307 of the Act advances safe maritime transportation in the Arctic by appropriating funds for aids to navigation, vessel escorts, search and rescue, and oil spill response. Section 706 of the Act provides for improved coordination between the Coast Guard and tribal entities around the nation, including those in Alaska.

Contingency plans for simultaneously addressing the practical needs of response workers and residents could also serve to reduce local and regional burdens of an unwanted spill event. While it may be difficult to address such problems in advance of an event of an as-yet unknown location and proportion, these issues would ideally be addressed at least in conceptual planning terms by the various state and federal agencies charged with addressing maritime oil spill impacts. Social effects documented during the *Exxon Valdez* accident, emergency, response, and near-term clean-up effort also indicate the need for consideration of such problems in spill-related community and regional planning processes. Because social problems occurring during the early phases of oil spills can persist and alter the trajectory of social and sociopolitical relationships in the future, the importance of such considerations cannot be overstated.

Finally, the *Selendang Ayu* incident was expensive. It resulted in known expenditures of at least $100 million. This incorporates many thousands of person-hours applied to emergency response and subsequent assessment, mitigation, and reporting processes among specific agencies. It does not account for all costs accruing to all agencies, nor does it account for economic costs or social effects resulting from the shift of available resources away from routine and/or other emergency duties elsewhere in the state or nation. In fact, federal costs and human resource challenges continue to date, as NRDA trustees continue to attend to assessment issues on Unalaska Island amid newer and equally pressing duties associated with the *Deepwater Horizon* accident in the Gulf of Mexico.

Conclusion. This study makes clear the value of examining human dimensions of maritime oil spills not only in the critical early response and clean-up phases of such events, but also during the subsequent years of adjudication and resolution. Significant maritime oil spills are in various ways socially disruptive and costly throughout their lifespan. This underscores the value of programs and policies designed to *prevent* such accidents along the nation's coastline.

Because a variety of social and economic effects resulted from the spill of the *Selendang Ayu*– an event that was relatively limited in scope– response planners can confidently expect similar effects to occur during spills of similar and larger scales in other parts of Alaska and elsewhere in the nation in the years to come. While difficulties are unavoidable, insightful planning that draws on lessons from the *Selendang Ayu*, the *Exxon Valdez*, and other spills and spill response efforts around the world may help minimize deleterious social impacts and economic costs.

Most unfortunately, the *Selendang Ayu* incident led to the loss of six lives and associated effects on families and communities in India. This outcome is not readily mitigable and its full ramifications are difficult to calculate and report in a meaningful way.

The incident command system implemented in response to the *Selendang Ayu* accident was successful in its mission to effectively coordinate the activities of numerous agencies in difficult environmental and logistical circumstances. However, a successful mission should not obscure the fact that the response effort was expensive and taxing to the agencies and personnel involved, and had the spill not occurred, expended funds and energies would have been applied to other operations.

The *Selendang Ayu* incident resulted in extensive economic impacts and various problematic social effects, including effects on social and political relationships within and between groups of persons involved in or affected by the spill and spill response. However, certain socio-political changes may be seen as manifesting more broadly and in a more positive direction. That is, the *Selendang Ayu* incident has led to establishment of institutions and programs that may ultimately enhance the capacity of oil spill response entities to meet the demands of prospective future spill situations in Alaska, with useful lessons for policy-makers in other regions.

For instance, the spill has led to implementation of emergency towing systems in ports in the Bering Sea, the Aleutian Islands, Kodiak, and Southeast Alaska. This constitutes a clearly practical means for preventing groundings, spills, and most significantly, situations that lead to the loss of life in some of the most treacherous conditions known to mariners across the world's oceans.

The *Selendang Ayu* incident also led to establishment of the Shipping Safety Partnership. In the years following the spill, the group heightened public and private sector attention to shipping-related challenges in the Bering Sea and Aleutian Islands.

Perhaps most significantly, the spill led to a formalized Aleutian Islands Risk Assessment, which is generating solutions to existing and potential future navigational challenges in the region (Aleutian Islands Risk Assessment Project 2011). The assessment is addressing problems such as those indicated by Kurtz (2008:633-644), who describes gaps in policy that have led to a lack of precautions for safeguarding vessels that make innocent passage through the Aleutians via the Great Circle route between North America and Asia.

Finally, the pending results of the NRDA process may also generate positive outcomes. These would occur through remediation of the spill-affected physical and human environments or through equivalent benefits to ecosystems and associated human populations elsewhere in the Aleutian Islands.

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