An aerial photograph of two large oil tankers in a rough, choppy sea. The tankers are viewed from above, showing their complex deck structures and masts. The water is dark with white foam from the waves. In the background, a rugged coastline with dark, rocky cliffs meets the sea. The overall tone is somber and documentary.

The Selendang Ayu Oil Spill: Lessons Learned Conference Proceedings

August 16-19, 2005 — Unalaska, Alaska

Reid Brewer, Editor

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I would like to thank the sponsors of this year's Aleutian Life Forum for their generous contributions, without which none of this would have been possible. I would also like to thank the publisher of this proceedings: Alaska Sea Grant. A special thank you goes to my editor, Jan O'Meara of Wizard Works in Homer, for her patience throughout the compiling of the papers that have gone into this publication.

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I would like to stress that the primary contributors to the success of this year's Aleutian Life Forum were the speakers and authors of this publication. Thank you so much for all that you have done.

Most of all, I would like to thank the community of Unalaska for allowing us to host this forum and for getting involved. This forum proved to be a wonderful success in collaboration and synthesis of responding organizations, government agencies, researchers, and local community members. I hope this publication will prove useful in the communication of the lessons that we learned for the planning and prevention of future oil spills for other coastal communities.

— Reid Brewer
Alaska Sea Grant Marine Advisory Agent
Unalaska, Alaska



To Tell a Story

by Nancy Deschu

Stories are vital to our lives. It is likely that we need stories, almost like our bodies need food and water. Our human brains search through stories for patterns and chronology to help us understand our surrounding world. We scan the story like it is a landscape, looking for an outcome, making sense of how we would fit into that story, what we would do in that landscape. When tragedy strikes, such as the oil spills that have hit Unalaska's shorelines, we try to make sense of it. From different perspectives, we each tell our stories — be it witnessing wildlife dying, the extreme danger of working on a spill, the upheaval of a community, the demands of scientific investigations, the loss of a food source, the desecration of a place. No one will tell the same story. The harm the *Selendang Ayu* oil spill caused can not be calculated without the element of people telling their stories. Only then, we begin to approach an understanding, sensing more about our surrounding world.

It may take time before personal stories surface from the *Selendang Ayu* oil spill. Time is needed to sort and sift, to get a focus and perspective after a disaster. The *Exxon Valdez* went aground in Prince William Sound in March 1989. The oil spill caused extensive damage in the Sound and as far away as 500 miles southwest of the tanker's grounding. Throughout the book are some stories about the *Exxon Valdez* oil spill. They take place along Alaska's southwest coast, reflecting some of the personal, ecological and safety themes we are all confronted with in some way in the midst of a major oil spill.

Preceding page — Cleanup workers at Skan Bay, January 19, 2005, ADEC photo.



Introduction

Reid Brewer
Unalaska Agent
Alaska Sea Grant Marine Advisory Program

In response to the December 8, 2004 M/V *Selendang Ayu* grounding and subsequent oil spill off the island of Unalaska, several local groups organized the Aleutian Life Forum to discuss the lessons the community learned through this incident. In August 2005, Unalaska played host to 33 speakers from Alaska, Mississippi, Washington, and California. Speakers included university, government, and contract researchers, as well as several tribal and local representatives.

The Aleutian Life Forum (ALF) was meant to be an annual celebration of the wonderful diversity of life in the Aleutian Islands. With the dramatic impact of the oil spill on so much of our ecosystem and the resources that many Aleutian communities depend on, we changed the focus for our inaugural year to observe the lessons learned from the spill and its effect on wildlife, fisheries, and communities.

Each day there was an invited keynote and lunch speaker, up to 12 session speakers, and, later, an evening recap of the topics covered that day. After sessions for each day ended, community round-table discussions were held where federal, state, and local representatives sat together to share information and determine the lessons learned from the spill.

The Aleutian Life Forum 2005 served three distinct purposes. The first was to provide a venue for oil spill responders to communicate their missions and objectives during an oil spill response to other oil spill responders. The second was to allow community members of Unalaska and neighboring islands to listen to response organizations and understand how they fit together under the Unified Command structure. The third was to get together all of those involved with the oil spill (responders, researchers, and community members) to see if we might be able to suggest lessons learned from this spill to aid in

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understanding and potentially streamline efforts in future incidents.

In the pages that follow, you will read articles from presenters at this year's Aleutian Life Forum. In addition, we have added a few related perspectives on the oil spill. Finally, we address the lessons learned and the issues brought up at the round-table discussions.

It is the hope of the organizers that the Aleutian Life Forum will be an annual event. This forum was an excellent opportunity to learn and share our experiences as we, the community, lived and continue to live through the *Selendang Ayu* oil spill. The Aleutian Islands offer a unique environment, and the community of Unalaska is one of many whose livelihood depends almost completely on the oceans and the nearshore environment. We hope that these proceedings grant you some insight into oil spill response, our local community issues, and the lessons that we learned.



Overview of M/V *Selendang Ayu* Response

Captain Ron Morris, USCG Retired
Federal On-Scene Coordinator
Unified Command

Setting the stage for the oil spill

The M/V *Selendang Ayu*, a 738-foot Malaysian flag bulk freighter, loaded with 60,000 metric tons of soybeans, was on a voyage on the Great Circle Route from Seattle, Washington, bound for a port in China. The Singapore-based company, IMC Transworld, owns the vessel. The vessel also had approximately 478,000 gallons of oil aboard, including Intermediate Fuel Oil 380 (IFO 380), diesel oil, and miscellaneous lubricating oils. The vessel had been experiencing mechanical problems, apparently, during the transit. At approximately 1200 hours on December 6, 2004, after going through Unimak Pass and traveling north of the Aleutians for a time, the decision was presumably made by the chief engineer and master to shut down the engine to make repairs to a cracked cylinder liner. The weather was violent, with winds over 60 miles per hour. The vessel drifted downwind, rolling in the trough.

At 0400 on December 7, the Coast Guard Marine Safety Detachment in Unalaska was notified by the Harbor Master for the Port of Dutch Harbor that the vessel was adrift and requesting assistance in arranging for a potential vessel assist to take them in tow. Vessels were dispatched to assist. The Coast Guard Cutter *Alex Haley* was underway on a Bering Sea patrol and was diverted to the stricken vessel's position. In the port of Dutch Harbor, three vessels answered the call and got underway: the towing vessel *Sidney Foss*, the towing vessel *James Dunlap*, and the motor vessel *Redeemer*. The crew of the *Sidney Foss* did an absolutely incredible job of passing a tow line to the *Selendang Ayu* in those high winds and seas at around 2030 hours on December 7. Due to the high winds, violent sea state,

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and safety considerations for fear of tripping the tug, the *Sidney Foss* was unable to bring the bow of the *Selendang Ayu* around into the wind and stop the drift, but the drift was slowed until the tow line parted at about 0700 on the morning of December 8. The Coast Guard Cutter *Alex Haley* tried to pass a tow line, getting a messenger line across, but the messenger parted and a near collision occurred between the two vessels.

The *Selendang Ayu* continued to drift in deep water until 1525 on December 8, when the vessel drifted into shallow waters off Unalaska Island and then dropped one anchor to stop the drift. The anchor held for a short time, then parted. The second anchor was then used, and it held a short time as well. The *Selendang Ayu* grounded offshore just north of Spray Cape on the western shore of Unalaska Island 54 hours after the main engine was shut down to make repairs.

At 1715 on December 8, the Coast Guard began to evacuate the crew off of the vessel by helicopter. There were two helicopters used during this evolution, one from the air station at Kodiak and the other from the cutter *Alex Haley*. During the evacuation of the last of the crew, the Coast Guard helicopter with 10 people on board crashed. The second helicopter was able to rescue four people from the icy waters: three Coast Guard air crew members and a member of the vessel. Two personnel remained on the bow of the *Selendang Ayu*: a Coast Guard rescue swimmer who had been lowered to the vessel to assist with the vessel's crew evacuation and the Master of the *Selendang Ayu*. In the next hour, while they awaited the return of the helicopter to evacuate them from the grounded vessel, the ship broke into two pieces. They were later hoisted off the bow of the vessel and flown to Unalaska. Tragically, six crew members from the *Selendang Ayu* are missing and are presumed to have died in the helicopter crash.

The Response begins

The response for this incident started while the vessel was drifting, attempting repairs. Notifications were made to the various agencies and initial concerns for the drifting vessel were obtained. One of the first issues raised was the possibility of the vessel grounding on Bogoslof Island, an important bird and Steller sea lion habitat. The island is also rat free. The vessel's drift was observed by means of a tracking system developed by the Marine Exchange of Alaska, whereby the ship's Inmarsat communications system was used to send data

The Selendang Ayu Oil Spill

via satellite to the Marine Exchange tracking system. In this way the Coast Guard District Office Command Center could see the location and the track the vessel was taking without having to ask the vessel's crew. This allowed the vessel's crew to attend to the repairs without constantly updating location information to authorities. The island was missed as the vessel drifted close by, and the M/V *Selendang Ayu* subsequently grounded off the western shore of Unalaska Island.

It is suspected that the initial grounding of the vessel created an oil spill, as the helicopter crew that was rescued from the water had oil on them that looked to be heavier than the helicopter fuel. The vessel had three centerline tanks that held IFO 380 in the bottom of the vessel. When the vessel broke into two pieces, the number 2 centerline tank that held 40,132 gallons was completely breached, and the oil was discharged at that time. An unknown amount of oil from the numbers 1 and 3 centerline tanks was possibly escaping due to the grounding damage. The number 1 centerline tank held 176,473 gallons, and the number 3 centerline tank held 104,448 gallons. There were additional tanks aft, on the port and starboard sides of the vessel, located higher up the sides, above the bottom, that also held IFO 380 and diesel oil. The engine room had additional tanks for lubricating oils and day tanks with IFO 380 and diesel oil.

On December 7, while the vessel was still drifting, a representative for Gallagher Marine, representing the responsible party (RP), the State of Alaska On-scene Coordinator (SOSC) from the Department of Environmental Conservation, and the Federal On-scene Coordinator (FOSC) from the Coast Guard Marine Safety Office in Anchorage met to discuss the initial response strategies in the event the vessel grounded. It was decided to maintain a command post at the offices of Pacific Rim in Anchorage, form a Joint Information Center in Anchorage, and to begin to forward deploy people to Unalaska. The FOSC arrived in Unalaska on the 8th at 1730 hours, finding a command post already established in the Grand Aleutian Hotel. The calls began with the Coast Guard District Commander in Juneau at 1813 hours, gathering the most up-to-date information on the vessel's position and condition, as it had just run aground and the remaining crew members were being evacuated. Our first incident action plan (IAP) was completed on the 8th, with the first IAP signed by the Unified Command of the RP, SOSC, and FOSC on the 9th. The objectives established in that early IAP were as follows:

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1. Protect the health and safety of the public and responders.
2. Protect sensitive areas, to minimize impact to the environment, cultural, subsistence, and economic resources and property.
3. Assess the condition of the vessel and prepare alternative courses of action for review.
4. Evaluate the feasibility of source control and on-water recovery operations, develop plans, if needed.
5. Establish Shoreline Cleanup Assessment Techniques (SCAT) program to assess shoreline impacts and recommend cleanup measures.
6. Provide wildlife recovery and rehabilitation as needed.
7. Mobilize resources needed for the response.
8. Develop an incident command organization suited to expected needs and contingencies.
9. Provide thorough liaison with local agencies and communities to keep them informed and address their needs and concerns.
10. Provide accurate information to news media and the public.
11. Provide proper documentation of the response.
12. Develop contingency plans and preparations for catastrophic discharge.
13. Develop waste management plan.

These objectives served as the foundation for the unified response and were amended as the situation warranted.

The response can be characterized by three main phases of activity, based on the seasons. The Initial phase began with the onset of the response and ran until we shifted to the Winter Operations phase. This was then followed up with the Spring/

Summer Operations phase that was still under way in August 2005.

Initial Response Phase (December to February)

The initial phase of the response began with the assessment of the situation, providing protective booming to important streams and other locations, planning how to recover the remaining oil on the two vessel sections, and gearing up for open-water recovery of floating oil. Contingency plans and environmental sensitivity maps were referenced to determine what might be at risk from the spilled oil. This information was used to develop a first-blush listing of where protective booming should be attempted. In one of our first meetings with local tribal members and Native corporation representatives, the Unified Command members asked for verification on our listing of sites for protective booming. The listing was validated, but the additional input on prioritization of the sites was especially important. The actual booming of the sites was not so easily accomplished, as some of the sites were in very exposed areas; but, through a combination of vessels and helicopters deploying the protective booming to the sites, the task was accomplished.

Later, the Unified Command had personnel assess the effectiveness of the booming that had been done, and some sites were eliminated, while others were adjusted to be more efficient. The commencement of oil removal from the heavily impacted beaches was an activity that initially was considered not too practical, due to what we thought would be severe winter weather that would prevent such activities from being safely accomplished. It was difficult not to compare what happened during the M/V *Kuroshima* spill, when the weather became so severe that beach cleanup was delayed and planned for the milder spring weather window when workers could more safely access the beaches. We changed direction though, as the winter storms did not come rolling into the area one after the other. The Unified Command directed beach cleanup of the more heavily impacted areas that had the most potential for remobilizing the oil if left alone and took advantage of the milder winter weather being experienced. Through local input, the Unified Command was informed that this type of milder weather was not so unusual. Once again, local input was valuable to the Unified Command's direction of the response. The shoreline impacts were assessed through a series of over

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flights and beach surveys with the use of helicopters, placing multi-agency teams of personnel trained to document the distribution and extent of oiling for the purpose of identifying gross oil removal priorities. At that time, we had divided the northern Unalaska Island shoreline into 460 segments to assist in identification and geographic referencing for response activities. A SCAT plan would be developed to mobilize a systematic field survey in the spring to update the data base and provide recommendations for planning shoreline treatment and operations.

During the initial phase, 1,760 meters of heavily impacted beaches had gross oil removal completed before shifting into the winter phase. An important mission that was prevalent throughout this response was the awareness of the cultural sensitivity of the area. Historic property specialists were provided by the FOOSC and the RP. They worked with the State Historic Preservation Officer and the local tribal members to ensure that any activities conducted during this cleanup did not disturb known historic sites, and they were to document new sites that might be discovered. The key document used for this activity was the Programmatic Agreement on the Protection of Historic Properties during Emergency Response developed for implementation of the National Historic Preservation Act.

There were also concerns with commercial fisheries scheduled shortly after the vessel grounding. A crab opener scheduled for Skan and Makushin bays was cancelled, but the Opilio crab fishery commenced as scheduled. Concerns with this fishery were for the returning vessels that must circulate sea water through their tanks while awaiting their turn at the processors' dock to unload their catch. Tar balls and large tar patties were floating around the island into Unalaska Bay. Extra efforts were provided through enhanced seafood inspections by the State of Alaska and a Unified Command backed water-quality testing program that included towing nets through the water and crab pot snares looking for tar balls. Whole-water sampling was also taken for water quality analysis. Advisories were published for the fishing fleet to help minimize the potential for tar ball contact. The entire crab fishery was completed without oil impact to any of the catch or the processors' production plants.

The bow and stern sections of the *Selendang Ayu* were initially assessed for the potential of refloating, but analysis revealed that the stern section would not float. The bow section had a chance early on, but progressive flooding was continuing

on the bow section and it was only a matter of a few days before the bow would be sunk completely. The amount of oil remaining on the vessel was unknown, and a survey of the bow and stern sections was made in an attempt to quantify the oil amounts that remained and to develop proposals for lightering that oil from the vessel sections. A lightering plan was developed that utilized a heavy-lift helicopter to off-load cubes filled with oil that would be pumped from the vessel's tanks. The bow section sank prior to the commencement of these activities, but the stern section remained accessible. A total of 144,931 gallons of oil were removed from the stern section through the lightering efforts. A remote operating vehicle (ROV) was used to view the sunken bow section and the underwater portion of the stern section to identify the tank integrity of the number 1 centerline tank on the bow section and the number 3 centerline tank on the stern section. Those efforts found substantial damage to the bow and stern sections, including no tank integrity to both of those tanks, leading the unified command to conclude that the oil loss from the vessel was 321,052 gallons, based on the oil in the number 1, 2, and 3 centerline tanks.

The U.S. Fish and Wildlife Service (USFWS) responded to this spill, providing the Unified Command with recommendations for the capture, stabilization, and rehabilitation of impacted wildlife. The FOSC entered into a Pollution Removal Funding Authorization (PRFA) with USFWS on the 8th of December for expenses that were related to the emergency response to wildlife and sensitive habitats. International Bird Rescue and Research Center (IBRRC) personnel were mobilized through USFWS to assist in the capture, stabilization, and rehabilitation of oiled birds. There was some capture of live oiled birds, but there was, by far, more carcass collection. It was observed that the carcasses were being scavenged, which led to some concern about the secondary oiling of wildlife. There were some impacts to otters as well, with some mortality noted. Also, several harbor seals were noted to have been oiled.

The Unified Command developed a winter operations plan and shifted to that plan when worker safety was impacted for vessel operations with icing conditions, shoreline operations were impacted due to snow and ice, and weather delays unacceptably hampered operations.

Winter Operations Plan

There was a great deal of activity in the winter to prepare

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for shoreline cleanup in the spring/summer season. The objectives for this phase included:

- Safety of all response personnel.
- Minimize environmental damage.
- Maintain information on the situation status and provide to stakeholders.
- Continue to track oil movement and identify extent of shoreline oiling.
- Commence planning for springtime SCAT surveys.
- Conduct appropriate HAZWOPER training in Unalaska through the winter to maximize local hiring for spring/summer shoreline cleanup.
- Monitor for and respond to, new significant wildlife impacts.

During the winter phase, vessels were identified to support the upcoming cleanup activities and, through coordination with the Coast Guard, the vessels were either inspected or examined to ensure suitability for the task. Communications to the fleet of vessels and shoreline workers was also something that was necessary to plan and resource, as voice and data communications needed to be established to the other side of the island. Surveillance flights of the wreck and beaches were conducted, and the SCAT plan was developed to determine the shoreline cleanup priorities and end points.

Spring/Summer Operations

Mobilization for this phase began in early April, with shoreline assessment training for the teams that would be working together to survey and document the extent of oiling and provide an accurate geographic or spatial picture of the shoreline oiling conditions. The surveys would provide appropriate information for decisions regarding shoreline treatment, cleanup operations and tactics, and end points for cleanup. The SCAT surveys began with two helicopter-based teams and two boat-based teams. The total number of segments to be surveyed was 806 and included areas on Unalaska, Umnak, and Akutan islands.

To date, all of the segments have been assessed. As of this

writing, 123 segments were recommended for treatment of some kind. The shoreline cleanup was to be done from a vessel-based support system. Shoreline cleanup personnel would be berthed on vessels and access their assigned segments of beaches during favorable weather and tides. Two teams of personnel, in Skan and Makushin bays, were assembled. To date, 84 of the 123 segments are ready for final landowner inspection and 57 segments are ready for final Unified Command and landowner approval. The waste stream was developed to have the waste brought from the beaches and placed onto a barge that, when full, would proceed to Washington state for off-loading and further transport to a secured landfill in Oregon.

Cleanup of the segments continued as this forum met, with 94 of 123 segments completed by the crews. There is hope that most of the cleanup can be completed this season, but there is a chance that follow-up will be necessary next year. The wreck removal issue is still being worked, but plans are being developed to remove the superstructure of the stern section. The future of the remaining portion of the wreck has yet to be determined.

Lessons Learned

The response is not complete, and this listing is by no means all inclusive, but here are several lessons learned, to share from our early assessment of our actions to this oil spill.

Public outreach — At one of the first Unified Command meetings designed for members of the response team, we found the room jammed with people from the island who were very interested in the response. We quickly determined that this was very disruptive to our meeting and we needed another avenue for public information. Also, security to the room needed to be stepped up immediately. We established a nightly meeting schedule at the city hall to update the citizens of Unalaska on the response. We started out nightly, and adjusted the meeting schedule as the response entered into the winter and spring phases. One of the ground rules for the meeting was that the press was allowed to attend and record the event, but the FOOSC established that no questions would be entertained from the press during these town meetings, which were for the citizens of Unalaska. Regular press conferences were held separately for the press.

Consultations with tribal and Native corporation representatives — The Unified Command set a daily meeting schedule (Sunday excluded) to provide a forum in which to gain information on the response operations and to get their feedback and concerns. We worked with four Native corporations and one tribe. Tribes have government-to-government status with the FOSC. This arrangement proved to be very valuable to the Unified Command. The group grew in number at times, as we started to include other landowners/trustees, such as the Alaska Maritime National Wildlife Refuge.

Documentation of the response — The Unified Command, early in the response, established that the RP would compile the documents generated during the response and provide copies of all of the documents to the RP and the State of Alaska, with the originals going to the Coast Guard. The Unified Command also generated decision memos for the file, outlining the reasons for some of the more important or contentious issues.

Unified Command — The UC consisted of the FOSC, SOSOC and the RP. All of the members presented respective areas of responsibility and expertise and worked together in public forums, press conferences, and in creating decision memos that helped to document their actions.

Position of the Salvage/Lightering section within the ICS structure — The Salvage/Lightering section was provided with direct access to the UC, and cooperated with the operations section in air operations and the logistics section in meeting some of their equipment shipping issues. The salvors had flexibility to make changes without bureaucracy and provided their information in the form of daily reports and UC attendance at their section meetings at the beginning of the day. Salvors may prefer to be independent, but having them integrated within the ICS structure, with direct access to the UC worked, yet gave them the freedom to complete their mission.

Liaison Officer — The FOSC for this response was fortunate to have on his staff an officer who had a great deal of local knowledge and knew just about all of the business and government people in the community. The Liaison Officer function rotated between several different Coast Guard personnel after the course was set for good communications.

ADEC Web site use — Once again, the State of Alaska turned on the switch and established the UC Web site for this response. The posting of information on the site was a great way for the public and the press to see documents such as the Incident Action Plans, message traffic, and plans that were developed by the UC. Pictures were also posted and links to other sites were added. The Web site was a great tool and deflected some of the “feed the beast” labor that is always present in a response.

Captain Morris was the Federal On-scene Coordinator for the initial response and continued in that capacity until his retirement from the Coast Guard on June 15, 2005.

The Oil Comes Ashore Cape Douglas, Katmai Coast

by Nancy Deschu

I kneel down at a tide pool and examine the oil. For four weeks it has been adrift on cold sea water, changing its chemical makeup and color, becoming viscous. Now it is dark brown, like bittersweet chocolate, and it has the consistency of peanut butter. The smell is hardly noticeable, the lightweight hydrocarbons have volatilized during its nearly 350 mile journey from Prince William Sound to this shoreline. I plunge my penknife into the oil and pull it out. The oil clings to the stainless steel blade like thick glue. I wipe it off on a bandanna but a thin film remains smeared on the blade.

Parallel to the upshore edge of the oil, I lay out the 100 meter tape measure. I start at the 0 mark. Measuring, observing. 5 meters. Collect a sample of oil for fingerprinting, as we have to prove in court that this giant wave of oil indeed fled from the grounded *Exxon Valdez* tanker. Collect a sample of water for analysis of petroleum components. Mark the chain of custody sheet. 10 meters. I probe with a metal meter stick for oil depths — but I already know that it is at least ankle-deep in certain places, because I accidentally stepped in a tidepool and the oil marked my rubber boot. 15 meters. A few pools escaped oiling, small fish dart around, some crabs scuttle, pink coralline algae still dazzles here and there. 20 meters. I collect another sample of oil, mark the chain of custody sheet. 25 meters. Take photographs, enter the information into the photo log.

At 30 meters, I notice a pattern. There are so many cobbles the same size, the same shape. It is not a normal distribution of beach rock sizes. I look back to where I started and then look ahead. Too much of a pattern. I stand puzzled for a moment. Then slowly, so slowly, I reach out with the meter stick and tentatively touch one of the suspect cobbles. The silver metal edge cuts into the oil layer and continues to sink, revealing the fine white belly-feathers of a bird. All around me, a field of birds coated in oil. . . .

Preceding page — Oiled pelagic cormorant, USFWS photo.



Shipwrecks, Spills and Seabirds: Wildlife at Risk on the Alaska Maritime National Wildlife Refuge

Anne Morkill, Deputy Refuge Manager
U.S. Fish and Wildlife Service
Alaska Maritime National Wildlife Refuge

Introduction

The Aleutian Island archipelago has a long history of human occupation that relies on the region's rich marine resources. The islands were first inhabited some 10,000 years ago by the Aleut people, who continue to subsist today on marine invertebrates, fish, birds, mammals, and plant species. Russia's "discovery" of Alaska in 1741 led to its subsequent settlement and exploitation beginning in the mid 1700s, followed by the Americans after the United States purchased Alaska in 1867. The harvest of fur-bearing marine mammals and fish supported large commercial enterprises and expanded trade throughout the North Pacific. However, the exploitation of some native species was not sustainable, and various scientific expeditions eventually brought national attention to the declining wildlife in the region. The Harriman Alaska Expedition reported not one single sea otter in their travels along the Alaska coast in 1899. In 1911, the Convention for the Preservation and Protection of Fur Seals regulated commercial harvest of northern fur seals and halted sea otter hunting. Further protection was afforded in 1913 when President William Taft established the Aleutian Islands Reservation, primarily for sea otters and native birds. In 1980, the Aleutian Islands refuge was combined with several other insular refuges to create the Alaska Maritime National Wildlife Refuge (NWR).

The Alaska Maritime NWR today encompasses some 4.9 million acres of islands from the southeast panhandle, through

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Figure 1. Alaska Maritime National Wildlife Refuge.

the Gulf of Alaska and Alaska Peninsula, along the entire chain of the Aleutian Islands, and several islands and headlands in the Bering and Chukchi seas (Figure 1). The Aleutian Islands Unit represents the majority of the refuge at nearly 2.4 million acres. Within the refuge boundary, there are also privately owned village and regional Native corporation lands, as provided for by the Alaska Native Claims Settlement Act of 1972. Unalaska Island includes the most diverse mix of land ownership, with more than half of the island privately owned by five different entities. In addition to Dutch Harbor-Unalaska, there are four communities (Adak, Atka, Nikolski, Akutan) and two occupied military sites (Attu, Shemya) located within the refuge's Aleutian Islands Unit.

There are other special designations of lands within the Alaska Maritime NWR that provide additional protections or highlight special features:

- More than 60% (2.37 million acres) of the refuge is designated wilderness under the Wilderness Act of 1964. According to that law, wilderness is “an area where the earth and its communities of life are untrammelled by man, where man himself is a visitor who does not

remain.” Wilderness areas have ecological, geological or other features of scientific, educational, scenic or historical value, and certain uses (such as motorized equipment) are regulated in these areas to protect the wilderness values.

- In 1976, the International Union for the Conservation of Nature (IUCN) designated the Aleutian Islands as an International Biosphere Reserve for the purpose of conserving, for present and future use, the diversity and integrity of biotic communities of plants and animals within natural ecosystems and safeguarding the genetic diversity of species on which their continuing evolution depends.
- The National Park Service’s National Natural and Historic Landmark Programs have designated several natural or historic features within the Alaska Maritime NWR that deserved special recognition — for example, Bogoslof Island for its geological interest and rich wildlife assemblage, and Attu and Kiska islands as World War II battlefields, among others.

About 40 million seabirds of more than 30 species nest on Alaska Maritime NWR lands, representing some 80% of all seabirds found in North America. Many other migratory birds, including ducks, geese, and shorebirds, also nest on refuge islands or winter in the protected bays. Refuge islands provide habitat for hundreds or thousands of marine mammals, such as sea otter, harbor seal, northern fur seal, walrus, polar bear, and the majority of rookeries for the endangered Steller sea lion. Some islands and headlands host terrestrial animals, including caribou, brown bear, arctic and red fox, and ground squirrel. Because of the isolation of many of the refuge islands, a number of genetically unique terrestrial forms occur that are found nowhere else, including six subspecies of rock ptarmigan, the Aleutian cackling (formerly Canada) goose, Aleutian green-winged teal, Aleutian rock sandpipers, and the Amak vole.

Alaska Maritime NWR is part of a national network of lands and waters for the conservation, management, and restoration of fish, wildlife, and plants, and their habitats for the benefit of present and future generations. There are more than 550 refuges nationwide, with 16 refuges located in Alaska. The National Wildlife Refuge System Improvement Act of 1997 amended earlier enabling legislation and reaffirmed that wild-

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life comes first on refuges, and priority public uses must be compatible wildlife-dependent activities, such as hunting, fishing, wildlife observation, wildlife photography, interpretation, and environmental education.

The establishing purposes for the Alaska Maritime NWR specifically include: (1) conserve fish and wildlife populations and habitats in their natural diversity, including marine mammals, marine birds and other migratory birds, and the marine resources on which they rely; (2) fulfill international treaty obligations with respect to fish and wildlife and their habitats; (3) provide the opportunity for continued subsistence uses by local residents; (4) provide a program of national and international scientific research on marine resources; and (5) ensure water quality and necessary quantity within the refuge. Alaska Maritime NWR achieves these purposes through annual monitoring of seabird productivity and population trends on ten sites throughout the refuge; conducting seabird, marine mammal and oceanographic coordinated investigations at select sites; implementing invasive species prevention, control, and eradication efforts; and offering interpretation and environmental education programs at the Alaska Islands and Ocean Visitor Center in Homer and various communities throughout the refuge.¹

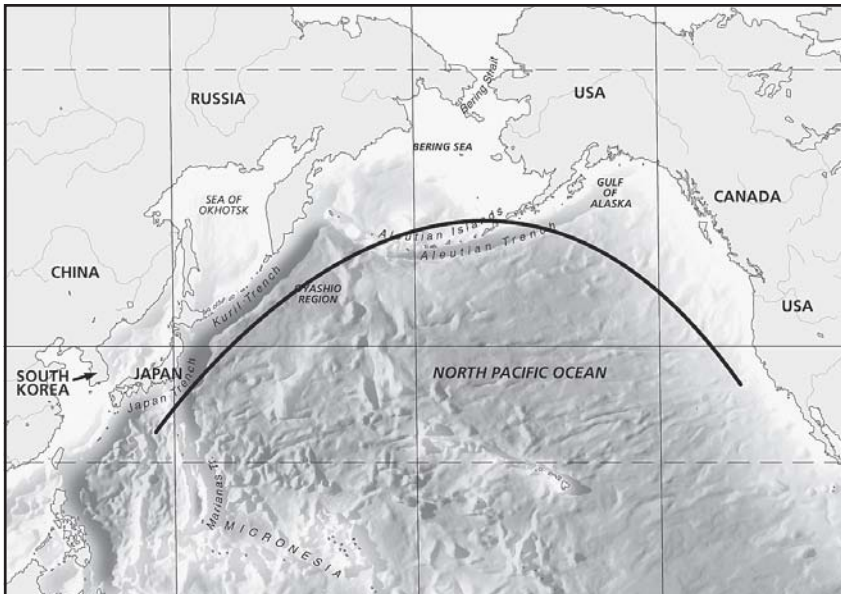


Figure 2. General representation of the North Pacific's Great Circle Route.

The purpose of my presentation as the keynote for the Aleutian Life Forum 2005's opening session on wildlife impacts is to offer an assessment about the vulnerability of the Alaska Maritime NWR's wildlife and wild lands to shipping accidents. In the following sections, I will, first, review the history of shipwrecks in the vicinity of the refuge; second, highlight regionally and globally important wildlife at risk in the Aleutian Islands region; and, last, illustrate resource challenges from shipping accidents on Alaska Maritime NWR.

History of Shipwrecks

The M/V *Selendang Ayu* event publicized the fact that an estimated 3,000 large vessels a year, on average of 10 per day, pass through the North Pacific's Great Circle Route on their way from major ports in the continental United States to and from Asia. The Great Circle Route transits through the Aleutian archipelago twice, passing through Unimak Pass in the eastern chain, and again to the west in the vicinity of Buldir and the Near Islands group (Figure 2).

In addition to the Great Circle Route, there are countless numbers of fishing boats, factory trawlers, barges, and passenger ships that travel to different coastal villages, harbors, and fishing grounds along the Aleutian Islands and Bering Sea coast.²

To frame the potential scope of shipping accidents, it may be instructive to look at what we know has happened to date. Based on records maintained by refuge staff and the Minerals Management Service, we know that more than 190 wrecks and groundings have occurred on or adjacent to lands that are now part of the Alaska Maritime NWR. These data can be categorized into vessel function and time periods:

- 15 Russian ships in mid to late 1700s during Russian exploration, settlement, and commercial sealing periods;
- 11 Japanese fishing boats or "junks" in the late 1700s and early 1800s;
- 75 schooners or steamers in the mid 1800s to early 1900s during American commercial whaling, sealing, and fish cannery periods;

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- 30 American or Japanese military vessels during the Aleutian Campaign of WW II (includes 13 Japanese ships and submarines at Kiska alone);
- 35 fishing vessels, primarily during the 1980-90s, which corresponds with the peak of the Bering Sea crab and groundfish fisheries;
- 26 freighters, barges, cargo vessels, and passenger ships in recent decades.

Recent freighter groundings of note include the T/V *Exxon Valdez* oil tanker in Prince William Sound (1989), the F/V *Kuroshima* in Unalaska Bay (1996), and the M/V *Selendang Ayu* in Skan Bay (2004). Large vessel accidents have not been limited to industrial traffic; for example, the M/V *Clipper Odyssey* passenger cruise ship grounded near the Baby Islands and spilled an unknown amount of marine diesel (2003). Interestingly, but perhaps not so surprising, the most shipwrecks and groundings on any single island occurred at Unimak Island, the largest island in the eastern Aleutians, adjacent to Unimak Pass, the most heavily traveled gateway between the Pacific Ocean and Bering Sea.³

What does the future hold for shipping patterns in the Aleutian Islands? Given observed rates of ice retreat and predictions by global climate models, scientists estimate that the Arctic Ocean may experience nearly ice-free summer seasons as early as 2050.⁴ Government and maritime interest groups are, consequently, assessing the potential economic opportunities and environmental risks of increasing the number and variety of marine vessels that could travel across the arctic, including more regional routes to service coastal communities and future resource development, trans-arctic traffic navigating between the Pacific and the Atlantic, and research and tourism cruises. It is likely that shipping traffic would increase in the Aleutian Islands and Bering Sea as a main access route from Pacific ports to the Arctic Ocean.

Why should we be concerned about current shipping and the potential for increased traffic in the Aleutians? Even before the M/V *Selendang Ayu* grounding, the idea of an Aleutian Life “Festival” was originally born from this community’s enthusiasm and dedication to celebrating and sharing the region’s rich cultural and natural history. We, therefore, need to learn how to avoid and mitigate future shipping accidents in order to conserve the natural values of the region. I’d like to take a few moments to highlight the unique natural values of the Aleu-

tians that support the abundance and diversity of wildlife found here and, in many instances, found nowhere else.

Life on the Edge

The Aleutian Islands are the world's longest archipelago, reaching 1,100 miles from Alaska's mainland nearly to Russia and crossing the east-west hemisphere line. It is characterized by a narrow ocean shelf that drops abruptly 25,000 feet in the Aleutian trench, it receives little fresh water input and no seasonal ice cover, and there are active volcanoes and frequent earthquakes resulting from the Pacific and Continental plates colliding along this arc. The archipelago is a major transition zone, where high velocity straits and passes connect temperate Pacific waters with subpolar Bering Sea waters. All of these features promote high productivity through intense mixing, nutrient upwelling, and high zooplankton production, which, in turn, support incredible numbers of marine fish, birds, and mammals. As I've mentioned previously, some 40 million seabirds of more than 30 species nest on the refuge, and each species has adapted to fill certain niches within the marine ecosystem. There are several layers to the food chain, within which seabirds form various foraging guilds: diving fish feeders (examples: murre, puffin, cormorant, guillemot), surface fish feeders (kittiwake, tern), diving plankton-feeders (auklet), surface plankton-feeders (storm petrel), opportunistic feeders (gull, bald eagle), and marine invertebrate feeders (oystercatcher, harlequin, goose). By studying representative species within each of these foraging guilds at the Alaska Maritime NWR's annual monitoring sites, we are able to document long-term trends in order to understand how the marine ecosystem functions and what environmental factors may be affecting seabird populations.

Among the abundant marine wildlife found on the refuge are several noteworthy species that may be particularly vulnerable to impacts from shipping accidents due to their restricted range or low abundance. Eight species live and breed nowhere else but in the Bering Sea, including whiskered auklet, crested auklet, least auklet, red-legged kittiwake, and red-faced cormorant. Several species — including fork-tailed storm-petrel, horned puffin and tufted puffin — breed in other areas of the North Pacific in relatively low numbers, but the overwhelming majority breed on Alaska Maritime NWR. Some species that travel long distances to this region to forage on its rich marine

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resources. For example, albatross (short-tailed, black-footed, Laysan) that nest in Hawaii or Japan forage widely across the North Pacific and offshore the Aleutian Islands. Millions of shearwaters travel from the southern hemisphere to spend their winter in Alaskan waters during our summer to feast on the abundant ocean resources.

Alaska Maritime NWR also provides important habitats to species that are formally listed as threatened or endangered under the Endangered Species Act of 1973. Nearly 70% of the world's population of threatened Steller's eiders winter in Alaska, from the eastern Aleutian Islands to lower Cook Inlet. The southwest stock of sea otters, representing populations from Kodiak to Attu, was recently listed as threatened due to their precipitous decline by nearly 70% since the mid 1980s. One of only two northern fur seal rookeries in Alaska is found on the refuge's Bogoslof Island, located northwest of Unalaska Island. Endangered Steller sea lions are found throughout the archipelago, but their numbers have declined 75% between 1976 and 1990, now numbering about 10,000 animals in the Aleutians Islands. Most sea lion rookeries and haulouts are located on refuge islands, and the National Marine Fisheries Service enforces no-fishing zones around rookeries.

This rich assemblage of diverse and often unique species has attracted the attention of many scientific and conservation groups, which have subsequently developed various initiatives aimed at conserving the biological diversity and integrity of the Aleutian archipelago and Bering Sea region:

- The World Wildlife Fund and Nature Conservancy are focused on linking species conservation programs and eco-regional planning across the Bering Sea from Alaska to Russia,⁵ and part of their effort has recently supported a "sister refuge" relationship between Alaska Maritime NWR and Russia's Commander Islands Nature and Biosphere Reserve.
- The National Audubon Society designated 49 sites on the U.S. side of the Bering Sea as Globally Important Bird Areas, including seabird colonies and adjacent marine waters where hundreds of thousands of crested auklets and other Beringian endemic species nest and forage.⁶
- The Marine Biology Conservation Institute, in cooperation with the Commission for Environmental Coopera-

tion, listed both the western Aleutian Islands with Bowers Bank and the eastern Aleutians with Unimak Pass as two priority marine conservation areas in a tri-national initiative to establish a network of marine protected areas from Mexico's Baja California to the Bering Sea.⁷

- The North Pacific Fishery Management Council recently recognized the need to balance the protection of sensitive coral reef and sponge habitats with sustaining world-class commercial fisheries, and, thus, designated several coral garden marine reserves and imposed restrictions on bottom trawling in the western Aleutians.⁸
- Most recently, the National Wildlife Refuge Association named Alaska Maritime NWR as one of six refuges most threatened from activities outside its boundaries, primarily due to the threats from shipping accidents such as the M/V *Selendang Ayu* case.⁹

Resource Challenges

Now, I'd like to review two different, but related, environmental risks from shipping accidents: oil spills and the introduction of invasive species, particularly rats. In the next few days, we will learn a great deal about how oil spills affect wildlife, fish, and intertidal species, and the communities and industries which rely on those resources, from the speakers that follow me during this forum, so I will only briefly review the M/V *Selendang Ayu* event. I will conclude with an overview of our rat management program in order for you to understand the resource challenges that we confront with shipping accidents.

M/V *Selendang Ayu* — The U.S. Fish and Wildlife Service (FWS) was notified on December 7, 2004, that a grain ship was adrift in the Bering Sea and headed toward Bogoslof Island. In addition to our initial fear of an imminent oil spill, we were highly concerned that the grain ship could be carrying rats, and a wreck on Bogoslof could have devastating effects on the island's wildlife. Despite its small size, at about one mile long by a half mile wide, Bogoslof hosts large numbers of nesting seabirds, remnant numbers of the endangered Steller sea lion,

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and it is one of only two Alaska rookeries of northern fur seals. The island is the tip of an active submarine volcano, located on the edge of the continental shelf where upwelling currents bring nutrients and prey to the surface for foraging marine life. President Theodore Roosevelt originally dedicated Bogoslof in 1909 as a sanctuary for sea lions and marine birds, and it is now part of the Alaska Maritime NWR. We, consequently, began preparations to respond to both an oil spill and possible “rat spill” on Bogoslof.

The ship continued to drift without power and bypassed Bogoslof, but grounded the following day near Spray Cape on Unalaska Island. The ship split in half, releasing about 336,000 gallons of fuel oil and diesel and most of its 60,000 ton cargo of soybeans. The most directly impacted shorelines were the exposed headlands and Skan and Makushin bays. Initial spill response efforts were hampered by poor weather and overshadowed by the tragic loss of human life. Responders were able to quickly identify environmental resources that were likely at risk using readily available information, such as the Aleutian Subarea Contingency Plan and Environmental Sensitivity Index Maps,¹⁰ and personnel and resources were mobilized accordingly. We did not implement a rat response effort because Unalaska Island already has introduced rats;¹¹ however, FWS personnel were deployed to the spill site to participate in the recovery of live and dead oiled wildlife as part of the Unified Command’s oil spill response effort.

Soon after the grounding, FWS also initiated natural-resource damage pre-assessment activities in coordination with other resource trustee agencies (State of Alaska, NOAA). Using Alaska Maritime NWR’s research vessel, M/V *Tigllax*, and contracted aircraft, biologists worked in the spill area to determine the abundance and distribution of wildlife resources at risk, and began assessing the loss of marine birds and mammals. There was a diversity of shoreline habitats present in the spill area that host large concentrations of wintering birds as well as resident populations of marine birds and mammals. Crested auklet, common murre, Steller’s eider, and emperor goose are examples of wintering species found in the offshore waters and protected bays of Unalaska Island. Black oystercatcher, harlequin duck, and Aleutian rock sandpiper were some of the species present in the intertidal habitats. Sea otters, harbor seals, and Steller sea lions were observed in nearshore waters and hauled out on rocks.

Biologists observed some 600 live oiled birds in Skan and Maksuhin bays during the first few days following the ground-

ing. However, weather and access hampered their capture attempts; and, consequently, only 23 live birds were captured. Live oiled harbor seals were observed, but no injured or dead seals were found. There were numerous sightings of live oiled gulls, bald eagles, and red fox during the response and assessment activities, which demonstrated that secondary oiling was occurring due to scavenging of oiled birds. Standard wildlife response objectives include the prompt removal of oiled debris (including carcasses) to minimize secondary oiling. More than 1,600 dead birds (representing at least 29 species¹²) and 6 sea otter carcasses were subsequently collected or documented during the initial response and pre-assessment activities through March 2005. Analyses are still under way to determine the full extent of wildlife injury, which will be used to calculate monetary damages in support of restoration efforts.

Rat Spills — With any shipping accident, Alaska Maritime NWR is also highly concerned about the potential for the introduction of rodents, particularly Norway rats. Rats have invaded 80% of the world's islands, primarily by way of ships, and they are responsible for 40-60% of all bird and reptile extinctions. Rats devastate native wildlife that have existed on islands without land predators and, thus, have not evolved adaptive strategies to evade predation. The first known rat introduction in the Aleutian Islands occurred in 1780 from the grounding of a Japanese fishing vessel on what is now known as Rat Island, in the Rat Island group of the western Aleutians. Additional rat introductions occurred on many islands that were occupied by the military during WW II's Aleutian Islands Campaign, and we now believe 17 Aleutian islands are infested with rats. Rat "spills" can, in many situations, be a more lasting and bigger environmental problem than oil spills, particularly to island nesting birds. Rats have a direct impact on the entire island ecosystem, eating terrestrial insects, marine invertebrates, and all life stages of birds, from eggs to chicks to adults. Rats have the ability to raise several litters of young per year, expanding their populations rapidly. Rats may also transmit disease to other animals, and they can damage human food stores, buildings, and other materials and supplies.

Alaska Maritime NWR has a successful history of removing invasive species from islands and restoring native species. Since the late 1940s, we have removed foxes, originally introduced by the Russians and, later, by the Americans for commercial fur farming, from 40 islands, totaling more than one million acres of restored habitat. Post-removal monitoring has

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demonstrated that the diversity and abundance of nesting birds has increased on these fox-free islands. The once-endangered Aleutian cackling goose and the endemic Evermann's rock ptarmigan are two species, in particular, that have benefited from fox-removal efforts. Given these successes, we are now transitioning into a comprehensive program of protecting and restoring islands through the prevention, control, and removal of rats.

The first, and most important, tier of this program is the prevention of new rat introductions to pristine islands. Fortunately, most Alaska islands are still free of rats. Rats can infest any kind of marine vessel, and any time an infested vessel docks, unloads cargo, wrecks, or even sends a skiff onshore, there is a risk of carrying rats along. Alaska Maritime NWR, with support from the National Fish and Wildlife Foundation, the Nature Conservancy, and World Wildlife Fund, has developed a collaborative program in the Pribilof Islands. Now managed primarily by the St. George and St. Paul tribal organizations, the program includes permanent trap stations surrounding the harbors, local ordinances prohibiting rat-infested vessels from entering the harbors, on-board inspections, and distributing rat prevention kits to the marine fleet. Thanks in part to the Aleutian/Pribilof Islands Association, this program is expanding to Sand Point and Adak, and, we hope, to Unalaska-Dutch Harbor. Alaska Maritime NWR also practices other prevention efforts, including maintaining trained personnel and rat-detection kits (traps, sticky boards, etc.) to respond to shipwrecks, and quarantining all field supplies and gear prior to loading onto the refuge's M/V *Tiglax*, which visits dozens of islands each summer.

The other program tiers are to control and eradicate rats on islands they currently occupy. Rodent eradication by baited traps and aerial broadcast of rodenticide has been successfully employed in New Zealand, British Columbia, and California. Alaska Maritime NWR is in the process of testing and modifying those methods to be effective in an Aleutian setting. Field studies include small-scale removal trials on small islets in the Bay of Islands at Adak and research on rat ecology and their impacts on intertidal ecology on Rat and Adak islands. Researchers are also monitoring auklet productivity at a large colony on Kiska Island that experiences high rates of rat predation. Control efforts may be the only feasible way to manage rats on large islands such as Kiska, whereas total eradication may be possible on smaller islands, such as Rat. We will continue to build our capacity towards implementing a long-term

comprehensive program to return rat-infested islands to their former status and restore the native wildlife.

Conclusion

Even though the wildlife and wild islands of the Aleutians are protected as a National Wildlife Refuge, and other conservation measures in the region further enhance the sustainability of the marine ecosystem, the mere existence of such designations is not enough. Effective management requires proactive, collaborative efforts among landowners, regulatory agencies, communities, industry, conservation organizations, and other stakeholders to recognize and address the threats of human activities occurring both within our designated boundaries and from beyond. I believe that this forum provides an excellent opportunity for an educated discussion of what we have learned from the M/V *Selendang Ayu* event, which will ultimately inform a broader effort to enhance the safety of shipping in Alaska waters. The Aleutian Life Forum celebrates the linkages between air, land, and sea, and I have, I hope, set the stage for discussing the impacts of oil spills on wildlife by highlighting this region's rich and "intricate fabric of life," to borrow from Rachel Carson:

The shore is an ancient world, for as long as there has been an earth and sea there has been this place of the meeting of land and water. Each time that I enter it, I gain some new awareness of its beauty and its deeper meanings, sensing that intricate fabric of life by which one creature is linked with another, and each with its surroundings.

¹ For more detailed information about the Alaska Maritime National Wildlife Refuge, visit our Web site at alaska.fws.gov/nwr/akmar/index.htm.

² See "Vessel Traffic in the Aleutians Subarea" report to ADEC for a comprehensive assessment of current marine traffic levels at www.dec.state.ak.us/spar/perp/docs/050429%20vessel%20report%20S.pdf.

³ Note that our numbers emphasize shipwrecks on the refuge, but there are many other areas of Alaska's coastline that have experienced shipwrecks. These data also do not include all reported fuel spills which may not have involved a wreck or

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grounding. See Alaska Department of Environmental Conservation's Division of Spill Prevention and Emergency Response Web site for data on reported spills at www.dec.state.ak.us/spar/perp/index.htm.

⁴ See Arctic Marine Transport Workshop report at www.arctic.gov/files/AMTW_book.pdf.

⁵ See www.panda.org/about_wwf/where_we_work/arctic/what_we_do/marine/bering.cfm.

⁶ See iba.audubon.org/iba/viewState.do?state=US-AK.

⁷ "Priority Conservation Areas: Baja California to the Bering Sea" report can be downloaded at www.mcbi.org/marineprotected/Marine.htm#PCA.

⁸ See www.fakr.noaa.gov/npfmc/current_issues/HAPC/HAPCmaps205.pdf.

⁹ "State of the System: Beyond the Boundaries" report can be downloaded at www.refugenet.org/new-publications/SOS.html.

¹⁰ See at www.akrrt.org/plans.shtml.

¹¹ It is unknown if the M/V *Selendang Ayu* was infested with rats or other rodents.

¹² Bird species were identified on site when possible; however, some 500 carcasses that were either too oiled and/or heavily scavenged to identify were sent to UAF for further analysis (results pending as of 9/05).



Remote Wildlife Response Issues: A Case Study of the *Selendang Ayu* Response in Unalaska, Alaska

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Abstract

On December 8, 2004, the Malaysian freighter, *Selendang Ayu*, ran aground on the rugged west coast of Unalaska Island, some 800 air miles from Anchorage, Alaska, in the Alaska Maritime National Wildlife Refuge. The freighter then broke in half and spilled most of the 478,000 gallons of fuel on board.

Responding to and managing an oiled wildlife event is challenging enough, but when a spill happens in an extremely remote area of the world and a wildlife response is needed, the logistical aspects can be very complicated, further adding to the difficulty of providing a timely, organized response. In such a case, contingency planning, stockpiling of equipment, and pretrained personnel all play a vital role in accomplishing a difficult task.

During the initial days of the response, over 600 live, oiled seabirds were counted in the oiled area and wildlife crews were staged, equipped, and deployed to begin search and collection. Large crabbing vessels were used as platform vessels to support all field operations for the wildlife response teams, providing berthing, meals, equipment storage, skiff launch, and wildlife stabilization space on board. Captured birds were stabilized on board and transported to Unalaska by helicopter and then on to the Alaska Wildlife Response Center (AWRC).

Owing to a hurricane-force storm that came through on day four of the response, only 23 oiled birds, in total, were captured and treated; ten of those were released successfully.

This paper will use the case study of the *Selendang Ayu* spill response to explore the issues of remote response, includ-

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ing the need for contingency planning, training and stockpiling of equipment in sensitive marine areas, as well as response in extreme weather conditions.

Discussion

On December 8, 2004, the Malaysian freighter, *Selendang Ayu*, ran aground on the rugged West coast of Unalaska Island, some eight hundred air miles from Anchorage, Alaska, and along the Aleutian Chain, in the Alaska Maritime National Wildlife Refuge. The stricken freighter very quickly broke in half and spilled an estimated 321,052 gallons of IFO 380 (Intermediate Fuel Oil), along with 14,680 gallons of marine diesel fuel and 60 thousand tons of soybeans as freight.

The International Bird Rescue Research Center (IBRRC) was activated on the afternoon of December 8, and two IBRRC staff arrived in Unalaska Island early on the 9th of December, with an additional eight team members arriving that afternoon. IBRRC Executive Director, Jay Holcomb, arrived in Anchorage on December 15, along with two additional Rehabilitation Staff members to ramp up the AWRC in Anchorage and prepare to receive oiled birds at that facility. IBRRC supplied the following positions for the *Selendang Ayu* Wildlife Response:

- Wildlife Branch Director - Command Center;
- Wildlife Recovery Group - Spill site;
- Stabilization - Shipboard, wildlife recovery vessels;
- Stabilization - Dutch Harbor Unalaska Fisheries Center;
- Rehabilitation - Alaska Wildlife Response Center in Anchorage.

The Aleutian Islands provide wintering habitat for a number of migratory birds, including, but not limited to: loons and grebes; three species of cormorants; emperor geese (*Chen canagica*); dabbling ducks and diving ducks, including the threatened Steller's eider (*Polysticta stelleri*); mergansers (*Mergus*); raptors, including bald eagles (*Haliaeetus leucocephalus*) and peregrine falcons (*Falco peregrinus*); shorebirds such as the rock sandpiper (*Calidris ptilocnemis*); gulls; alcids, including murrets (*Uria*) and auklets; and a number of passerines, including belted kingfisher (*Ceryle alcyon*), corvids, winter wren (*Troglodytes troglodytes*), song sparrow (*Melospiza*

melodia), and gray-crowned rosy-finch (*Leucosticte arctoa*). Additionally, there are a number of marine mammals that make the Aleutian Islands home, including sea otter (*Enhydra lutris*), seals — northern fur (*Callorhinus ursinus*) and harbor (*Phoca vitulina*) — Steller sea lion (*Eumetopias jubatus*), as well as a number of whale species.

Search and Collection

The *Selendang Ayu* ran aground and broke in half approximately twenty-five air miles from Dutch Harbor, at Spray Cape, on the southwest side of Unalaska. With seas as high as 25 feet and sustained winds of 40-60 knots, gusting to 70 knots, it was deemed unsafe by the Coast Guard to send vessels to the spill site during the first days of the spill. In the early morning hours of December 13, the vessel *Cape Flattery* left port with spill response crews to lay boom and two IBRRC Search and Collection Staff (Curt Clumpner and Ken Brewer) on board, as well as two U.S. Fish and Wildlife Service (USFWS) biologists.

The *Cape Flattery* is a 168-foot vessel that was equipped with several 22- to 24-foot aluminum skiffs, one of which was dedicated to wildlife recovery. The vessel arrived at the spill site in Skan Bay at 0600 on December 13, and, by afternoon, search and collection for live, oiled animals began. Wildlife crews used the *Cape Flattery* as a platform vessel, sleeping and eating on board, and used the smaller skiffs for wildlife collection. One room on the *Cape Flattery* was outfitted for wildlife stabilization. The room was directly accessible from the deck and off the common transit corridors. With coastline being predominately rocky shores, search and collection was done from skiffs, a boat operator and one or two capture personnel on each wildlife skiff.

During initial stages of stabilization, birds were warmed by using heat packs, as well as by placing them in a warm room and allowing them to regain normal body temperature. Birds were then given Toxiban® (Lloyd, Inc., Shenandoah, Iowa, USA) orally and followed by oral Pedialyte® (Abbott Laboratories, Abbott Park, Illinois, USA) to counteract dehydration. Once birds were hydrated, they were given Ensure® (Abbott Laboratories, Abbott Park, Illinois, USA), orally, for nutrition.

Birds deemed stable enough for transport were then taken to the Stabilization Center in Unalaska (managed by IBRRC staff), via helicopter or by vessel transport. Once in Unalaska, birds were further stabilized by providing thermoregulatory

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assistance, fluid therapy and nutrition and then moved to the AWRC, Anchorage (managed by IBRRC), via commercial airline, for rehabilitation. Generally, stabilization in Dutch Harbor took 12 to 24 hours before the birds were medically ready to be transferred to the AWRC. In total, 23 live, oiled birds were captured, with ten of those being released (Figure 1).



Figure 1. Crested auklets in reconditioning pool.

It was immediately obvious that dedicated wildlife resources were needed, as several hundred oiled birds were



Figure 2. Preparing launch from *Exito* for Search and Collection.

observed by USFWS and IBRRC capture personnel in the spill area, but since the primary mission of the *Cape Flattery* was to support the boom-laying operations, search and collection for wildlife was a secondary priority. Authorization for a dedicated wildlife platform vessel was given on December 14, and IBRRC staff in Dutch Harbor spent the next several days preparing the F/V *Exito* as a platform vessel for collection and field stabilization of oiled wildlife.

The *Exito* is a 124-foot crabbing vessel that is capable of supporting three 22- to 24-foot skiffs

(one aluminum and two inflatable boats were put on board), as well as Alaska Chadux Inc.'s wildlife trailer (Figure 2). The trailer was stocked with wildlife stabilization supplies and secured onto the deck of the *Exito*.

On December 17, the *Exito* left Dutch Harbor for the spill site with additional four IBRRC staff. Curt Clumpner and Ken Brewer were transferred to the *Exito* from the *Cape Flattery*.

On December 18 and 19, wildlife crews captured five live, oiled birds, which were stabilized on the vessel and brought into Dutch Harbor by the *Exito*. U.S. Fish and Wildlife staff counted an additional 600+ oiled birds. On December 19, the *Exito* came into port after all vessels in the response fleet were called back to Dutch Harbor by the Unified Command, because of extreme weather conditions.

All response crews were made to stay in port for four full days. Finally, on December 23, 2004, the *Exito* was allowed to depart Dutch Harbor and was positioned in Makushin Bay, near the spill site, by early on December 24.

A second wildlife platform vessel was authorized by the Unified Command on December 21, and the F/V *Norseman* was contracted. The *Norseman* is also a 124-foot crabbing vessel that was outfitted with the Alaska Clean Seas Wildlife Stabilization Unit, which is made up of two 14-foot connex containers and supplied with a chest freezer, refrigerator, microwave oven, medical supplies, water, and heat capacity. The ACS Stabilization Unit was trucked to Anchorage from Prudhoe Bay and then brought to Dutch Harbor on a C-130 aircraft. The unit was secured onto the deck of the *Norseman*, along with three 24-foot aluminum work skiffs.

The *Exito* and *Norseman* wildlife collection and stabilization crews were able to capture a total of 23 live, oiled birds, which were stabilized on the vessels and then transported back to Unalaska for further stabilization prior to transport to the AWRC in Anchorage (Figure 3).

No live, oiled wildlife has been seen or reported since December 26, and the last oiled bird was captured on December 25. In consultation with USFWS, Search and Collection crews were brought into Dutch Harbor from the spill site on January 6 and demobilized on January 7. For more information on total animals captured, by date and species, please refer to Table 1. For information on final disposition of captured birds, please refer to Table 2.

Oiled birds that were brought to the Stabilization Center in Unalaska were given treatment consistent with IBRRC published oiled-bird-care protocols. Stabilization procedures were



Figure 3. IBRRC Search and Collection team at wreck site.

Date Captured	Species	# captured
12/13/04	Common murre (<i>Uria aalge</i>)	1
	Long-tailed duck (<i>Clangula hyemalis</i>)	1
	Harlequin duck (<i>Histrionicus histrionicus</i>)	1
12/14/04	Horned grebe (<i>Podiceps auritus</i>)	1
	Pelagic cormorant (<i>Phalacrocorax pelagicus</i>)	1
12/15/04	Common murre	2
12/16/04	Crested auklet (<i>Aethia pygmaea</i>)	6
	Common murre	1
12/18/04	Crested auklet	3
	Common murre	1
	Glaucous-winged gull (<i>Larus glaucescens</i>)	1
12/19/04	Glaucous-winged gull	1
	Long-tailed duck	1
	Crested auklet	1
12/25/04	Common murre	1
TOTAL		23

Table 1. Total numbers of birds captured presented by date and species.

Total Captured	23
Total Euthanized	2
Total Died	11
Total Released	10

Table 2. Final disposition of birds.

continued, which were, generally, providing the birds a warm environment and fluid therapy. Fluid therapy included various methods of administering fluids such as gavage, i.v., and subcutaneous. Initial blood diagnostics were performed at the Stabilization Center, including Packed-Cell Volume, Total Solids, Buffy Coat, and Blood Glucose. Based on the overall evaluation of each animal, a transportation plan was put in place to get the animal to Anchorage to the AWRC (managed by IBRRC).

Once at the AWRC, the oiled birds were given supportive care, including continued fluid therapy, antifungal medication, and nutritional support, and monitored. When the oiled birds met all pre-wash criteria (PCV >30%, TS > 2.5 g/dl, good body condition and responsiveness), they were washed, rinsed and dried, according to IBRRC published protocols.

After cleaning, birds were re-waterproofed, using reconditioning pools. Waterproofing is a process that usually requires several days to a week, allowing time for the birds to realign their feathers by preening and repeatedly going into the water and getting out to preen.

Birds that were 100% waterproof, able to stay in a pool with no haulout for 48 hours, met all pre-released blood criteria (PCV > 40%, TS > 3.0 g/dl, normal body weight within 10%, good body condition, normal behavior), were released according to the release plan developed with USFWS. Birds were released in Whittier, Seward, and Homer, depending on species.

To date, USFWS personnel have collected over 1,600 dead oiled animals from the oiled areas. Had the weather not prevented response personnel from being in the spill site area, there is a high likelihood that several hundred live, oiled birds would have been collected. In such a case, all logistical aspects of this spill response would have been greatly magnified and there would have been even greater challenges faced by the wildlife response team, such as shipping additional stabilization equipment and supplies to the island of Unalaska, increased transportation needs for shipping live birds to the rehabilitation center in Anchorage, transport of change-out personnel, etc.

Conclusion

The remote nature of this spill emphasized the absolute need for stockpiling first-response equipment and supplies in remote coastal areas such as Dutch Harbor. Since the commu-

Callahan and Clumpner – Remote Wildlife Response

nity of Unalaska has only approximately 4,300 year-round residents, there are only one or two commercial flights per day into the area. Of course, during the spill response, these flights were at a premium and, even with extra flights added to the schedule, it was difficult and time-consuming to get equipment, supplies, and personnel from Anchorage. Thanks to the spill response organization, Alaska Chadux, Inc. (Anchorage, Alaska, USA), oiled wildlife response supplies and equipment were stockpiled in Unalaska prior to this spill, such as bird capture and stabilization kits. Additional kits and supplies that were owned and stockpiled at Alaska Chadux, Inc. in Anchorage were sent immediately following the activation of the wildlife response.

One of the most difficult aspects of this wildlife response was the fact that the spill site was actually over four hours, by boat, from the town of Unalaska and in a completely wild and uninhabited area. This meant that response crews couldn't go back and forth between the field and the Command Center, and this brought about major logistical issues that had to be overcome, such as staff safety, housing, and food for field crews, communications, transportation for personnel and captured animals, and restocking of equipment and supplies.

The extreme weather conditions made working in the field very dangerous, and human safety was the absolute first priority. All precautions were taken to ensure the safety of all personnel working in the field by mandating survival suits in skiffs, supplying VHF marine radios, communications plan, boat safety instruction, and a clear chain of command on each vessel. Vessel captains were responsible for authorizing the launching of collection skiffs at any given time.

Much like the cleanup crews, the Wildlife Operations field staff were berthed and fed on two different vessels that were dedicated to wildlife operations. Satellite phones were used by the crew to communicate with the Incident Command Center each day, but they proved to be unreliable due to weather and the proximity of the mountains. Captured animals were transported back to Unalaska by helicopter and vessel. On days where communications systems worked, field crews would request a live-animal pick-up and the Air Operations helicopter would meet one field crew on a designated beach for animal transfer. Transportation by helicopter took approximately 30 minutes. On other occasions, when a vessel was coming back to port, birds were transported by boat, which took approximately four hours. Vessels that were resupplying the cleanup crew vessels were also utilized to bring equipment

and supplies to the Wildlife Operations staff in the field.

It may seem like tremendous resources were dedicated to the Wildlife Operations for only 23 live, oiled birds captured; however, in the first two to three weeks after the spill, it was believed that there was only about 40,000 gallons of fuel spilled. This meant that there was still a potential spill of over 300,000 gallons of oil, assumed to still be on the ship. It was subsequently determined that the majority of oil, about 336,000 gallons, had actually spilled in the initial days of the spill, but a sizeable slick was never found. The Wildlife Operations were ramped up to respond to a potential spill of the entire 478,000 gallons of oil and the possibility of being able to retrieve a substantially higher number of oiled animals. Additionally, had there not been a hurricane-force storm that called the fleet into port for several critical days, there's no doubt that several hundred more birds would have been captured and rehabilitated.

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Impacts of Oil Spills on Unalaska Island Marine Mammals

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Introduction

Marine mammals constitute a diverse group of wildlife with no taxonomic basis. They are long-lived, late to mature, and have low reproductive output. Marine mammals have adapted to life in and around the ocean through morphological modifications of their limbs for swimming, physiological modifications of their respiratory system for diving and their circulatory system for thermoregulation. Although three taxonomic orders make up the group known as marine mammals (Carnivora, Cetacea, and Sirenia) only carnivores and cetaceans occur off the coast of Unalaska Island, Alaska.

Sea otters (*Enhydra lutris*) and harbor seals (*Phoca vitulina*) are the most recognizable and well known of the Unalaska marine mammals, but Steller sea lions (*Eumetopias jubatus*), minke (*Balaenoptera acutorostrata*), humpback (*Megaptera novaeangliae*), gray (*Eschrichtius robustus*) and killer (*Orcinus orca*) whales also occur in the waters off Unalaska. The likelihood and extent that marine mammals are affected by oil depends on their behavior, physiology, morphology, life history, and habitat (Garaci and St. Aubin 1990).

Most marine mammals encounter oil at the surface. Animals that spend the majority of their time at this air-water interface, such as sea otters, are more susceptible to oil spills. Seasonal migrations and aggregations can increase the number of animals exposed to oil. Exposure to oil can occur through a variety of pathways, and marine mammals can suffer both acute and chronic effects.

Properties of Oil

Duration or level of exposure, as well as the oil's toxicity, play a role in the effect the oil will have on an organism. Very light oils (jet fuel, gasoline) are highly volatile and are among the most acutely toxic oils; however, they evaporate quickly, limiting the amount of time they are in the marine environment. Light oils (diesel, light crude, heating oils) are moderately volatile and have the potential to cause long-term contamination. Medium oils (most crude oils) are less likely to mix with water and can severely impact fur-bearing marine mammals. Heavy oils (heavy crude, No. 6 fuel oil and Bunker C) do not readily mix with water and have far less evaporation and dilution potential. These oils tend to weather slowly. Heavy oils can have severe impacts on sea otters. Cleanup of heavy oil is difficult and usually long-term.

Routes of Exposure

Inhalation and ingestion are two common routes of exposure to oil for marine mammals (Doerffer, 1992). Inhalation of oil vapors occurs at the water's surface as the lighter constituents of oil evaporate or are volatilized. Because these lighter hydrocarbons are highly toxic, inhalation often causes acute effects such as interstitial emphysema, liver and kidney damage, and gastrointestinal ulcers (Garaci and St. Aubin 1990). Sublethal effects from vapors include eye and skin lesions, nerve damage, and behavioral abnormalities. Ingestion of oil often occurs through consumption of oiled prey or grooming. Baleen whales may ingest zooplankton that was exposed to oil, and killer whales may consume oiled prey such as seals or sea otters. Marine mammals that consume shellfish are at higher risk of exposure because shellfish do not metabolize oil as efficiently as vertebrates. Because marine mammals are able to process or metabolize oil relatively quickly, short-term ingestion may not have deleterious health impacts, but prolonged exposure can impact the digestion and the nervous system, as well as lead to secondary organ dysfunction, such as liver lesion and kidney failure.

Long-term or chronic effects on marine mammals are less understood, but oil ingestion of a large amount of oil has been shown to cause suppression of the immune system, organ damage, skin irritation and ulceration, damage to the adrenal system, and behavioral changes. Damage to the immune sys-

Rocque – Marine Mammals

tem can lead to secondary infections that cause death, and behavioral changes may affect an individual's ability to find food or avoid predators.

Whales and other cetaceans — Cetaceans are less vulnerable to oil spills than other marine mammals because they rely on blubber for insulation. Their smooth skin also limits areas on their body that oil can adhere to. The majority of whales are exposed to oil through inhalation, although baleen whales are more susceptible than toothed whales because heavy oils can foul baleen plates. All cetaceans are vulnerable to ingestion through oiled prey.

Seals and sea lions (pinnipeds) — Seals and sea lions are also less susceptible to oil spills than fur bearing marine mammals. Pinnipeds spend more time at the surface than cetaceans and are therefore more vulnerable to inhalation of volatile hydrocarbons. Their behavior also increases the chance that oil may come in contact with sensitive mucous membranes, such as eyes and nose. Of this group, pups are the most vulnerable. Seal and sea lion mother-pup bonds are based on odor and can be affected by strong hydrocarbon smells (Garaci and St. Aubin 1990). Young pinnipeds can also be exposed to oil through ingestion of oil from contaminated teats when nursing. In addition, many species of seals and sea lions have furry pups that can become hypothermic if oiled.

Sea otters — Sea otters are the most likely marine mammal to be injured by oil spills because they spend the majority of their time at the surface and they rely on fur for insulation. Sea otters can be affected by oil through ingestion and inhalation, but many sea otters are killed as a result of acute hypothermia. Once oiled, sea otters become obsessed with grooming, which often spreads oil deep into fur. Oiled sea otters spend over 25% more time grooming and 35% less time resting than non-oiled otters (Costa and Kooyman 1982). Sea otters with marginally oiled pelts experience three times more heat loss than non-oiled otters (Davis et al. 1988). This heat loss and increased activity prompts metabolism to increase, and more calories are used, which can lead to hypothermia or starvation. Oiled sea otters that died at rehabilitation centers following the *Exxon Valdez* oil spill had interstitial pulmonary emphysema, gastric erosion and hemorrhage, hepatic and renal lipidosis, and hepatic necrosis that caused or contributed to death, all of which were absent in unoiled otters (Lipscomb et al. 1993).

Sea otters can also be exposed to oil through contaminated prey. Because sea otters have strong site fidelity, they are unlikely to seek food in other areas. Ingested oil can also cause decreased retention time for food in the gut and, therefore, calories from food items are not as easily absorbed or incorporated into body tissue. While this may affect the calories consumed, the decreased retention time also can serve to limit the hydrocarbons that are absorbed (Ormseth and Ben-David 2000). Exposure to hydrocarbons also results in fewer oxygen-carrying cells in the blood, which reduces aerobic capacity. This can lead to decreased dive time and less time foraging for food.

Oil in the marine environment affects marine mammals in a variety of ways. Acute effects often garner more attention than chronic effects that may, through decreased survival and reproduction and behavioral changes, have a greater impact on local populations.

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The Storm on Shelikof

by Nancy Deschu

The waves lashed at the hull, amplified below when the water slapped the wooden planks at the level of our bunks. The boat yawed left and right and pitched forward between waves. I put in earplugs, but the noise was not the problem— earplugs did not prevent me from rolling and knocking against the lip of my bunk or alleviate the nausea and fear that was descending on me.

After a half-hour, I rummaged for my headlamp and shone it towards Julie and Ray. Ray appeared to be asleep even though his big body rolled back and forth in his bunk. Julie lay wide awake. . . . With the waves cracking near our heads and the tightness of the bunk space pressing on us, Julie and I looked at each other through the beams of the headlamp and, without another word, gathered our gear and clothing to go above for the night.

We settled into the galley on cushioned benches. Although the light and open space was a welcome change, the motion above was just as bad as it had been below. The boat's pitch and yaw were increasing. It was necessary to hang on to something with each step. I grappled my way into the wheelhouse, where John was looking out over the sea, his face worried. "How ya holding up?" he asked quietly. "Pretty rotten; I'm staying above for the night."

Mike pulled himself into the wheelhouse. "Not good down there, John," he said, wiping sweat from his forehead. "I jury-rigged the autopilot but it's straining bad. . . . John turned to face Mike, "We've gotta keep that autopilot working."

Back in the galley, cupboards were flung open. Boxes of spaghetti and brownie mix and plastic containers of oatmeal and sugar were traveling across the floor. The waves were hammering the small galley windows, turning the entire window dark green. . . . Julie and I skated back to the benches at the table and sat, holding on to the table's edge. We watched the giant waves smash against the galley windows. We worried about the survival suits that sat in a deck box on top of the wheelhouse. A loud alarm went off below. Mike slid through the galley, racing to get to the engine room calling out, "The bilge pump is out."

Preceding page — Setting boom in Pumicestone Bay, Scot Tiernan, ADEC.



Impacts from Oil Spills on Fisheries and to the Seafood Industry That Supports the City of Unalaska

Frank Kelty,
City of Unalaska Resource Analyst

Overview

The Alaska Department of Environmental Conservation (ADEC), which has a zero-tolerance policy on oil contamination on seafood products, went to great lengths and expense to provide every available seafood inspector to ensure that seafood landed in Unalaska was safe and free of any oil contamination. This included the vessels and all processing waters that were used in the processing plants, as well as surveying waters by trawl vessel in the Unalaska Island and Akutan Island areas for oil contamination that could have been heading into Unalaska Bay.

However, after ADEC listed the spill area as an impacted water body, because of the amount oil spilled in the area and the contamination found in various samples of fish and crab species, the Alaska Department of Fish and Game closed fishing in the spill area. This had a major economic impact on the local small boat crab fleet, which lost the opportunity to harvest 175,000 lbs of Bairdi Tanner crab, Pacific cod, and halibut in Makushin and Scan Bay areas. Their loss may be partially recouped if the claims they submitted to the responsible parties' insurance company are honored.

Importance of Seafood Industry to Unalaska

The importance of the seafood industry to Unalaska cannot be overemphasized. In the city's main revenue categories, sale taxes depend on fuel sales to the fishing fleet, fish

Kelty – Impacts from Oil Spills

taxes account for the largest revenue stream for the city. Property taxes, both personal and real, paid by processing plants, account for the third highest stream of revenue for the city, behind fish and sale taxes revenues.

National rankings of port landings in pounds and dollar value — Unalaska has been ranked number 1 in the nation in landings of seafood for 15 straight years, and number 2 in value, nationally, for the past five years. See Figures 1 and 2 below.

Rank	Port	Millions of Pounds	Millions of Dollars
1	Unalaska/Dutch Harbor, Alaska	908.7	156.9
2	Empire-Venice, LA	400.0	50.8
3	Reedville, VA	375.3	24.2
4	Introcoastal City, LA	325.2	21.5
5	Kodiak, Alaska	262.9	81.5

Figure 1. 2003 landings by U.S. Port, ranked by pounds.

Rank	Port	Millions of Pounds	Millions of Dollars
1	New Bedford, MA	155.5	176.2
2	Unalaska/Dutch Harbor, Alaska	907.7	156.9
3	Kodiak, Alaska	262.9	81.5
4	Hampton Roads Area, VA	30.1	78.0
5	Empire-Venice, LA	400.0	50.8

Figure 2. 2003 landings by U.S. Port, ranked by dollars.

Bering Sea/Aleutian Islands quotas for groundfish and crab for 2004 amounted to a total of 2 million metric tons. The potential impact of this spill can be seen by comparing the volume of landings as well as the value of the nation's fisheries for the year 2003, to the landings in Alaska for the same period. Nationally, a total of 9.5 billion pounds were landed at a value of \$3.3 billion. Of that, Alaska landed 5.3 billion pounds at a value of \$1.0 billion, or 53% of the nation's total. The majority of the Alaska landings are from the groundfish fisheries in Bering Sea/Aleutian Islands.

Growth of the groundfish fisheries in Alaska — From 1970 to the 2003 Alaska's groundfish fishery has increased from a harvest of 545 million pounds, valued at \$96 million, in 1970, to a harvest of 5.3 billion pounds, valued at \$989 million in 2003. Since 1970, 92 billion pounds of seafood has been landed in Alaska at a value of \$26 billion.

The cod fishery alone has grown from a harvest of 12 million pounds, valued at \$2.6 million, in 1980, to 564 million

pounds, valued at \$158 million, in 2003. Total pounds harvested since 1980 equal 8.7 billion pounds, at a value of \$1.7 billion.

The largest increase, however, has been in the pollock fishery. In 1980, 2.2 million pounds were harvested, having a value of less than \$150,000. By 2003, the harvest had increased to 3.3 billion pounds, with a value of \$203 million. Nearly 45 billion pounds of pollock have been harvested since 1980, for a total value of \$3.5 billion.

Revenue streams to Unalaska from the seafood industry — Charts 1 to 3 below show the importance of the groundfish fishery to the city of Unalaska. When revenues are divided by species (Chart 1), the pollock fishery leads the way at over \$4.0 million, followed by Pacific cod at \$2.0 million, and red king crab at \$1.2 million.

When revenues are separated by the onshore and offshore sectors (Charts 2 and 3), pollock still leads the way, accounting for 38% of shore-based revenues and 53% of offshore revenues. The onshore percentage is lower due to fact that they do more species, such as crab, halibut, and sablefish, than the offshore sector does.

Charts 4 and 5 show the importance of fisheries to the city of Unalaska, which relies on them for a major portion of its revenues.

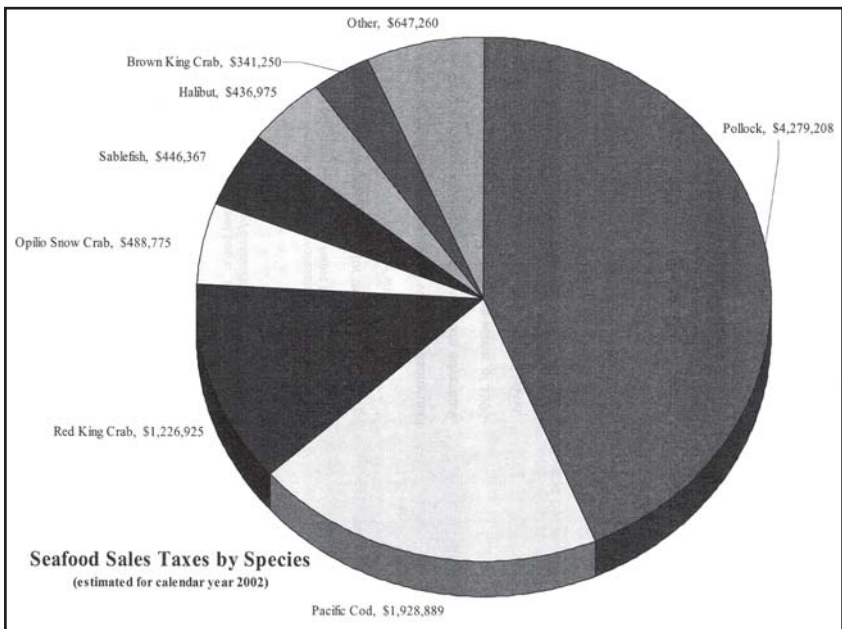


Chart 1.

Kelty – Impacts from Oil Spills

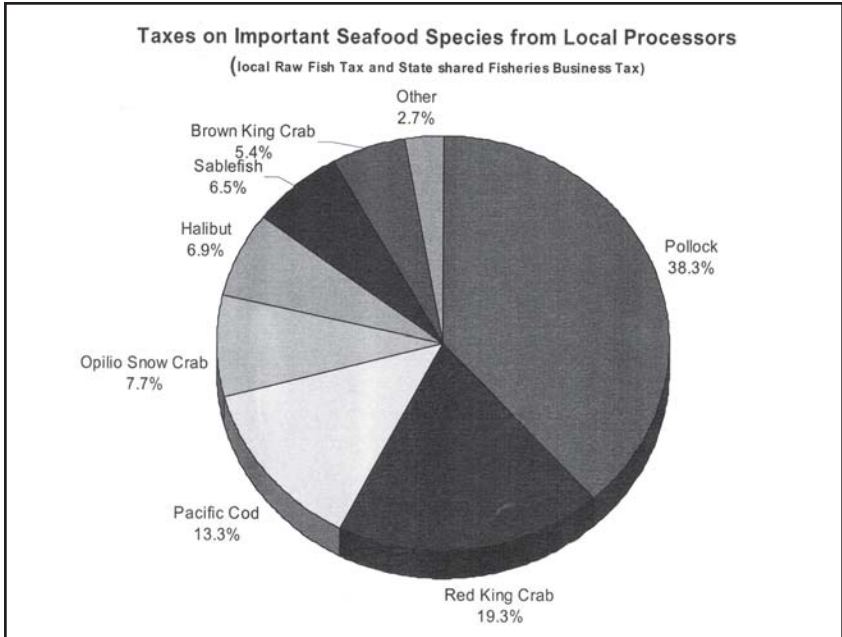


Chart 2.

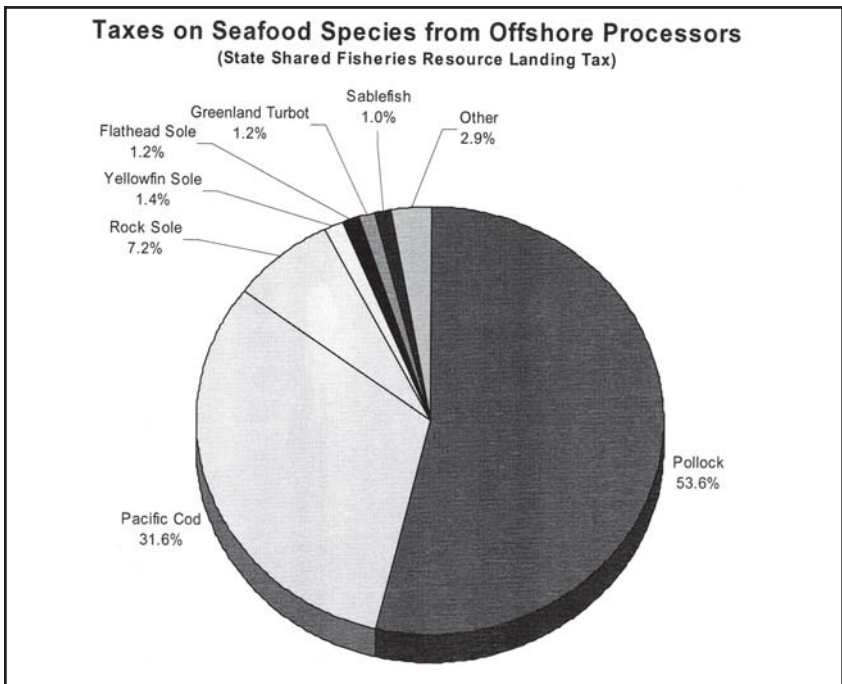


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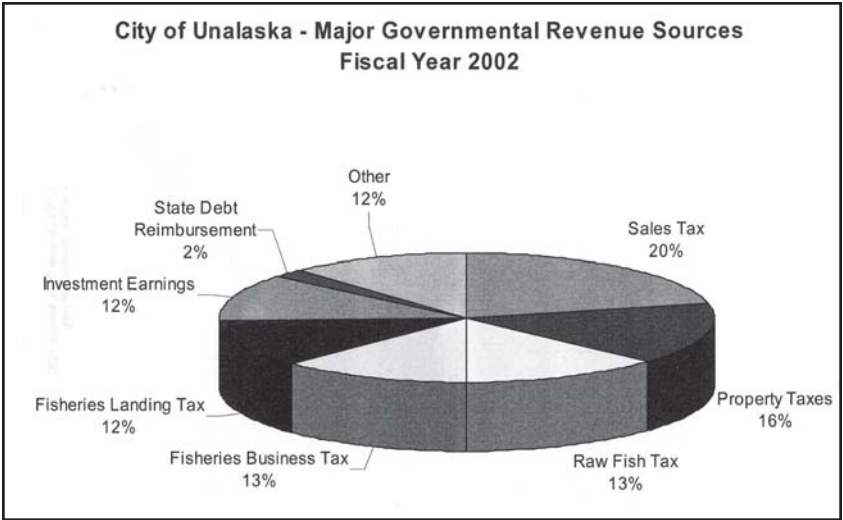


Chart 4.

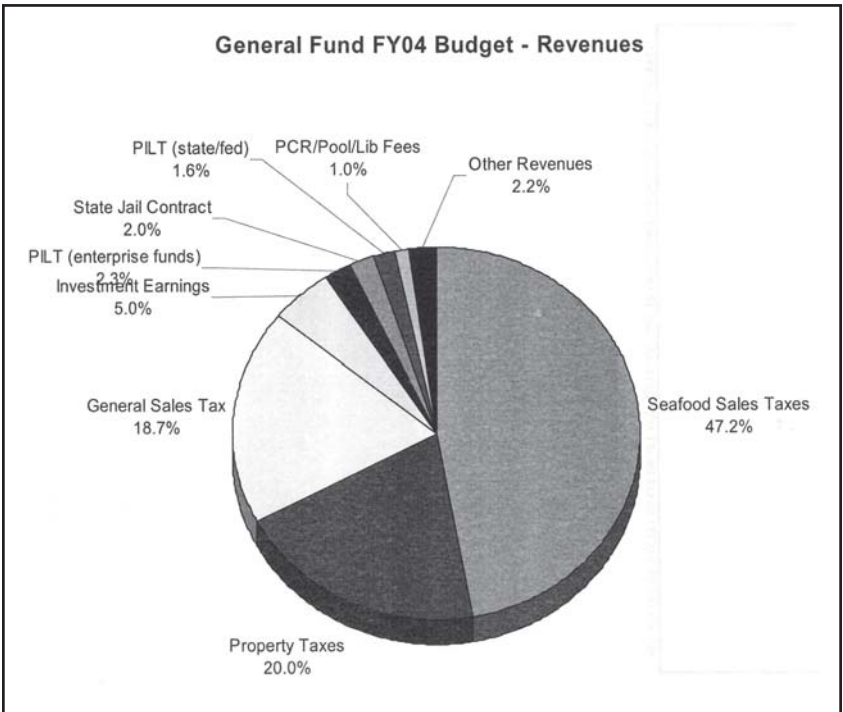


Chart 5.

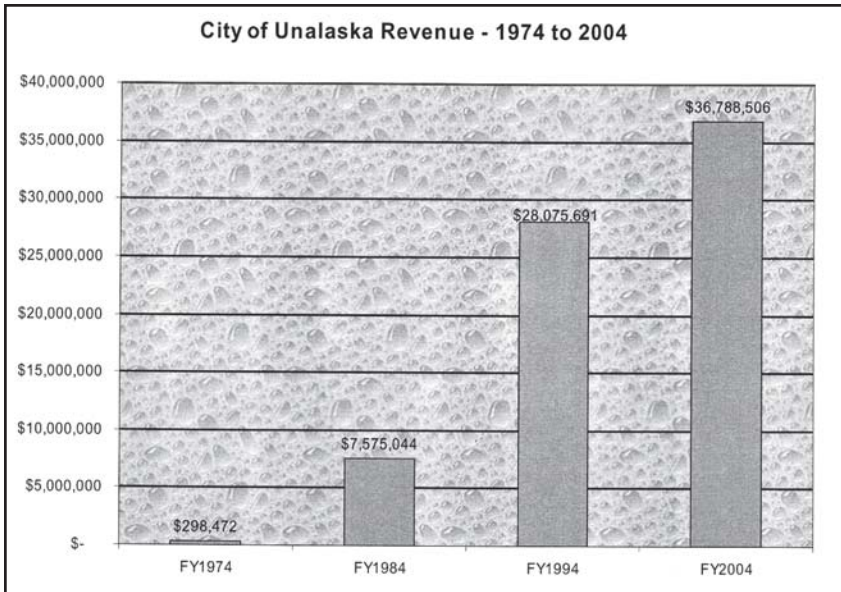


Chart 6.

When viewed over a ten year period, it is clear the impact the groundfisheries have had on the revenue of Unalaska. In 1974, the total of all revenues to the city was \$298,472. For the year 2004, revenues totaled \$36 million. (See Chart 6.) This huge increase in revenue has specifically been due to the growth of the seafood industry, and particularly to the growth of the pollock fishery in the Bering Sea-Aleutian Islands area.

Conclusion

The foregoing shows the tremendous size and value of the nation's most important fisheries and the damage that could be done to this valuable resource by a catastrophic oil spill in the Central Bering Sea/Aleutian Islands area, as well as the harm it would do to the City of Unalaska and the seafood industry and support sector business that are located in our community.



M/V Selendang Ayu Response

Leslie Pearson
Alaska Dept. of Environmental Conservation
Prevention and Emergency Response Program

Release

On December 7, 2004, the M/V *Selendang Ayu* lost power and went adrift off Unalaska Island. Efforts to tow the vessel failed and it went aground and broke apart between Skan Bay and Spray Cape on December 8. The *Selendang Ayu* carried approximately 446,000 gallons of Intermediate Fuel Oil and 31,600 gallons of Marine Diesel. Total estimated amount of oil released to the environment is 335,732 gallons.

Immediate Response

Shortly after the Coast Guard's initial rescue efforts, state and federal agencies created a unified incident command and mobilized incident management teams, contractors, internationally recognized salvors, spill cooperatives, response organizations, and veteran spill responders.

Immediate response actions included deployment of heavy, viscous oil recovery systems and state-of-the-art water recovery devices, although severe weather conditions prevented their use. On February 11, 2005, the Unified Command successfully completed lightering 146,774 gallons of fuel and water from the stricken vessel, using a heavy-lift helicopter to enable recovery during brief weather windows at a time of the year that is otherwise plagued with adverse weather conditions.

Fisheries Protection

On December 20, 2004, the Alaska Department of Environ-

mental Conservation (ADEC) established a work group to address the risk to commercial fisheries posed by the vessel grounding and oil spill. The Fisheries Work Group consisted of state and federal fisheries management agencies; experts in environmental health, fisheries biology, and oceanography; and representatives of local government and fish marketing organizations. At the direction of the work group and ADEC, a fisheries water-quality sampling program was implemented to monitor water and seafood quality in areas where commercial fishing, processing, and fishing vessel transits occur and to facilitate decision-making by fishery managers.

The fisheries water-quality sampling program ran from December 25, 2004, to March 24, 2005. Sampling was conducted in Unalaska Bay and in state and federal waters surrounding Unalaska Island and Akutan Island. The program was implemented as part of the State of Alaska's "zero tolerance" policy, which aims to prevent contaminated finfish and shellfish species from reaching the consumer when an oil spill occurs. Nationally accepted standards for sampling protocols and seafood safety inspections were followed throughout the program. At-risk fisheries under way during the sampling program period included two crab fisheries and several economically significant ground fisheries, including pollock, Pacific cod, and halibut.

Water quality sampling was conducted, using a variety of sampling methods and materials. The program was established and implemented under tight time constraints to provide real-time data regarding potential oil contamination in areas where commercial fishing, fish processing, and fishing vessel transits occur. Tasking was recommended by the Fisheries Work Group, approved by the Unified Command, and was specifically linked to imminent fishery risks posed by the spill incident. Results were presented daily to the Unified Command and were reported periodically at public meetings.

The information was collected through the program for the purpose of facilitating real-time decision making. The sampling methods and equipment used to support this program were developed or adapted to address the changing information needs of fishery managers and the Unified Command. The requirements of this program ensured the protection of Alaska's commercial fisheries, which experienced zero contamination.

Cleanup

The Unified Command's cleanup crews have made significant progress removing oil from Unalaska Island shorelines. Shoreline Cleanup and Assessment Teams designated 123 areas which required cleaning; 97 of which have been cleaned. Twenty-six areas were not signed off by the Unified Command as being cleaned to a preestablished end point. These 26 areas received some level of cleanup, and the remaining contamination does not pose an imminent or substantial threat to the marine environment. Additional shoreline assessments will be conducted in May 2006.

Eighty-eight percent of shoreline cleanup crew members were Alaska residents, with 50% Alaska Natives from corporations affected by the spill. This marks one of the first times a Unified Command has been able to draw upon such a large trained pool of residents to support a local response. Local government officials, tribal leaders, local businesses, and Unalaska citizens have also contributed significantly and supported the response effort. The level of expertise involved with this response is unparalleled.

Current Status

The M/V *Selendang Ayu* remains aground in two pieces at Spray Cape, with the bow section completely submerged. A local contractor, Magone Marine Service, has begun salvage operations to remove the superstructure and deck equipment from the stern section. All known oil and hazardous substances on board the vessel have been removed.

Next Steps

Partial removal of the wreck is under way and will be completed next summer. Partial removal includes dismantling and removal of the wheelhouse, deck cranes, and other structures protruding from the deck. Proposals for removal of the remaining stern and bow hulls have been received and are under review. Removal of the remaining bow and stern hulls will require a major mobilization of equipment and could occur next summer. The state is currently weighing all environmental impacts before making a decision regarding total removal of the remaining bow and stern hulls.

Navigation Safety and Risk Assessment

Gov. Frank Murkowski, in his 2005 State-of-the-State address, requested a vessel traffic study and risk assessment to determine how best to improve the Aleutian spill prevention and response system. The state has completed the vessel traffic study. The Marine Exchange of Alaska has installed an Automatic Identification System (AIS) receiver at the old Coast Guard installation at Scotch Cap on Unimak Island. The equipment receives signals from ships transiting Unimak Pass and allows the Marine Exchange to display vessel information on ships passing through the area. The Marine Exchange will monitor vessel traffic to allow state authorities and the Coast Guard to better assess the amount of traffic in the area.

The state is working with the Coast Guard to initiate a vessel risk assessment for the Aleutians. Various management strategies may evolve from the risk assessment, such as maintaining offshore distances, rescue tug capabilities, safe harbor identification, tracking systems, notification requirements, emergency tow packages, communication protocols, closure conditions, training, vessel equipment standards, or others. The risk assessment will draw from similar systems and operating rules developed and used in Prince William Sound and Cook Inlet. In Prince William Sound, for example, closure conditions have been established for Hinchinbrook Entrance, because it is unrealistic to assume any size rescue tug can safely and effectively function in extreme sea conditions. When the National Transportation Safety Board's official investigation report and the vessel risk assessment are completed, the credible recommendations on how to improve the Aleutian spill prevention and response system will be known and recommendations will be prepared.



NOAA Support for the M/V *Selendang Ayu* Oil Spill Scientific Issues

John Whitney, Ph.D.
NOAA Scientific Support Coordinator for
Alaska

According to the National Contingency Plan (NCP), and traditionally, NOAA provides scientific support on a variety of topics surrounding an oil spill event in the navigable waters of the United States. The NCP reads:

Scientific Support Coordinators (SSC) are the principal advisors for scientific issues, communication with the scientific community, and coordination of requests for assistance from state and federal agencies regarding scientific studies. The SSC strives for a consensus on scientific issues affecting the response, but ensures that differing opinions within the community are communicated to the On-Scene Coordinator (OSC). . . . NOAA SSC's are assigned to USCG Districts and are supported by a scientific support team that includes expertise in environmental chemistry, oil slick tracking, pollutant transport modeling, natural resources at risk, environmental trade-offs of countermeasures and cleanup, and information management. During a response, the SSC serves on the federal OSC's staff and may, at the request of the OSC, lead the scientific team and be responsible for providing scientific support for operational decisions and for coordinating on-scene scientific activity. Depending on the nature and location of the incident, the SSC integrates expertise from governmental agencies, universities, community representatives, and industry to assist the OSC in evaluating the hazards and potential effects of releases and in developing response strategies.

With this as a backdrop and orientation to the NOAA Hazard Materials Response Branch, on December 8, 2004, I

happened to be at our NOAA Hazmat headquarters in Seattle, as opposed to my usual duty station in Anchorage, where most of our scientific support team resides. Sitting in the war room, a call had just been received from U.S. Coast Guard MSO Anchorage that the M/V *Selendang Ayu* was approximately 50 nautical miles NW of Unalaska Island experiencing 60- to 100-knot NW winds, was dead in the water, and hadn't been able to start its engines for the past 13 hours. All within the next 10 hours, I had flown back to Anchorage, checked in at the MSO regarding the fate of the vessel, got the reports that the vessel had grounded off Spray Point, the Coast Guard helicopter had crashed, the vessel had split in two, and a substantial amount of heavy fuel had been released, oiling the western shorelines of Unalaska Island. Figure 1 shows the final fateful trajectory of

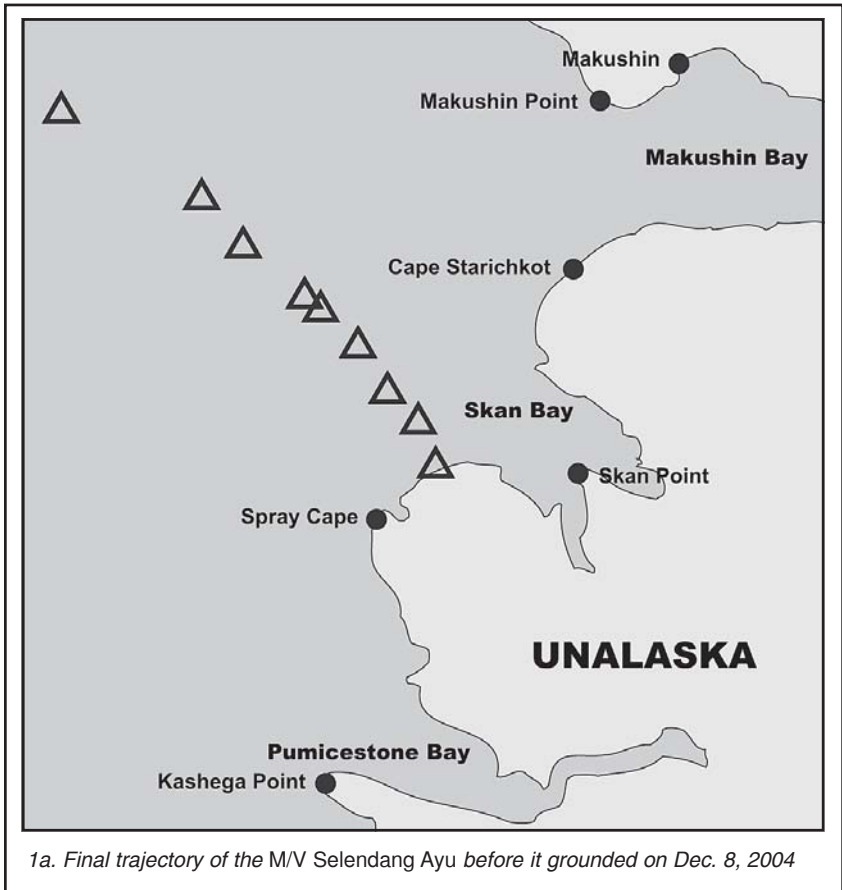


Figure 1. Five illustrations showing final track, grounding, and breakup of M/V *Selendang Ayu*.

The Selendang Ayu Oil Spill



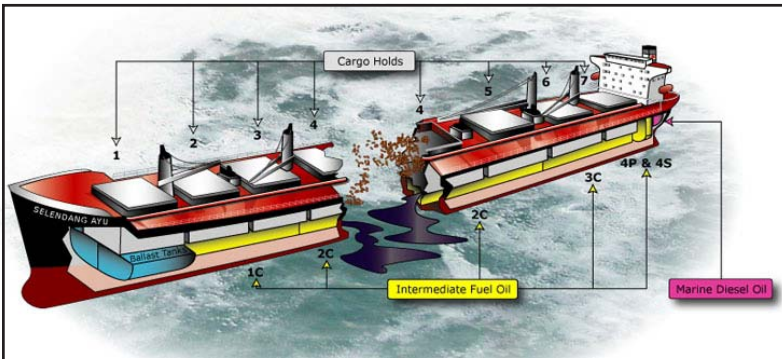
1b. Dec. 8, 2004, aground.



1c. Dec. 9, 2004, broke in two.



1d. Dec. 23, 2004, bow section sunk.



1e. Diagram of initial breakup of M/V Selendang Ayu.

Figure 1, continued

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the vessel, its intact grounded position offshore Unalaska Island on December 8, the breakup of the vessel on December 9, the sunken bow section on December 23, and a diagram of the split-apart vessel releasing oil and soybeans.

Before heading out to the spill site the next morning, NOAA Hazmat was heavily into seeking answers to the kinds of scientific questions that the Coast Guard and other responders would be asking. What kind and how much heavy fuel may have been released? Where would the oil most likely go? What are the fate and effects of this oil? What are the fate and effects of the soybean cargo?

This was wintertime in the Aleutian Islands of Alaska, where inclement is a description of good weather, and williwaws, extremely harsh conditions, and severe weather conditions are generally the norm. So the first thing that NOAA did was to bring in an on-scene incident meteorologist (known as an IMET) from the National Weather Service (NWS). Within a few days, he was in the command post in Dutch Harbor, providing daily, and at times hourly, weather briefings for pilots, vessel skippers, salvors, and responders who needed to travel to and work around the grounded vessel and the oiled beaches in Skan and Makushin bays, some 25 to 80 miles from the Dutch Harbor airport and port of refuge. Within a week, the NWS had installed a portable weather station at Cape Kovrizhka on the exposed western coast of Unalaska Island. Not only did this allow for crucial observations and more accurate weather forecasts, but the weather records were made publicly available in real-time on the NWS Web site. Figure 2 shows the location and deployment of this weather station. This turned out to be an incredible plus for the response, and a public thank-you needs to be extended to the NWS for providing this timely service, which has continued throughout the spill response.

Trajectories, the movement of the oil on the water, are always a question at oil spills and one that NOAA seeks to answer. With 80-knot-plus westward winds occurring during the vessel grounding and breakup, it was fairly obvious that the initial oil release would come ashore in Skan and Makushin bays, downwind to the east. The more significant and difficult questions, though, were the potential path of subsequent oil releases from the vessel and of remobilized oil — that is, oil initially grounded but then refloated due to a combination of winds and tide levels. For answers, NOAA turned to the extensive experience of the NOAA Hazmat oceanographers in Seattle and to the larger NOAA general investigations over the past

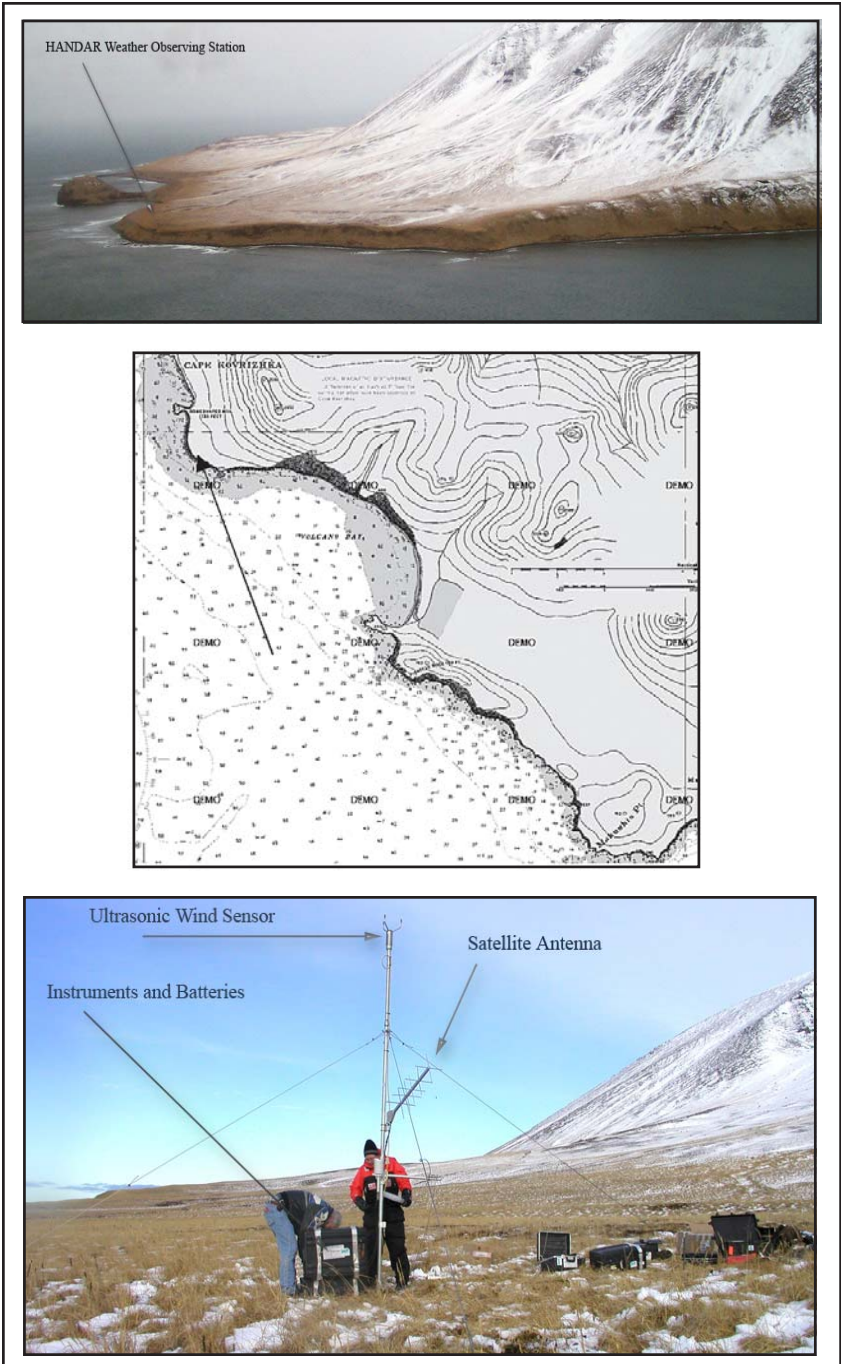


Figure 2. Location and construction of the specially installed weather station by the NWS.

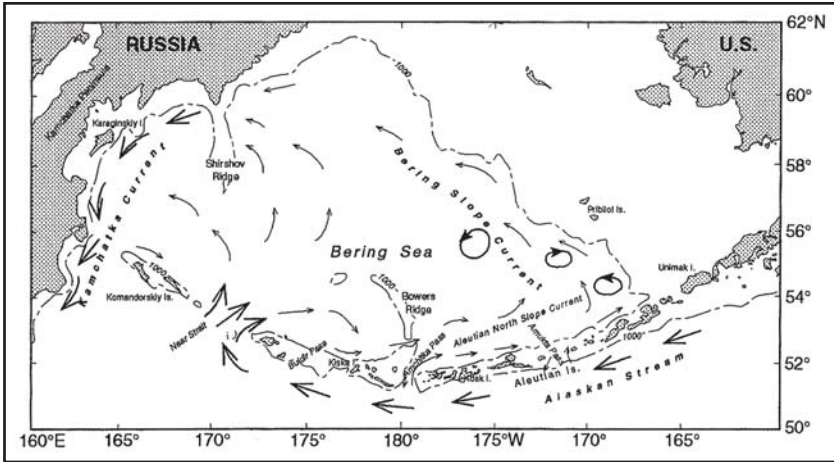
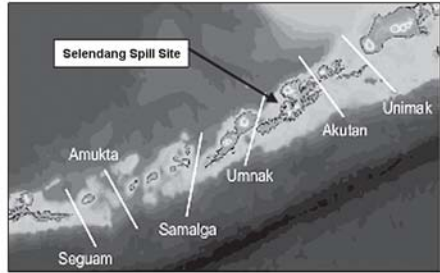


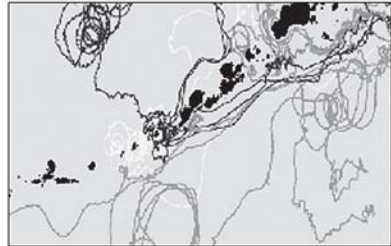
Figure 3. Ocean circulation showing the exchange of water and circulation through the Aleutian Islands (Reed and Stabeno 1998).

few decades, such as the FOCI program (Fisheries Oceanography Coordinated Investigations at www.pmel.noaa.gov/foci), a joint project between the Alaska Fisheries Science Center and the Pacific Marine Environmental Laboratory (PMEL) exploring the oceanography in the Northern Pacific Ocean and in and around the Aleutian Islands. Figure 3 shows a result of this effort, documenting the exchange of water between the North Pacific Ocean and the Bering Sea. The entire system is driven by the Alaskan Stream flowing westward along the southern margin of the Alaska Peninsula and the Aleutian Islands. Though there is a net clockwise tidal circulation around Unalaska Island, the dominant effect on the spill site includes a net northward exchange of water with the Bering Sea and the generation of the eastward flowing Aleutian North Slope Current along its northern edge.

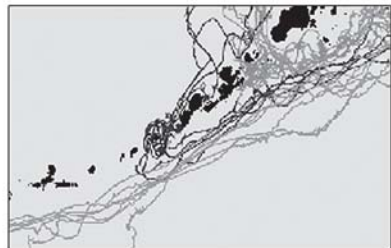
NOAA oceanographers (such as Dr. Phyllis Stabeno with PMEL) have worked in this area for several years, mostly during the summers. We drew on this vast experience to understand and to visualize the basic flow patterns of this area. Turns out, though, that there isn't enough current data collected to give an estimate of what the mean currents are over the course of a day, a week, or a month, and we have no idea what the turbulent mixing is out there or how it changes, as it surely does, with the winds and currents. In short, there is way too much variability, of which we don't understand the degree or cause of well enough to do a trajectory model like you might see for Prince William Sound or Puget Sound. As an illustration of this variability, Figure 4 shows the results of NOAA/



1986-1992



1993-2000



2001-2002

Figure 4. NOAA/PMEL Aleutian satellite-tracked drifter trajectories from 1986-2002. Drifter trajectories illustrate the tendency for Gulf of Alaska water to flow into the Bering Sea through either Unimak Pass or Samalga Pass but rarely through any of the other eastern passes. Over 17 years, of 53 drifter deployments in this region, almost 60% went through either Unimak or Samalga Pass with another 26% bypassing the passes altogether (Ladd et. al. 2003).

Dispersants:

- Alaska Regional Response Team (AART) recommends Corexit 9500
- Limited application parameters as described in ARRT recommendations
- Use approval extended to February 14, 2005

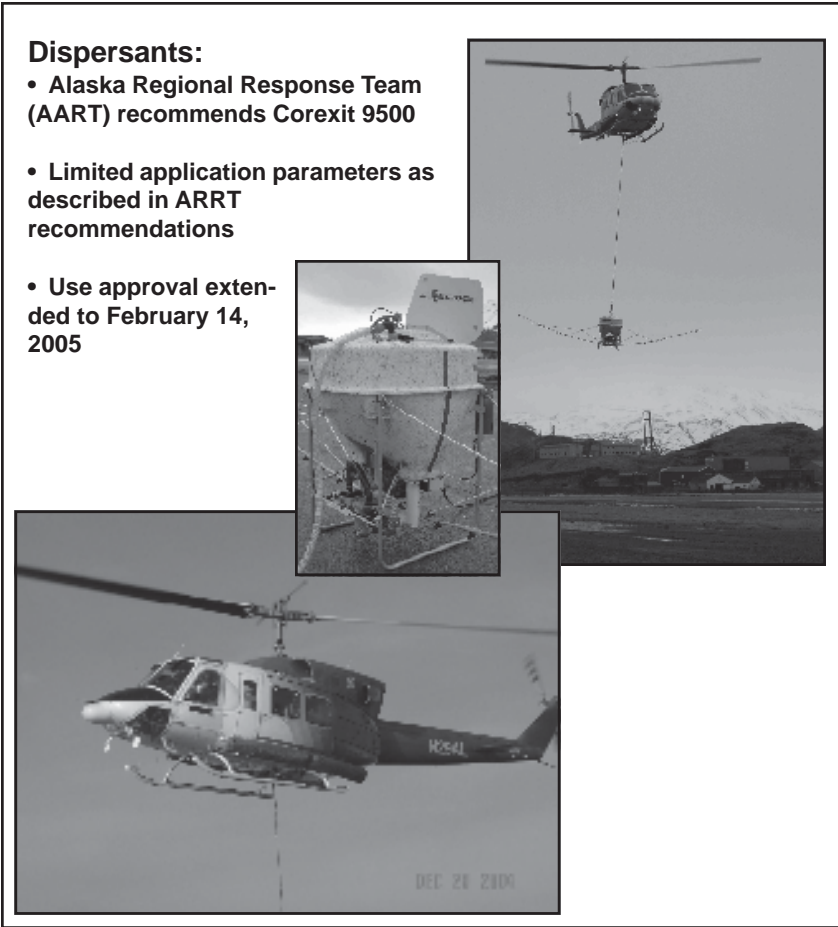


Figure 5. Staging of dispersants for potential use on possible additional oil releases from the wreck.

PMEL having released a large number of satellite tracked drifters in this area. The exchange of water from the North Pacific Ocean into the Bering Sea is clearly evident, as well as the tremendous variability in the Aleutian North Slope Current. It is interesting to note that none of the drifters in the ANSC are carried into Unalaska Bay. These drifter tracks can be viewed at www.pmel.noaa.gov/foci/globec/gl_drifters.shtml. (It should be noted that none of the drifters were released right next to the shoreline, and they don't behave like oil.)

After the grounding of the vessel and the release of its IFO-380 fuel from the #3 center tank, it was thought that a substantial amount of fuel still remained in both the bow and the stern sections, posing the potential of another substantial

release onto the water. The Unified Command met this threat by staging a couple of skimmers near the wreck site, including the innovative current-buster skimmer from Alyeska/SERVS. NOAA felt that dispersants might also be effective and useful, and was asked by the Unified Command to explore this possibility. Hotel room testing of Corexit 9500 on oil samples from the vessel showed that dispersants could definitely be effective on fresh samples of the IFO-380. After receiving the necessary dispersant-use approval from the Alaska Regional Response Team, NOAA was instrumental in obtaining the necessary dispersant equipment, providing training to the helicopter pilots on use of the heli-bucket dispersant dispenser, and establishing the protocols for the actual use of dispersants should an additional release occur (Figure 5). Fortunately, no such release occurred, and the 16 drums of Corexit 9500 sat, unused, at the Dutch Harbor airport.

One of the by-products of a heavy oil spill, like the IFO-380 on the M/V *Selendang Ayu*, and strong winds is an abundance of tar balls of various sizes that break off from the initial oil slick and/or, secondarily, from refloated oil. Knowing where

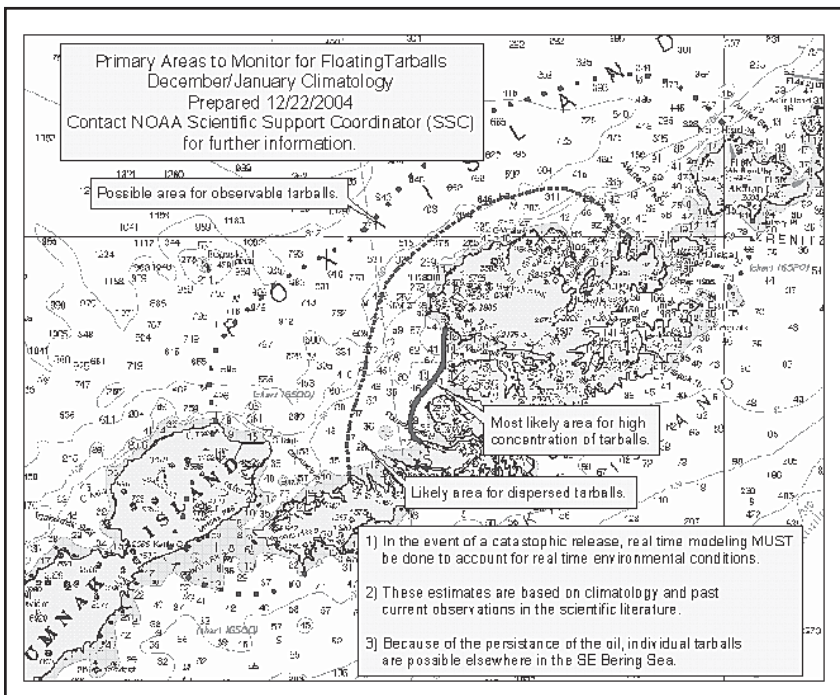


Figure 6. NOAA's qualitative probability distribution of tar balls coming from the wreck and from refloating of oil on the beaches.

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these might travel became extremely important, particularly in light of the huge Bering Sea crab fishery that opened the middle of January, with several crab processing facilities in Unalaska Bay. The random occurrence in time and space of these tar balls makes trajectories extremely difficult. As a result, NOAA consulted with several oceanographers who have worked in the eastern Aleutians. This information was combined with climatological wind data for Unalaska and our own understanding of how tar balls might reside in the water column to prepare a semi-quantitative probability distribution of the movement of these tar balls. Figure 6 shows that distribution. The long-term trajectory implications were captured in our accompanying text message that was produced immediately after the spill occurred, as follows:

The oil could persist and travel for hundreds of miles in the form of tar balls. Given the conditions, the tar balls would be widely scattered. The mean current is to the NE and this could result in scattered tar ball impacts along the northern side of Unalaska Island, Akutan, Akun, and even Unimak Island over the course of weeks to months. Flow through the passes between the Islands has a net to the north, which would make it difficult for significant amounts of oil to exit from the Bering Sea to impact the southern side of the Islands.

NOAA's scientific support for an oil spill extends beyond the immediate Incident Command structure; we believe that it is extremely important to disseminate this information to the public as well. As a result, we try to develop one-page fact sheets that capture the important information regarding an issue and make those available at public meetings, which were held every night for the first two months. Figure 7 shows the Fate and Transport one-pager that was developed and made available early on in the incident.

The M/V *Selendang Ayu* was a freight vessel transporting soybeans from Seattle to markets in China, and, certainly, the fate of the soybeans was unknown and of extreme interest. There were greater than 30X by volume the amount of soybeans than there was oil. Contacting the American Soybean Council, NOAA put together information on the fate of soybeans in the cold, saline waters of the Bering Sea. We learned that soybeans generally sink in salt water; soy milk is produced by soaking soybeans in brine water; when wet, soybeans may swell to double their size, possibly causing structural damage (which

Fate and Transport

M/V Selendang Ayu



CHARACTERISTICS OF THE SPILLED OIL

The vessel carried 430,000 gallons of Intermediate Fuel Oil and 21,000 gallons of marine diesel. Typical physical property data for the types of petroleum products loaded on the *M/V Selendang Ayu* was used in this analysis. Actual property information is unknown, but may be determined by chemical analysis if samples can be secured from the vessel.

Intermediate Fuel Oil (IFO 380)

- **Density:** 0.989 g/cc; fresh water is 1.00 and oceanic seawater is 1.025. Therefore, the oil is lighter than both fresh water and seawater.
- **Pour Point:** 2 to 10°F and at ambient water temperature (low 40's) will quickly cool and form thick "patties" rather than remaining as a thin film or sheen.
- **Viscosity:** 346 centistokes (cSt) at 122°F and at ambient water temperature greater than 3500 cSt, meaning, when initially spilled, the oil's viscosity would be similar to honey. Spilled oil will undergo chemical and physical changes and the viscosity will increase to be similar to peanut butter.
- **Composition:** the actual chemical composition is unknown, but heavy refined products such as Intermediate Fuel Oils are routinely made by blending a diesel (Fuel Oil No. 2) with a heavy residual oil or with the residuum from the refining process itself.

Marine Diesel

- **Density:** 0.839 g/cc; therefore, diesel oil is lighter than both fresh water and seawater.
- **Viscosity:** ~10 centiStokes (cSt) and at ambient water temperature will spread to form a thin film or sheen.
- **Composition:** the actual chemical composition is not known.

BEHAVIOR OF THE SPILLED OIL

At the spill location, large breaking waves are the primary mixing mechanism. In a high-energy environment, spilled Intermediate Fuel Oil will quickly break into small particles, while the lighter diesel oil will form sheens that easily dissipate. In addition, the viscous nature of Intermediate Fuel Oils will form discrete "patties" and tarballs rather than a slick with sheens. These patties may range in size from less than an inch to hundreds of feet in diameter.

One of the key concerns is whether the oil will float and remain floating when spilled. Using the ADIOS model for a typical Intermediate Fuel Oil 380, 5 to 10% of the oil could evaporate within 5 days of the release. For typical marine diesel, 30 to 60% of the oil could evaporate in 5 days. Even after evaporation, both oils are expected to float on fresh water and seawater. Although the oil is buoyant and will float, observers may have difficulty seeing the oil on the surface due to the tremendous amount of mixing from breaking waves. Oil may be washed over by waves. The refloat time for a half-inch diameter oil particle is on the order of seconds and may penetrate into the water column at a depth of about one and one-half times the height of the breaking waves.

As the oil drifts into calm water, the oil will be easier to observe. The oil is sticky and may coalesce into larger patties. Natural surface collection areas include convergence zones created by winds, currents, and saltwater/freshwater interfaces. Kelp beds may trap oil.

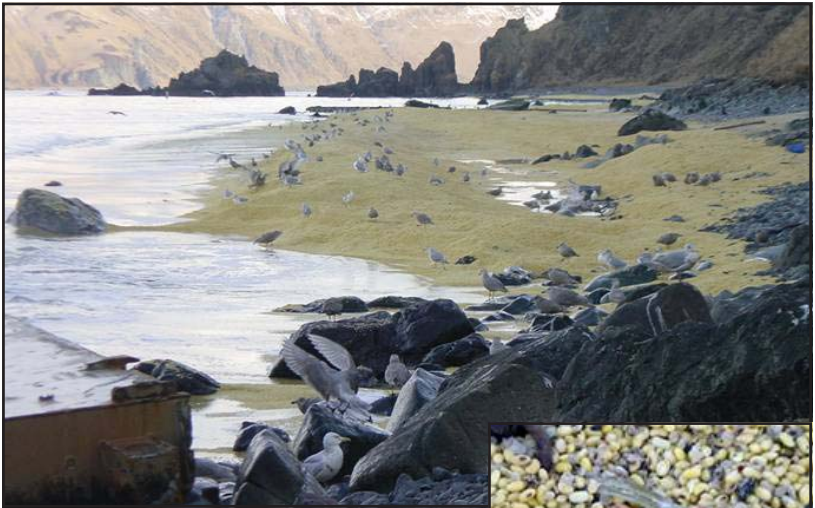
Scattered tarballs will be difficult to observe by either visual or remote sensing techniques. Tarballs will persist for many months resulting in long-range transport (tens to hundreds of miles) and shoreline oiling.

On-scene characterization of the spill site suggest that the suspended sediment load in the water column is low. Neither the Intermediate Fuel Oil nor the diesel fuel is expected to collect sediment in the water column and sink. However, at a few areas located near the spill site such as heads of bays and streams, oil on the shoreline may pick up sediment. Only a small amount of sediment attached to weathered Intermediate Fuel Oil could increase the density of the tarballs enough to sink. The sediment-laden oil could be washed from the shoreline, tumble along the bottom, and collect in calm areas and subtidal depressions.

Figure 7. NOAA's one-page fact sheet on Fate & Transport of *M/V Selendang Ayu* oil.



8a. Soybean milk streaming from wreck.



8b & 8c. Soybeans on Spray Cape.



Figure 8. Photos of soybeans spilled by the M/V *Selendang Ayu*.

was observed); the soybeans do not represent a hazard; and the soybeans will degrade naturally. However, large masses of soybeans could create a localized oxygen demand. Figure 8 clearly shows soy milk streaming from the wrecked vessel and the large amount of soybeans that were washed ashore, although most of the soybeans coated the bottom of the rocky platform where the vessel grounded.

Unfortunately, oil spills in Alaska can be very damaging to natural resources, and the M/V *Selendang Ayu* was no different. With the spill being in a portion of the Alaska Maritime National Wildlife Refuge, the USFWS took the lead; lots of birds and some sea otters suffered fatal effects. NOAA's trustee resources involved the harbor seal and the Steller sea lion, which is listed as an endangered species in this part of Alaska. As a result, NOAA personnel identified sea lion haulouts and rookeries and was vigilant in making sure that these areas were given wide berth by the responders. Figure 9 shows the sea lion critical habitat area around Unalaska Island and its coincidence with the core area of contamination.

As a result of the heavy winds that grounded the vessel, most of the released oil was also grounded on the shorelines of

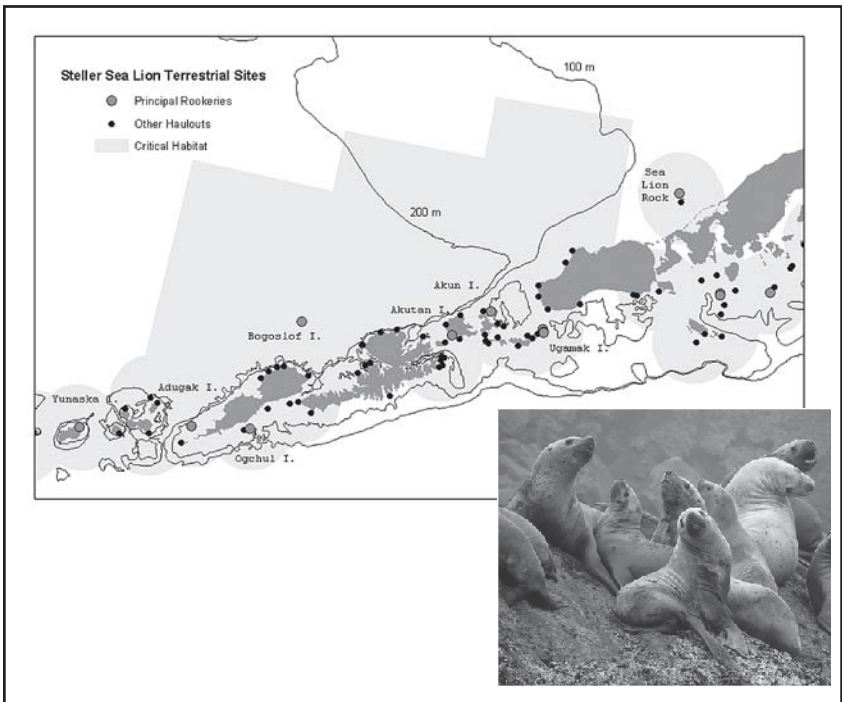


Figure 9. Steller sea lion critical habitat area around Unalaska Island.



10a. PTN-4 showing oil band deposited at highest storm berm level of shoreline. Cleaned shoreline is to left and oiled shoreline is to right.



10b and 10c. Close-ups of thick, narrow band of oil on segment PTN-3, which is characteristic of several shorelines where M/V Selendang Ayu oil was deposited in the storm of Dec. 7-10, 2004.

Figure 10. Aerial view of PTN-4 with PTN-3 close-ups of oiled mat.

Makushin and Skan bays. In fact, this storm was so energetic that nearly all the oil was concentrated at or above the storm berm or supra-tidal level. On rock outcrops closest to the wreck, such as KPF Point and Spray Cape, the oil was splattered high up on the rocks, and in distant areas like Portage Bay, the oil was deposited in a thick, narrow mat at the highest storm level of the beach, just below the line of vegetation (Figure 10). One of the roles that NOAA traditionally fills at oil spills is as the federal representative on the SCAT team, or the Shoreline Cleanup Assessment Team, in which the nature, position, and condition of the oil on the shoreline is documented, along with recommendations on possible cleanup techniques. This information then goes to the operations section to conduct the actual cleanup of the oil on the shorelines. An example of a NOAA innovation SCAT team product on a shoreline aerial photograph is shown in Figure 11.

NOAA also worked with the local community to address subsistence and seafood safety concerns. The port of Dutch Harbor on Unalaska Island processes the largest volume of fish of any port in the United States, a testament to the richness of the Bering Sea. In January, the crabbing fleet fishes the Bering Sea and returns to Dutch Harbor with tons of crab, kept alive

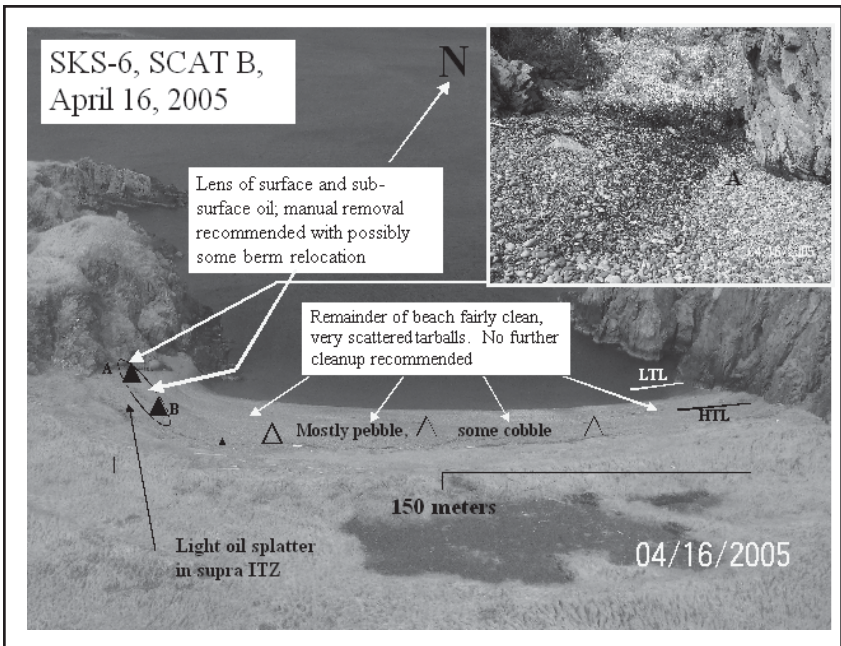


Figure 11. Segment SKS-6 (Skan Bay South) showing SCAT assessment report for Planning and Operations.

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by constantly circulating sea water through the vessel holds. Any real or perceived contamination of the crab with oil could literally cause the bottom to fall on the worldwide markets for this product. With a combination of trajectory analysis and advice on monitoring techniques, NOAA was able to provide invaluable assistance to the Seafood Safety Task Force. Since Unalaska Island is the home of a large Alaska Native population, similar concerns were expressed for the safety of the subsistence foods harvested from the sea and intertidal zones. As the result of similar concerns in the *Exxon Valdez* spill and other spills that NOAA has dealt with, we were able to provide meaningful input, based on actual experiences, as a member of the Subsistence Foods Task Force. We've learned that the concerns of the public regarding an oil spill are quite often very similar, and NOAA's experience and corporate knowledge allow us to deal with these issues in a credible fashion.

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Although released by NOAA, the information in this paper does not reflect, represent, or form any part of the support of the policies of NOAA or the Department of Commerce. Further, release by NOAA does not imply that NOAA or the Department of Commerce agree with the information contained herein.

People at the Aleutian Life Forum, particularly the people of Unalaska, may wonder why it is I return to this island, what it is about the Aleutians that calls me. So as a guest to your island and a guest to the Forum, let me tell you who I am and why I am here.

A Story Softly Wrapped

by Nancy Deschu

I spring from islands. Maybe that is why I am drawn to Unalaska. This place, land circled by the sea, a culture entwined with boats and ships and fish, generation upon generation.

In 1624, my maternal ancestors, the Van Voorhees, walked away from their farm in the Netherlands, leaving behind a small house, a flock of sheep and a yard full of trees, holly bushes and a vegetable garden. Weary of burdensome taxes imposed by the church, the family journeyed to the port of Amsterdam, where they boarded a small sailing ship with an upturned bow and flat stern. The ship, named *de Bonte Koe*, (The Spotted Cow), set off on the dark Atlantic, making landfall on the southeast tip of a flat sandy island at the Dutch village of Nieuw Amersfort, which today would be called Long Island in the state of New York.

Three hundred years later, across the Hudson River, just a few miles from Long Island, my paternal grandparents arrived by steamship at Ellis Island, welcomed by the Statue of Liberty. My grandmother brought with her a wooden trunk filled with family keepsakes, hand-embroidered linens and a quilt made of down from the geese on her family's farm, her home that now was an ocean away. Years later, she quietly cut a large block out of the quilt each time one of her children married. Four times she cut and sewed pillows filled with goose down, to pass along a small gift of heritage to her children, and, hence, their children, a story softly wrapped.

The *Selendang Ayu* oil spill has caused damage to the island of Unalaska. In the midst of the disaster, cleanup and recovery, in the frustration, grief, and lack of sleep, it is sometimes

difficult to remember the natural beauty nearby. Following is part of an essay on the ferry trip from Homer to the Aleutians, just before the ferry reaches its final port, the island of Unalaska:

At dawn, sunlight moves in patches upon the choppy sea. We pass through giant flocks of shearwaters, their sleek wings gracefully skimming just above the waves. Then we are in a field of fulmars, literally thousands of stout bluish-gray seabirds. They play the wind above the crested waves, banking this direction and that, looking for fish. Few places on earth have this sort of concentration of seabirds and here we are, sailing in the midst of their unfathomable numbers.

Alone on the bow, a woman from Anchorage continues to bird watch long after we have passed the huge flocks. Just off the island of Unalaska, she is rewarded for her diligence when an albatross, a seabird with a seven-foot wing span, glides by. She only has time to call to one other passenger, who also gets a look. It is the only albatross sighting of the trip.

Preceding page — Unified Command members answer questions from audience members during a public meeting in Unalaska, January 5, 2005, ADEC photo.



Community Responses to Oil Spills: Lessons to be Learned from Technological Disaster Research

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Introduction

On December 8, 2004, the Malaysian-flagged freighter *Selendang Ayu*, carrying 60,000 tons of soybeans and nearly 500,000 gallons of fuel, grounded, and split in two off of Unalaska Island, a remote, wildlife-rich area in Alaska's Aleutian chain. More than 300,000 gallons of heavy bulk fuel leaked from the *Selendang Ayu*, much of which washed ashore on beaches of Skan Bay and Makushin Bay — areas providing recreational, subsistence, and commercial fishing resources for residents of the Dutch Harbor/Unalaska community. Dutch Harbor/Unalaska is a renewable-resource community that annually processes over \$1 billion of fishery resources. Although initial Coast Guard projections indicated that oil from the *Selendang Ayu* would not threaten this industry, some tar balls did enter Unalaska Bay, from which processing plants and crabbing vessels draw much of their water. Close monitoring and removal of these tar balls, combined with vigilant inspection of seafood processing during January's critical crab season, prevented closure of the industry. The shipwreck and oil spill, however, represented a "shot across the bow" for Dutch Harbor/Unalaska, as it highlighted risks associated with the high volume of international shipping that occurs in the region.

This "shot across the bow" raises questions and concerns about what happens to communities that experience major oil spills or analogous events. More specifically, what were some of the community effects of this particular oil spill and what might have happened if the spill had been larger or more

damaging? Understanding possible community effects is enhanced if we consider major oil spills as a type of technological disaster. We can enhance understanding by familiarizing ourselves with what we mean by disasters, technological disasters, and how social scientists study them.

The first part of our paper is intended to provide basic definitions of disasters and concepts used in technological disaster research. These definitions and concepts help guide research in communities that have been impacted by such an event. We then describe how we conducted our research and collected data in Dutch Harbor/Unalaska. Next, we describe our findings and what we can conclude, particularly regarding our conceptual guides. Finally we suggest some lessons we should be learning.

Conceptualizing Disasters

The term “disaster” has many synonyms in popular American culture, including catastrophe, emergency, calamity, tragedy, and cataclysm. What defines each of these words is not simply what is found in a dictionary or thesaurus, but the meanings people and societies attribute to them. What makes an event a disaster is not just physical effects associated with it, such as environmental damage or destruction of a built environment, but people’s awareness of and reactions to it.

There is little consensus on the definition of disaster (Green 1996; Quarantelli 1998). Prior to the 1960s, disasters were primarily defined with respect to physical agents (e.g., tornadoes, floods, hurricanes, or earthquakes), physical impacts of these agents, and assessment of these impacts (Quarantelli 1981). Over the years, a dichotomy has developed, distinguishing between physically oriented descriptions of disaster and socially driven conceptualizations. Fritz’s (1961) definition is attributed as a turning point in conceptualizing disasters sociologically:

[An event] . . . concentrated in time and space, in which a society or a relatively self-sufficient subdivision of society, undergoes severe danger and incurs losses to its members and physical appurtenances [such] that the social structure is disrupted and the fulfillment of all or some of the essential functions of the society is prevented. (655)

Almost a decade later, Barton’s (1969) discussion of collec-

tive stress offers a distinctly social characterization of disaster: “[C]ollective stress occurs when *many members of a social system fail to receive expected conditions of life from the system*” (p. 38, italics in the original). This conceptualization incorporates social disruption that ensues following the physical impact of an event, perceptions of crisis situations whether or not they involve physical impacts, political definitions of situations, and an imbalance in the ability of a social system to meet the demands of a crisis situation (Quarantelli 1981). From a sociological viewpoint, disasters are only disasters with respect to their social causes and effects and, thus, disasters cannot be understood apart from their social context (Dynes 1970, 1974; Quarantelli 1992; Quarantelli and Dynes 1978).

Increasingly, however, definitions of disaster are considering different origins of events, particularly natural and technological origins (Green 1996). Technological disasters are induced directly or indirectly as a result of technological malfunctions or human error (Perrow 1984). Clarifying distinctions between natural and technological disasters, Freudenburg (1997) states:

The simplest rule of thumb for categorizing disasters as natural or technological ... has to do with the triggering event: if the triggering event could have taken place even if no humans were present ... then the disaster is most appropriately seen as a 'natural' one. By contrast, if the triggering event was one that inherently required human action ... then the disaster is most appropriately seen as technological. (24-5)

Another way of distinguishing between natural and technological disasters involves conceptualizing trauma along a “continuum of deliberateness” where technological disasters fall midway between natural disasters and purposeful acts of violence (Green 1982, 1993, 1996). Figure 1 presents a revised version of Green’s model incorporating litigation and terrorism as “events.”

Technological Disaster Concepts

There is a substantial body of research literature on community responses to technological disasters from which we can draw. In general, seven features tend to characterize community responses to technological disasters and thus have bearing on major oil spills. These features, represented in Figure 2, are:

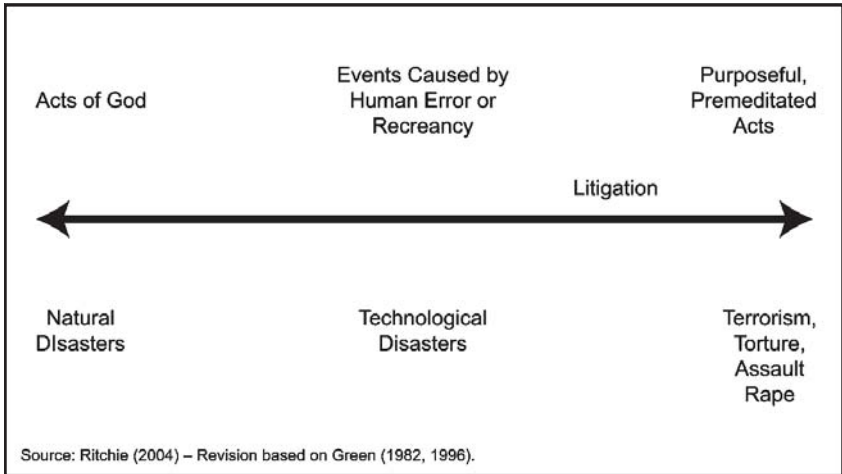


Figure 1. Revised continuum of deliberateness for traumatic events.

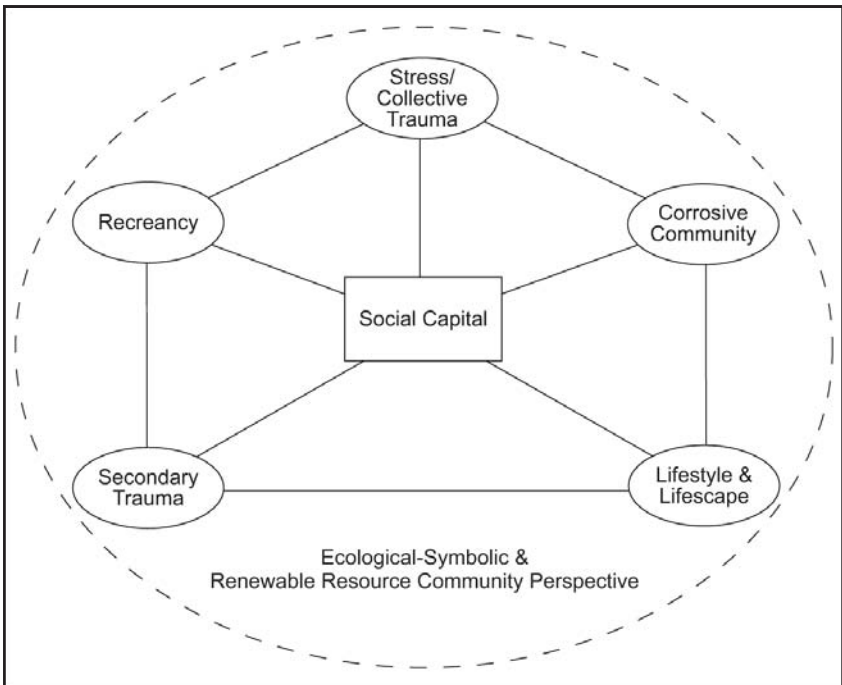


Figure 2. Technological disaster concepts.

an ecological symbolic context; recreancy; a corrosive community; collective trauma and stress; lifestyle/lifescape changes; secondary trauma; and social capital. Each of these concepts will be examined and related to the *Selendang Ayu* incident. (The term “*Selendang Ayu* incident” includes the wreck, the subsequent spill, spill-response activities, including lightering oil remaining on the vessel and shoreline/beach cleanup, as well as community interpretations and response to these events.)

Ecological-symbolic context — One social response to technological disasters is a realization of how connected we are to our local environment, whether it is our natural environment or our “built” environment. Kroll-Smith and Couch (1991) proposed that our interpretative processes that mediate how we experience disaster events are influenced by the type of environment that is damaged. For example, in the aftermath of 9-11, citizens of New York describe emotional reactions influenced by the absence of the twin towers in the skyline. This damage to the built environment affected the way they experienced the disaster.

A renewable-resource community (RRC) is another example of the ecological-symbolic context. An RRC is a community whose primary cultural, social, and economic existences are based on harvesting and using renewable natural resources (Picou and Gill 1997). When an event such as an oil spill affects renewable natural resources upon which a community is based (e.g., fish, crabs, edible plants, etc.), individuals and groups in the community interpret the event from that perspective. More importantly, the closer these individuals and groups are tied to these resources — economically, culturally, and socially — the greater impact the event has on them.

A confounding factor in many technological disasters is the uncertainty that accompanies environmental contamination. Visible damages from natural disasters leave no doubt that something occurred, and recovery is discernable when buildings, bridges, roads, and other structures have been rebuilt. Damages from technological disasters are not always visible, and contamination creates uncertainty about long-term threat of exposure, effects on health, property, and resources, and recovery/restoration. This uncertainty leads affected individuals and groups to construct their own definitions of the situation as opposed to a “collective” definition found after a natural disaster. These individual definitions are made in an ecological-symbolic context, but are often contested or in

conflict with definitions of others.

As previously noted, Dutch Harbor/Unalaska is an RRC dependent on several commercial fisheries as well as a variety of subsistence resources. We would expect that differences in the degree to which individuals and groups are linked to these resources would result in different interpretations of the wreck and oil spill, as well as different impacts the event might have within the community.

Recreancy — A technological disaster raises questions about blame. Natural disasters are blamed on “nature” or “God,” but a technological disaster is usually caused by some person(s) and/or organization not properly doing their job. This phenomenon has been termed “recreancy,” defined as “the failure of experts or specialized organizations to execute properly responsibilities to the broader collectivity with which they have been implicitly or explicitly entrusted” (Freudenberg 2000:116). As a result, there are identifiable parties to blame and hold accountable (i.e., “responsible party”) and this can lead to litigation as victims attempt to gain compensation for damages they have experienced. The idea that someone is responsible for a disaster also evokes higher levels of anger, rage, and hostility than would be found in a natural disaster.

Corrosive community — Borrowing an analogy from earthquake studies, communities have social “fault lines” based on factors such as demographics (e.g., race/ethnicity, occupation, gender, age), attitudes (e.g., liberal versus conservative, pro- versus anti-development), and residential status (e.g., permanent versus seasonal, old-timers versus newcomers) (Gill 1994). Although group conflict can occur as a result of these fault lines, conflict tends to be mediated by a general consensus emphasizing the “common” good. Natural disasters tend to promote this consensus, as revealed by an emergence of a “therapeutic” community in which community members come together to help each other cope with traumatic events and move toward recovery. These efforts are augmented by assistance from outside agencies such as the Red Cross, the Federal Emergency Management Agency (FEMA), and other government agencies.

Technological disasters, however, are characterized by a “corrosive” community (Freudenberg and Jones 1991) in which social fault lines become exacerbated. In a technological disaster, damages — particularly contamination — are not always clear or obvious. As a result, uncertainty is generated by com-

peting definitions about environmental damages, social consequences, and future threats/recovery. A corrosive community is characterized by social disruption, uncertainty, lack of consensus about what is taking place, and who should be held responsible for a disaster (i.e., who was “recreant”). This concept suggests a deterioration of relationships resulting from confusion, conflict, fear, anger, and stress in a milieu of uncertainty.

Stress and collective trauma — There are different ways to think about stress. A convenient definition suggests that stress occurs when there is a “substantial *imbalance* between environmental demand and the response capability of the focal organism” (McGrath 1970:17, italics in the original). Erikson (1976) views individual stress as individual trauma — that is, “a blow to the psyche that breaks through one’s defenses so suddenly and with such brutal force that one cannot react to it effectively” (Erikson 1976:153). Stress also occurs at a collective or community level. Barton’s (1969) conceptualization of collective stress captures linkages between stress and social structure: “[C]ollective stress occurs when *many members of a social system fail to receive expected conditions of life from the system*” (38, italics in the original). For Erikson (1976), collective trauma is “a blow to the basic tissues of social life that damages the bonds attaching people together and impairs the prevailing sense of communality” (154).

Hobfoll’s (1988, 1989) conservation of resources (COR) model proposes that stress results from loss of resources, threat of resource loss, and/or when resources are invested without gain or return. According to Hobfoll, traumatic stress results in rapid loss of resources that are typically resources of highest value (e.g., loss of a loved one, involuntary termination from employment). These traumatic stressors attack individuals’ and communities’ basic values, occur unexpectedly, place excessive demands on individual and collective resources, are beyond the normal scope of resource utilization, and leave behind a powerful mental image of loss (Hobfoll 1991).

Numerous empirical studies have established that technological disasters produce higher levels of stress than natural disasters. In some cases, certain types of stress actually increase over time among certain individuals and groups. Chronic feelings of demoralization, loss of ability to cope, depression, anger, frustration, fear, brooding, paranoia, alienation, distrust, low self-esteem, and diminished self-worth have all been associated with exposure to technological disasters (See Ritchie 2004:77 for a referencing of these studies). Further, technologi-

cal disasters tend to generate chronic, long-term negative mental health outcomes that rarely occur in natural disasters (See Ritchie 2004:91 for references to these studies).

Stress reactions following technological disasters result in changes in social dynamics: the way people and groups relate. For example, if avoiding reminders of a traumatic event such as the EVOS is a coping strategy for some individuals, frequency and quality of association with others may decline (e.g., Arata et al. 2000). According to social capital research, this in turn affects information flow, trust, and norms of reciprocity.

Lifestyle and lifescape changes — In the wake of technological disasters, communities undergo both a “lifestyle change” and a “lifescape change” (Edelstein [1988] 2004, 2000). The former refers to a disruption in normal patterns of everyday life, which occurs following both natural and technological disasters. The latter reflects a much deeper, fundamental disruption of underlying, taken-for-granted assumptions about society and often occurs in the aftermath of technological disasters. “The lifescape reflects each individual’s way of embodying a larger shared societal paradigm in the context of personal life” (Edelstein 2000:131). Similar to the corrosive community concept, negative lifescape changes may result in feelings of isolation and/or abandonment, health concerns, distrust of others, distrust of the environment, and loss of control.

Stress, lifestyle change, and lifescape change are mutually influential. To cope with stress following a disaster, individuals and communities change daily routines — couched as lifestyle change by Edelstein ([1988] 2004, 2000). Lifestyle changes can produce additional individual and collective stress; moreover, lifestyle changes lead to lifescape changes, which also may be stress inducing. Changes in lifescape influence day-to-day decision-making processes, challenge beliefs, and threaten “ontological security,” that is, “the confidence that most human beings have in the continuity of their self-identity and in the constancy of the surrounding social and material environments of action” (Giddens 1990:92).

Secondary trauma — Erikson (1976) introduced a term, “secondary trauma,” to describe the loss of communality experienced by survivors of the Buffalo Creek, West Virginia, dam collapse and flood. Communality emphasizes social networks and neighbor relationships that run much deeper than the physical space of a community. In Buffalo Creek, this

loss of communality was exacerbated by rescue and recovery activities from outside authorities who were faced with the destruction of 16 communities and villages in the valley. This was most pronounced when surviving families were placed in a temporary mobile home park without regard to preexisting neighborhood patterns. This disruption of social capital further demoralized many survivors.

Secondary trauma can be thought of as trauma caused by a poorly planned or failed response from social organizations having response obligations (Gill 2005). Most communities have government and civic organizations that have obligations for disaster response (e.g., law enforcement, firefighters, medical staff, utility crews, local government, churches, and relief organizations). Moreover, these organizations generally have experience and, in many cases, formal training in responding to *natural* disasters; as such, they tend to coordinate their efforts to better plan for and address this type of emergency situation. Thus, few natural disasters produce secondary trauma except in cases where response is viewed as lacking or inadequate (e.g., FEMA's inadequate response to Hurricane Katrina probably caused a high degree of secondary trauma).

Compared to natural disasters, technological disasters are a "new species of trouble" (Erikson 1994); thus, response planning and coordination are less developed and actual responses to disasters are often poorly executed. As a result, secondary trauma is more likely to be found after a technological disaster. Further, because of recreancy and identification of responsible parties, technological disasters (at least in the United States) typically involve the judicial system, where claims of damages and injury disasters are litigated. For example, a lack of resolution of litigation associated with the *Exxon Valdez* oil spill — ongoing 12 years after the jury trial and verdict — further traumatizes individuals, groups, and communities impacted by this disaster (Picou et al. 2004). Impacts of secondary trauma are related to a corrosive community, chronic stress among individuals and communities, negative lifescape changes, and diminished social capital.

Social capital — There are many forms of capital available in most communities. Among these we find financial capital, human capital, physical capital, natural resource capital, and social capital. Social capital refers to social networks, the reciprocities and trustworthiness that arise from them, and the value of these networks for achieving mutual goals (Putnam 1993, 1995, 2000). In comparing social capital with other forms

of capital, Coleman (1988) observes:

*Unlike other forms of capital, social capital inheres in the structure of relations between actors and among actors. It is not lodged either in the actors themselves or in physical implements of production. . . . If physical capital is wholly tangible, being embodied in observable material form, and human capital is less tangible, being embodied in the skills and knowledge acquired by an individual, social capital is less tangible yet, for it exists in the **relations** among persons. (S98, 100-101, emphasis in the original)*

Social capital promotes social cohesion, social solidarity, and economic achievement for communities and organizations and enhances spiritual well-being, a sense of identity, and belonging, honor, social status, and prestige for individuals.

Social capital is integral to technological disaster concepts (Ritchie 2004; Ritchie and Gill, forthcoming). First, recreancy confronts beliefs about organizational trustworthiness and reliability, as well as feelings of security. When trust and ontological security are diminished, social capital becomes limited. Second, a corrosive community involves disruption of relationships, loss of trust, and declines in reciprocity. This diminishes individual and community social capital. Third, stress reactions following technological disasters change social dynamics and how people and groups relate. Negative changes in associations — e.g., if associations break down or communication is diminished — represent diminished social capital. Stress often leads to decreased interaction and isolation that can further tax social capital and create additional stress. Fourth, lifestyle changes may produce stress reactions, such as avoidance behaviors, that reduce social interaction, thus affecting social capital. Moreover, lifescape changes, particularly involving ontological security, may challenge essential elements of social capital, such as trust, interaction, and reciprocity. Finally, secondary trauma further taxes already depleted “stores” of social capital, and a cumulative social capital loss spiral may cause additional secondary trauma.

Research approach

Conducting research in a community is the most effective approach to understanding and documenting social responses to events such as the grounding of the *Selendang Ayu*. A few

days after the ship wrecked, we initiated telephone and e-mail inquiries with local residents and determined there was sufficient interest and need to study this incident. Two primary points of contact — one from the Alaska Native community and a non-Native community leader — strongly encouraged our work and provided excellent entrée to the area. Prior to arrival, we used a Web search to contextualize our study by researching community history, demographics, geography, and ecology. We also used Web sources to monitor spill response activities and track media coverage dating back to December 8, 2004.

Logistical issues prevented us from traveling to the community until early February, two months after the grounding. Our primary goal was to interview individuals who comprise a cross section of the community. To make the most of our time, we began meeting with community leaders the evening of our arrival and maintained a rigorous interview schedule from that point on for the duration of our 10-day stay. People in the community were extremely busy, but gracious with their time as we scheduled interview appointments.

We used a combination of purposive and snowball sampling techniques to intentionally select individuals representing various groups and perspectives within the community (e.g., Alaska Natives, commercial fishermen, community leaders, business owners, etc.). We began with names provided by our telephone contacts and proceeded to develop a matrix of possible interviewees. We focused on people who were recommended by at least two individuals as being knowledgeable about the community as we proceeded with scheduling interviews. As we made contacts throughout the community, we distributed a one-page information sheet introducing ourselves and providing information about the study. No one we contacted declined to be interviewed, although we were unable to contact or schedule an interview with some recommended individuals.

From February 4-14, 2005, we conducted 31 personal interviews averaging about one hour each. Interviews were conducted in locations convenient for participants, ranging from individuals' homes, to work places, to fishing boats, to a private setting in a bunkhouse. All interviews were tape-recorded for transcription at a later date. Ultimately, our sample included Alaska Natives, commercial fishermen, long-shoremen, Filipinos, fish processors, business owner/managers (including eco-tourism), community leaders, environmentalists, the general public, and the Incident Commander (Coast

Guard). As we learned more about the community, incident, and population, we refined our discussion guide to appropriately explore and capture key issues identified by local residents. We also spent time observing and participating in various community settings (e.g., attending spill briefing meetings, participating in an Aleutian Life Forum planning session, visiting the local library and museum, etc.).

Findings

Our findings are based on interviews, observations, media accounts, and background information on the community. At a general level, we found that individual and community reactions were tempered by the initial loss of life in the rescue effort of *Selendang Ayu* crew members. This fact, combined with the December 26, 2004, Indian Ocean tsunami, contextualized individual, group, and community perspectives about the incident.

“We were fortunate,” “It’s not a question of ‘if’ but ‘when,’” and “shot across the bow” summarize various expressions we heard throughout the community. The *Selendang Ayu* incident heightened awareness of risks associated with the high volume of international shipping passing through the region along the Great Circle Route. Similar events experienced by the community during the past ten years further contribute to local risk perceptions (e.g., the *Kuroshima* and the cruise ship *Clipper Odyssey*). These risk indicators are valid and warrant consideration in developing approaches to reduce risks. As a renewable-resource community, Dutch Harbor/Unalaska has evolved a collective lifescape that accepts risks associated with its environment (e.g., extreme weather) and activities required to coexist with and thrive in that environment (e.g., subsistence, commercial fishing). Local involvement and utilization of local knowledge, development of a collective lifescape, and high levels of social capital are vital to addressing these risks.

Various presentations at the 2005 Aleutian Life Forum describe and examine ways in which subsistence, Native culture, commercial fishing, and ecotourism have been affected by the incident (e.g., Kelty 2005; Kniazowski 2005; Svarny-Livingston 2005). Makushin and Skan bays have traditional cultural value for Aleutian people. For example, many Natives had relatives living in these areas until WW II. Cultural traditions of subsistence and memories of ancestors provide significant symbols that help define individual and group identity.

Indeed, the *symbolic* importance of this region may outweigh the relatively small amount of subsistence activities that actually occur there.

Commercial fishing is integral to the community economy and government. Damages to a Tanner crab fishery in the impacted region are not fully resolved, but commercial fishing, in general, should continue on course. Tourism and ecotourism may take longer to recover due to a lost season in 2005. Most ecotourism businesses are expected to resume activities next year. Ultimately, recovery will depend on how tourism client bases have been affected and it is too early to gauge continuing ecotourism impacts.

Recreancy was evident throughout our interview data, with several respondents blaming the ship's captain for the wreck. Media accounts of the captain's trial (after our initial data collection in February) indicated he pled guilty to lying to federal investigators and falsifying records about circumstances following the grounding and instructing his crew members to do the same. In the case of the *Selendang Ayu* grounding, the shipping company was officially identified as the "Responsible Party" and prepared to assist in response and recovery efforts. In addition, some interviewees placed some blame on the government for not having more effective prevention policies, given the level of vessel traffic in the region.

Other than recreancy, we found little to no evidence of other social impacts outlined in our conceptual model. That is, our data do not suggest collective trauma and stress, a corrosive community, negative lifescape change, secondary trauma, or loss of social capital in the aftermath of the *Selendang Ayu* incident. According to our conceptual model and experience studying community effects of the EVOS, we conclude that community impacts would have been more severe had the spill been larger and closer to Unalaska Bay.

Overall, there is little to no evidence to suggest that there will be negative long-term social impacts from this single incident. Indeed, some positive outcomes have occurred in terms of an increased appreciation for the community's ties to the natural environment. We also observed considerable social capital, as well as financial, human, and natural resource capital in this community. These various forms of capital combine to create healthy community resilience. Maintaining resilience, however, depends on continued local involvement in community issues, particularly discussions about risks. Indeed, the *Selendang Ayu* incident heightened awareness of other environmental risks in the area. For example, some groups are

concerned about risks from contaminants in Unalaska Bay.

Our findings are not intended to close the book on social impacts of the *Selendang Ayu* incident. Although the community as a whole has experienced little stress or collective trauma, some individuals and groups have experienced social disruption and stress as a result of this event and may continue to do so. After cleanup operations are concluded, there may be a period of individual and collective reflection on this incident that may produce stress. Further, if expectations about compensation for damage claims are not met, stress and social friction may ensue.

At the same time, the incident opens opportunities to maintain and build upon high levels of social capital observed in this community. The 2005 Aleutian Life Forum exemplifies efforts to do this. It is important for formal and informal community leaders to be aware of social capital and other factors of resilience as citizens, groups and the community continues to process meanings and implications of this incident.

Lessons to Be Learned

Combined with disaster research on issues associated with prevention and preparedness, the *Selendang Ayu* incident reveals several lessons to be learned that can enhance community resilience. Our research experiences focus on social processes of prevention and preparedness, particularly with respect to social capital, and, thus, frame our discussion of some sociological lessons to be drawn from this incident.

The old adage that “an ounce of prevention is worth a pound of cure” underscores its importance in emergency management. In the aftermath of the *Selendang Ayu* incident, several preventive measures have been suggested (e.g., see Parker & Associates 2005). Implementing a vessel-tracking system, upgrading vessel construction standards, requiring emergency tow packages on vessels, improving enforcement of existing regulations, and legislating new policies and regulations are some of the recommendations aimed at preventing these incidents from occurring.

An understanding of risk provides a foundation for establishing prevention measures. Risks need to be articulated and recognized before informed and effective prevention measures can be developed and implemented. A recommended “Risk Assessment for the Aleutian Islands” is particularly relevant in this regard (Alaska Oceans Program 2005). A socio-

logical lesson to remember is to encourage civic engagement and invest social capital in this process. Like most leaders in rural Alaska communities similar in size, Dutch Harbor/Unalaska leaders are adept at using social capital and encouraging civic engagement in community affairs. However, it is not uncommon to find disenfranchised groups in these communities. A key component in socially assessing risks is striving to include varying and sometimes competing risk perceptions throughout this process. As Waugh and Hy (1990) note for disaster planning and management, “[there is a] need for strong cooperation and coordination among public, nonprofit, and private sectors.” (14)

Preparedness involves activities that enhance community capacity to respond to an emergency, as well as plans to mitigate effects from such an event. There is overlap where prevention ends and preparedness begins. One level of preparedness focuses on common hazards and threats experienced by the community. A second level of preparedness anticipates “worse case scenarios” (Clarke 2005). In either case, it is important to recognize and prepare for likely social and community effects. For example, the Prince William Sound Regional Citizens’ Advisory Council guidebook, *Coping with Technological Disasters*, offers strategies for mitigating social and psychological effects of such disasters.

Although recognized as the second largest oil spill in Alaska history, the environmental, economic, and social impacts of the *Selendang Ayu* incident — thankfully — remain far from that of the magnitude of the 1989 *Exxon Valdez* disaster in Prince William Sound. Indeed, the grounding of the *Selendang Ayu* could hardly be considered a “disaster” by sociological standards, although our data suggest that the incident affected individuals and groups within the Dutch Harbor/Unalaska community to varying degrees. This recent incident does, however, offer an opportunity to learn more about contextual factors associated with assessing the degree to which an event constitutes a disaster. As such, the *Selendang Ayu* shipwreck and oil spill provides an opportunity for the community to reassess and improve its preparedness for future incidents.

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The Oil Pollution Act and Natural Resource Damage Assessment and Restoration Process

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Introduction

Following the *Exxon Valdez* oil spill in Prince William Sound, Congress passed the Oil Pollution Act of 1990. The law broadened the scope of damages for which polluters are liable.

Among other legal requirements, parties who spill oil into the waters of the United States must restore or replace natural resources and related services injured by the oil. These “responsible parties” must also compensate the government for interim losses that occur, until those resources and services are restored. The process to ensure that these responsibilities are carried out is referred to as natural resource damage assessment and restoration (NRDAR).

Visit the U.S. Fish & Wildlife Service, Alaska Region, NRDAR Program Web site, www.r7.fws.gov/fisheries/contaminants/rest.htm, for more information about NRDAR activities in Alaska, or the Department of Interior NRDAR Web site, at restoration.doi.gov, for general information and helpful links.

Who Brings Damage Claims?

If an individual or organization suffers loss of damage due to an oil spill, the Oil Pollution Act (OPA) entitles them to seek compensation. Indeed, fair compensation is an important aspect of final recovery from the spill. The National Pollution Funds Center (NPFC) has the authority to use the Oil Spill Liability Trust Fund (the OSLTF, or the Fund) to pay for uncompensated removal costs and damages. Claims not paid by the responsible party (RP) or resulting from mystery spills (for which an RP cannot be identified) may then be submitted to the NPFC for payment.

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Costs and damages covered by the Fund include:

- Uncompensated removal costs
- Damages to natural resources
- Damages to real or personal property
- Loss of subsistence use of natural resources
- Loss of profits or earning capacity
- Loss of government revenues, and
- Increased cost of public services.

Claimants may include:

- Federal, state, and local government entities,
- Cleanup contractors,
- Corporations and businesses, and
- Members of the general public.

For the purpose of natural-resource damage claims, federal and state agencies that own, manage, or hold in trust natural resources are designated as Trustees. The President designates federal Trustees. The governor of each state designates state Trustees.

From the U.S. Coast Guard's National Pollution Funds Center (NPFC) web site. For more information, visit www.uscg.mil/hq/npfc/Claims/index.htm.

How Natural Resource Damage Assessment Works

After an oil spill or hazardous substance release, response agencies like the U.S. Environmental Protection Agency or the U.S. Coast Guard clean up the substance and eliminate or reduce risks to human health and the environment. But these efforts may not fully restore injured natural resources or address their lost uses by the public. Through the NRDA process, trustee agencies conduct studies to identify the extent of resource injuries, the best methods for restoring those resources, and the type and amount of restoration required.

A NRDA consists of three steps:

1. Preliminary assessment — Natural resource trustees determine whether injury to public trust resources has occurred. Their work includes collecting time-sensitive data and reviewing scientific literature about the released substance and its impact on trust resources to determine the extent and sever-

ity of injury. If resources are injured, trustees proceed to the next step.

2. Injury assessment/restoration planning — Trustees quantify injuries and identify possible restoration projects. Economic and scientific studies assess the injuries to natural resources and the loss of services. These studies are also 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 recover.

3. Restoration implementation — The final step is to implement restoration and monitor its effectiveness. Trustees work with the public to select and implement restoration projects. Examples of restoration include replanting wetlands, improving fishing access sites, and restoring salmon streams. The responsible party pays the costs of assessment and restoration and is often a key participant in implementing the restoration.

Although the concept of assessing injuries may sound simple, understanding complex ecosystems, the services these ecosystems provide, and the injuries caused by oil and hazardous substances takes time — often years. The season 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 that are 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 described above ensures an objective and cost-effective assessment of injuries — and that the public's resources are fully addressed.

From the National Oceanic and Atmospheric Administration Damage Assessment and Restoration Program (DARP) Web site. For more information, visit www.darp.noaa.gov/about/index.html.



Coping with Technological Disasters: Helping Communities Help Themselves

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Abstract

Major technological disasters, such as oil spills, create many situations that are addressed in typical government and industry contingency plans, such as how to boom a beach, or clean a bird, or lighter a tanker, for example. What is not addressed in contingency plans is how to mitigate the social and psychological impacts of such a disaster on residents of affected communities. Technological disasters have been shown to produce what have come to be known as "corrosive communities," characterized by unusually high levels of tension, conflict, ongoing litigation and chronic psychological stress.

Having experienced a major oil spill firsthand, the members of the Prince William Sound Regional Citizens' Advisory Council (PWSRCAC) initiated a project to fill this large gap in oil-spill response planning. In addition to drawing upon personal experience, PWSRCAC consulted experts in the fields of socioeconomic and technological disaster research to help in the development of a guidebook, titled *Coping with Technological Disasters*.

The guidebook was released in 1999 and contains information to help communities and individuals understand what a technological disaster is, how it differs from a natural disaster, and what to expect during, and in the years following, the disaster. Information, resources, and proven programs are presented in the guidebook for use by local governments, civic groups, mental health organizations, individuals, or just about anyone responding to a major disaster.

Since its release, the guidebook has been requested by communities, state and federal agencies, organizations, and

companies throughout Alaska, the United States, and internationally. It has been praised by community leaders, mental health professionals, and emergency responders as an excellent reference and resource. By sharing what the communities of the *Exxon Valdez* oil spill region have learned, PWSRCAC believes this guidebook will enhance existing contingency plans, not only for spill response, but for other emergencies as well.

Discussion

PWSRCAC is an independent nonprofit corporation whose mission is to promote environmentally safe operation of the Alyeska Marine Terminal in Valdez, Alaska, and associated tankers. The work of PWSRCAC is guided by the Oil Pollution Act of 1990 and a contract with Alyeska Pipeline Service Company. PWSRCAC's 18 member organizations are communities in the region affected by the 1989 *Exxon Valdez* oil spill (EVOS), as well as commercial fishing, aquaculture, Native, recreation, tourism, and environmental groups. Socioeconomic research is a requirement of PWSRCAC's contract with Alyeska.

There is a strong body of research that documents the unique trauma and stress caused by technological disasters (Arata et al. 2000). After EVOS, there were numerous studies carried out in various communities that documented social problems as a result of the spill. Having experienced the trauma and stress caused by a major oil spill firsthand, the members of PWSRCAC wanted to go beyond documentation and develop the means to lessen the psychological and sociological impacts. In essence, PWSRCAC set out to create a human-impacts contingency plan that would provide practical advice and solutions, much as a traditional oil spill contingency plan provides operational strategies to prevent and clean up oil spills. This was no small task, given there was no model to reference. It took PWSRCAC almost ten years of working with researchers and volunteers to develop the *Coping with Technological Disasters* guidebook. By developing the guidebook, PWSRCAC achieved its original goals, and has created a valuable resource for communities and emergency responders.

The guidebook provides information to help community officials and individuals identify and cope with the adverse psychological effects associated with major technological disasters. By referring to the guidebook, emergency responders from the responsible party and government agencies will gain a better understanding of psychological issues associated with

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catastrophic oil spills. The responders will also have practical tools at their fingertips that they can incorporate into the response. Showing sensitivity to community issues, such as stress and trauma, may also help relationships between the victims and the emergency responders from the responsible party and government agencies.

Background

As mentioned above, PWSRCAC devoted immense resources and time to developing the guidebook. The membership of PWSRCAC experienced firsthand a technological disaster when EVOS occurred in March of 1989. Large communities, small villages, and families found their normal routines drastically altered, if not altogether turned upside down. Subsistence users were afraid to eat their traditional foods. Commercial fishermen were faced with fisheries closures and uncertainties about the future. Small-business owners could not keep employees who were taking more lucrative oil spill cleanup positions. Towns were overrun with lawyers, dignitaries, and cleanup workers. Resentments ran high as some chose to make a lot of money on the cleanup and others either chose not to work on the cleanup or wanted to but could not get hired.

There was plenty of industry and government involvement in terms of cleaning up the oil spill, but very little, if any, outside assistance in terms of addressing the human stress and trauma. For example, the Seward Life Action Council (SLAC) issued a report describing the unprecedented demand on psychosocial services in Seward during 1989. SLAC documented increases in domestic violence and marital difficulties that “seemed to be exacerbated by the oil spill and cleanup activities” (Rodin et al. 1997). SLAC, like many of the local agencies, did not have the financial resources to hire additional staff.

The stress and trauma caused by EVOS did not end after the cleanup was officially finished. Results of *Exxon Valdez* oil spill studies indicate that mental health impacts still persisted eight years post-spill (Arata et al. 2000). These impacts include disruption of family structure and unity, family violence, depression, alcoholism, drug abuse, and psychological impairment. One of the things found is that the extent of chronic mental health patterns appears to be correlated to the extent that a community is dependent on its natural resources for survival. The communities most impacted by EVOS are extremely dependent upon natural resources.

The people in the PWSRCAC region learned many lessons because of EVOS. They learned that there was no outside help available to ease the stress and trauma caused by EVOS. They learned that they had to hire lawyers and embark in a long and contentious litigation battle with the responsible party (legal appeals to the \$5 billion jury award continue to be reviewed by the courts as of this writing). They learned that if they wanted help, then they had to help themselves. Thus, the PWSRCAC took on the large task of developing the *Coping with Technological Disasters* guidebook. This guidebook can be, and has been, used by other communities faced with their own technological disasters. It provides a road map to help communities. By using this book, communities may be better equipped to deal with the pressures, demands, and upheavals created by technological disasters. They are better able to restore the social fabric of their communities, rather than just watch it ravel away, as time marches on. The section below provides more detail on the “corrosive community” concept created by technological disasters.

Coping with Technological Disasters guidebook

Much of the scientific research behind the *Coping with Technological Disasters* guidebook was carried out by Dr. J. Steven Picou, a sociologist who is noted for his studies of technological disasters. PWS RCAC funded Dr. Picou to continue research he previously began in the EVOS impacted community of Cordova, Alaska, and to build a mitigation program. In addition to Dr. Picou’s strong body of research and knowledge, PWSRCAC tapped its own membership for ideas and strategies based upon their personal experiences with EVOS. Successful strategies and accompanying research make up the *Coping with Technological Disasters* guidebook, which is divided into six chapters and related appendices.

What happens in a technological disaster — Technological disasters are human-caused disasters such as transportation, industrial or nuclear accidents, and contamination from hazardous waste sites (Picou et al. 1997). Examples of technological disasters include Love Canal (New York), Three Mile Island (Pennsylvania), Bhopal (India), and more recently the *Erika* oil spill (France). Natural disasters, in contrast, are attributed to divine or natural causes.

Research indicates that technological disasters have unique impacts when compared to natural disasters. Researchers have coined the term “corrosive community” to describe

communities impacted by technological disasters. “Corrosive communities” are marked by many factors. There is typically a responsible party in a human-caused accident, resulting in the assigning of blame and responsibility, and, ultimately, litigation. The responsible party may minimize damages because of litigation considerations. Disaster assistance in the form of state and federal aid is not readily or likely available when there is a responsible party. Social relationships within the affected communities are often torn apart by apprehension, fear, anger, confusion, and stress (Picou et al. 1997). Rather than focusing on returning the community to the predisaster state, efforts are focused on proving or disproving damages for litigation purposes. Thus, the residents of the communities may find their claims, lifestyles, and even integrity under attack in the courts. The psychological impacts tend to be more severe, persist over longer periods, and may actually increase over time as compared to psychological impacts in a natural disaster (Picou et al. 1997).

Researchers use the term “therapeutic community” to describe communities impacted by natural disasters. As mentioned above, a natural disaster is attributed to divine or natural causes. Disaster assistance is provided by many sources, such as local, state and federal agencies. Efforts are focused on returning the community to the predisaster state. Trauma and stress tend to be short-term (Picou et al. 1997). The community pulls together, with the support of outside agencies, to rebuild. There is no “responsible party,” no complex litigation, and less anxiety over uncertain futures.

Awareness of the unique impacts of a technological disaster is one of the key elements in coping with those impacts by community members. It is also important for responders to understand why they may be faced with heightened anxiety and anger from the impacted community.

“Growing Together” community education program —

The guidebook presents outreach activities to help people understand the nature and kinds of stress reactions communities are experiencing and provide information and resources to assist them in coping with the effects of the disaster. These outreach activities are contained in the “Growing Together” community education program.

The activities were developed with the notion that established groups and mental health organizations in the impacted community would be the entities to implement the activities. Established social and civic organizations, such as churches,

The Selendang Ayu Oil Spill

Outreach Activity	Description	Strategy	Impact or Target Population
Community Education Newspaper Series	Nine articles on technological disasters, their impacts and coping skills	Run series in local newspaper	Community
Community Education Radio Series	Program on coping skills	Five-part program broadcast on local radio	Community
Community Education Leaflet Distribution	Coping skills information contained in nine leaflets	Distributed at locations throughout community	Individual Level
In-service Training Program	Mental health workers, teachers, clergy, law enforcement personnel training in appropriate intervention strategies	Identify organizations, develop schedule, implement	Individual Level
Peer Listener Training Program	Volunteers trained and provided materials for support counseling	Solicit volunteers, develop schedule train, implement, monitor	Individual Level
Talking Circle	Alaska Native and other community members participate in talking circle oriented toward <i>Exxon Valdez</i> oil spill disaster	Organize through traditional facilitators and invitation to villages within Prince William Sound	Alaska Native Community and other community members

Table 1. Outreach Activities for the Growing Together Community Education Program.

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professional groups (like teachers and mental health providers), tribal organizations, and trade unions, already have their group dynamics and a certain amount of infrastructure in place and can reach broad segments of the population.

The “Growing Together” program was developed by Dr. Picou and his research team, based upon careful study of technological disasters and the increased demands they place on mental health services. Research conducted in Cordova, Alaska, was also vital to the development of the program. Many local volunteers and groups were active in developing and refining these activities.

One of the components of the program is a generic community survey that can be used to tailor activities for any particular community. As collecting and analyzing such information for developing a program can take a long time and a considerable amount of money, a model program based upon the Cordova experiment was developed. Table 1, on the preceding page, presents an overview of the model outreach activities. Procedures for implementing each activity are also included in the guidebook. All of the outreach materials are included in the accompanying appendices.

Newspaper articles — One way to reach a broad audience in a community is through a local newspaper, if one is available. A newspaper series was developed to be presented in nine weekly vignettes as public service announcements. This series describes technological disasters, the known social effects, and various coping strategies. Each article is written in nontechnical terms for the lay audience. Titles for the articles are:

- “Technological Disasters: Why Are They Different?”
- “Three Mile Island: A Continuing Disaster”
- “Understanding Anger from Technological Disasters”
- “Letting Go of Chronic Depression”
- “Chronic Stress and Alcohol Consumption”
- “Talking to Children in Stressful Situations”
- “The Mood-Food Connection and Stress”
- “Chronic Stress and Cancer: Is There a Link?”
- “Coping with Technological Disasters”

Radio programs — If a station is available in the area of the disaster, radio broadcasts provide an important outreach vehicle. The “Growing Together” program includes five 30-minute programs involving experts informally discussing technological disasters and psychological stress, including

symptoms and coping skills. A call-in session with a local mental health expert is encouraged at the end of each radio program. Local issues can then be addressed and referrals made for any callers. The titles of these radio programs are:

- “What Are Technological Disasters?”
- “Community Recovery”
- “Depression”
- “Anxiety and Post Traumatic Stress Disorder”
- “Substance Abuse and Anger”

Community information leaflets — Information leaflets are an easy way to get information about technological disaster impacts into the community. They can be handed out, mailed out, or left in communal areas. Communities can also tailor leaflets to meet their own particular circumstances. Eight leaflets with the following titles are included in the program:

- “Growing Together: A Community Education Program”
- “Plain Talk about Domestic Violence and Abuse”
- “Plain Talk about Managing Anger”
- “Plain Talk about Depression”
- “Plain Talk about Post Traumatic Stress Disorder”
- “All about Alcohol: Just for Kids”
- “Plain Talk about Alcohol”
- “Plain Talk about Helping Children Cope with Disaster”

In-service training — Certain occupational groups within the community offer particular skills to reach various segments of the population. Professionals in occupations trained to deal with the public can be identified, trained by mental health professionals, assigned subject matter, and given their target audiences. In-service training for those identified (teachers, law enforcement, clergy, and mental health workers) is designed as two-hour presentations on the following subjects:

- What Are Technological Disasters?
- Symptoms of Chronic Stress
- Responding to Depression
- Alcohol Abuse

Each occupation has its own specific guidance in the training. For example, Figure 1 outlines one long-term inter-

LONG-TERM INTERVENTIONS

Drawing and talking activities – Activity #1

Start Classroom meetings/class discussions on issues involving feelings and relationships.

Suggested Ages — elementary for a 20 minute period, junior or senior high school during homeroom or study hall.

- Plan topics related to what the children/teenagers may be feeling. Examples might center around: when there is not enough money for children's school needs or spending, what it is like when parents fight, what happens if the family loses the family business due to the long-term effects of the oil spill, what would happen if the family needed to move.
- Class discussion on: "What would you do if..."
 "...your family lost their family business?"
 "...your parents lost their jobs?"
 "...your family had to move?"
- As teacher, introduce topic and begin by telling briefly about your own feelings or those of a close friend in a similar situation.
- Set ground rules: whatever is shared in the classroom meeting is private and shouldn't be repeated outside of the classroom.
- It is OK to express feelings and no one in the group may laugh.
- Once the topic has been introduced, it is your responsibility to keep the topic on track.

Figure 1. Teacher in-service training example.

vention strategy teachers can implement with their students.

Peer listener training — People affected by technological disasters are not viewed as “victims” by the larger society (Picou et al. 1997). This may be one reason why these folks are reluctant to use traditional mental health services. Often those affected might not even be aware they could use such services, even though research has documented a greater risk to experience long-term community, family, and personal disruption and distress as a result of the disaster. Research has shown traditional mental health services may not be effective in dealing with the long-term effects of disasters. One method for addressing these difficulties is the use of informal social support networks with trained peer listeners.

Properly trained peer listeners can provide a number of services to the community, from serving as an available ear to assisting in problem solving, to providing referrals to professionals.

Peer listeners drawn from the community are more likely to be trusted than outsiders are because they possess an understanding of the community and its relationship to the disaster. They may work with local church and community groups, directly with mental health organizations, or individually with family and friends.

The “Growing Together” program in Cordova drew volunteers for training from several high-risk groups. After recruiting and screening by local mental health professionals, selected listeners participated in a two-day training session. Supervision and support continued through the program with a follow-up contact about seven months after the initial training. While the program was intended to deal with the effects of the oil spill, developers found that it became an ongoing resource for mental health intervention. Cordova residents reported back to the PWS RCAC that this was one of the most successful components of the “Growing Together” program. As of this writing, the peer listeners continue to be an ongoing resource in Cordova. In addition, the network will be in place and available should future disasters or other traumatic events occur in the community.

One of PWS RCAC’s volunteers took the peer listener training to western Alaskan communities. These communities, heavily dependent upon subsistence and commercial fishing, have been dealing with fisheries failures for the past few years. The cause for the failures (natural or man-made) has not been determined, but the volunteer reported that the peer listener

training was very useful.

The talking circle — Culturally distinct groups within a community may require special intervention based on unique needs of tradition, language, and religion. To address this in Cordova, the “Growing Together” program worked closely with Alaska Natives through representatives of Eyak Village, a local Native Alaskan village. Together, they developed a program of talking circles, based on traditional Native custom. The circle was organized by the Native group and involved a number of spiritual leaders and facilitators. While the three-day meeting covered many subjects listed in previous sections, it also was designed to fit the Native community, with such activities as traditional healing ceremonies on the shores of Prince William Sound at the beginning and end of the session.

The talking circle program in Cordova proved a success and led to ongoing social programs sponsored by local Alaska Native villages and organizations addressing chronic social issues in the community.

Other resources — Although the “Growing Together” program is a large part of the guidebook and its appendices, other resources are also included to address a wide variety of issues. Chapter Three reaches out to individuals and families by outlining questions and concerns they may have and offering resources and coping strategies. Local governments can find useful information in Chapter Four, from how to establish a command structure to record keeping. Depending upon the situation, small businesses can be faced with supply surpluses or shortages and/or employee shortages. Small-business owners can find resources and ideas in Chapter Five. Chapter Six in the guidebook presents a volunteer management program. The use of volunteers is encouraged, while, at the same time, the responsibility and financial support needed to run a well-coordinated program is discussed.

Other resources in the appendices include information directories. They contain a full range of listings for institutions and organizations locally (PWS RCAC region), statewide, and federally that can be contacted in the event of a technological disaster. Project references are included in the appendices. The Cordova research compiled by Dr. Picou and used to develop the “Growing Together” program is in the appendices.

Evaluation and Reviews

The appendices also contain a scientific evaluation report describing a review of the "Growing Together" program implemented in Cordova, Alaska. The evaluation concluded that the implementation of the program, even five years after the *Exxon Valdez* disaster, did result in a number of positive consequences for a community chronically impacted by a major technological disaster. If the program had been implemented earlier in the disaster and run for a longer period, there might have been even more positive outcomes.

Beyond the formal evaluation, PWS RCAC has received a lot of feedback on the guidebook that indicates it is a valuable and much needed resource. It has been praised by community leaders, mental health professionals, and responders as an excellent reference and resource. Below are specific comments received on the guidebook:

From the perspective of a tribal Village Administrator, I must say that the ... Guidebook is emerging at a very appropriate time. Many tribes, statewide, are getting involved in the U.S. EPA's 'Indian General Assistance Program' (IGAP), and developing their own tribal environmental programs. One of Pedro Bay's objectives for the program is to develop local "spill response" capacity. The Guidebook provides the kind of "comprehensive" planning information that we need to implement a truly useful and workable program. The "hindsight is always 20/20" sort of perspective will make the ... Guidebook an invaluable resource to communities throughout the state, as they develop their own environmental programs and assess the 'technological' threats that are often overlooked in the planning process (Baalke 1999).

The ... document is one valuable contribution to community involvement in their own recovery. Every coastal community needs a copy of this template (Burwell 1999).

One oil industry emergency response specialist praised the guidebook for many reasons. She said it was "welcoming" in that it did not paint the responsible party as the enemy. It gives industry responders a sense of the community. And, she reported, it gives industry responders tools to allow them to be in the position to do the right thing for the community that is being impacted. Finally, as echoed by many others, she found the guidebook user-friendly.

The guidebook has been requested by a wide diversity of

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entities. Local recipients include state agencies, local and tribal governments, oil companies, and mental health agencies. Nationally, requests have been received from agencies such as the Red Cross and the federal Environmental Protection Agency, oil companies, insurance companies, public relations firms, and state agencies dealing with their own technological disaster issues. One example of that was a request for the guidebook from a Nuclear Waste Division with a local county in Nevada. PWS RCAC has also had international requests for the guidebook. The guidebook's value has been shown to go far beyond responding to oil spills.

Conclusion

By producing the *Coping with Technological Disasters* guidebook, PWS RCAC has made a significant contribution to technological disaster planning. Psychological impacts are rarely, if ever, addressed in traditional contingency plans dealing with technological disasters. Readers of the guidebook will learn about the unique social problems created by technological disasters. By raising awareness, those involved in such emergency responses (from the responsible party to local, state, and federal government agencies, to private organizations), will be more sensitive and understanding of these special community issues. This may help relationships strained by the emergency and all of the response activities. Further, the guidebook provides proven strategies that can be implemented fairly easily. The guidebook can be easily read, understood and used, by not only individuals, families and communities, but also by the responders.

The *Coping with Technological Disasters* guidebook and appendices can be downloaded for free from the PWS RCAC Web site: www.pwsrcac.org.

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Subsistence: Users and Stewards

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Introduction

Subsistence is a way of life for the Alaska Native people. It is the intimate and complex relationship that Alaska Natives share with their local natural resources. Subsistence is a lifestyle that combines values, beliefs, customs, and traditions to fashion community and cultural actions. It is the continued traditional hunting, fishing, and gathering of fish, wildlife, and flora for use as food, clothing, shelter, and as a commodity for trade and barter. But subsistence is much more than food and clothing to Alaska Native people. Subsistence is cultural survival.

The protection of the subsistence lifestyle and, hence, Alaska Native cultures requires a comprehensive resource management approach that should involve locals, from the ground up. Community members can contribute in formulating regulations, as well as in conducting baseline research and monitoring. Meaningful input from the most dependent users of the resource, the Alaska Native people, can result in additional data and, thus, better management.

Past to Present

Alaska is inhabited by distinct cultural groups including the Tlingit, Haida, Tsimshian, Athabaskan, Eyak, Yupik, Inupiaq, Alutiiq, and Aleut. These cultural groups live in different geographic areas which were owned or occupied by these peoples.

Survival and cultural development over several thousand

years in Alaska's varied ecosystems depended on an intimate knowledge of ecology, biology, migrations, and species life-cycles. A clan or community's survival required this knowledge base, along with careful utilization of these resources over area and time. Whole villages died when a poor season resulted in empty food caches midwinter. The ability to carefully harvest a resource established the prestige of the hunter, as well as the wealth and survival of the community.

Wars were fought to protect resources from intruders. Historically, Alaska Natives owned and managed these resources. In Southeast Alaska, where the Tlingit, Haida, and Tsimshian live, resources, rivers and coastal areas were owned by the clan. The head of the village managed the taking of the resource. Harvest levels were controlled to ensure continued return of that resource. Rituals, customs, and stories served to teach respect and conservation. These property rights and associated stewardship obligations were generally transferred along clan lines.

The rights to these resources were clouded with the arrival of outsiders. Alaska Natives have been impacted by non-Natives for over 200 years. During this time, the U.S. implemented an assimilation program and provided various economic and social incentives to civilize the Alaska Native. Assimilation has met with limited success: the religion is gone; languages in some areas are lost, and many of the legends, rituals, and songs are forgotten or dormant.

But Alaska Natives have clung to their culture through a subsistence lifestyle and have maintained their values for the resources and stewardship obligations. Subsistence is essential to the cultural survival of the Alaska Natives as a whole, and it is critical to the physical and spiritual well being of the individual.

The methods may have changed, but subsistence goes on. Families come together during harvesting times "to work on food." A subsistence activity may take days or require a commitment of weeks. It involves all. The elders take the lead in organization and their children perform the tasks of hunting, gathering, and processing, the grandchildren perform all the smaller tasks, such as gathering firewood or packing water.

Sharing is an important aspect of the subsistence — both giving and receiving. The family who is putting up food will always put up more than is necessary. The extra will be shared with extended family members. These cycles of harvesting, processing, distributing, and eating all keep cultures alive and active.

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Subsistence continues to support a major part of the state's rural economy. As of 1999, there were approximately 123,000 rural Alaskans, representing 20 percent of the state's population (Wolf 2000). Residents in 270 rural communities harvest approximately 43 million pounds of subsistence foods per year, or around 375 pounds per person per year. However, this take is small relative to the total harvests taken by commercial and recreational fishers and hunters. Statewide, the subsistence harvests of fish and game represent approximately 2 percent of the total harvests taken by subsistence, commercial, and recreational efforts.

Local Involvement

Alaska's fish and wildlife are managed by the federal and state governments. The federal government, by law, provides for a subsistence priority for rural residents who take resources on federal lands. The federal subsistence priority is managed through a federal subsistence program, which includes an agency board, federal agency staff, and ten regional councils. The regional advisory councils receive resource-related proposals and evaluate them based on subsistence standards. The regional councils' recommendations are considered by the federal board, and actions are enacted through the U.S. Fish and Wildlife Service.

An important part of this subsistence program is a grant program that funds communities or tribes that work with state and federal agencies to develop fishery monitoring and assessment research projects. The Fishery Information System (FIS) funding program has provided tribes and local residents the opportunity to become meaningfully involved in resource conservation, which is part of their cultural ethic.

Community members are being trained to write research grants, implement projects, collect data, and monitor resources. This program has demonstrated that committed locals who have an intimate knowledge of area resources are interested in being involved in resource conservation efforts. The success of this federal program should be expanded to allow for tribes and communities to be involved in local research and monitoring through other federal and state resource programs.

Trained locals can collect baseline ecosystem data that is otherwise too expensive to collect. Locals can monitor stock levels and report on significant changes which might otherwise go unnoticed. They can also immediately respond to oil spills,

mass strandings, or other dramatic events that occur in remote areas. Expanding this type of local monitoring and research can only benefit resources, especially during times of limited resource management funding.

Reference

Wolf, R. 2000. *Subsistence in Alaska: A Year 2000 Update*. Alaska Department of Fish and Game, Division of Subsistence.

The Barren Islands

by Nancy Deschu

At midnight, as we near the rocky island, a bat-like image sweeps over our boat. Then another. And soon there are hundreds flitting, casting shadows in the hemisphere of light that drapes the deck. We crane our necks to identify the fliers. They are storm petrels — small grey seabirds, drawn to our antennae light, flying with us to Anchorage.

We hole up in a calm cove, exhausted from the night's rough crossing of Shelikof Strait. Worn down from documenting the mire of an unfathomable oil spill, for the first time in weeks, we sleep soundly, knowing we're heading home.

In the early morning, one by one, the five of us awake. We climb out of our bunks up to the deck. An orange sun cuts through fine-grained fog, the sea is flat. Mike yawns and leans forward to stretch. With his head hanging down, he calls to us to come look.

There, near his feet, on the weathered wooden deck sits a storm petrel, huddled in the cool fog. We stare hard at this bird, in momentary disbelief. It is not oiled, just slowly waking from the cold night. Mike gently lifts the petrel into his cupped hands. The warmth of his rough hands stirs the bird to life, and it flies away.

We look up, scanning the deck. All over the boat, in tiny havens, sit resting petrels. Impulsively, we dash different directions to find another petrel. Each bird shakes its soft wings against our hands, preparing to take flight. And from around the boat, voices call out, over and over, "Fly!" until all the petrels are awake and the sun has burned away the fog.

Preceding page — Unidentified bird carcass on rocks, USFWS photo.



Lessons Learned and Final Thoughts — Aleutian Life Forum, Dutch Harbor, Alaska August 17-19, 2005

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To incorporate the opinions from responding organizations, community members, and other forum attendees, roundtable discussions were held each afternoon to discuss the lessons learned from the *Selendang Ayu* incident and the resultant response. The goal was to produce a list of things that were done well in this response as well as those things that could have been done better, with an eye toward passing this information on to other communities so that they might take some preventative measures and potentially avoid some of the pitfalls that we endured.

General Recommendations

What went well?

1. The Unified Command Web site was always up to date and easy to browse for responders and community members alike.
2. The Unified Command passed information out to the community every night at an open forum in city council chambers. This allowed community members to address their concerns and have their questions answered. Later, these meetings dropped to once a week and, finally, to once a month.
3. The Unified Command was very good at working with the tribal organizations and landowners. Representatives from the Unified Command met with these organizations independently and often and even talked with village elders at the senior center.

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4. The Unified Command addressed important issues quickly and established work groups to discuss impacts on sensitive coastal areas, commercial fisheries, endangered species, and importance of subsistence organisms.
5. With the aid of local organizations (Alaska Department of Environmental Conservation, Qawalangin Tribe, Museum of the Aleutians, and the Unalaska City High School), the Unified Command sponsored a subsistence round-table and a subsistence fair that were positive outlets for sharing information between locals and responders.

What could have been done better?

1. More input could have been used from local organizations and community members. Several suggestions were made throughout the response that seemed to be ignored by the Unified Command.
2. Establish a local on-scene coordinator in the Unified Command structure. This would allow a locally trusted and respected member of the community to be involved in all levels of the decision making and ensure that local issues were given consideration.
3. Establish oil-spill response training programs in remote communities. This would allow faster reaction time and might save valuable resources before the Unified Command structure comes online.
4. Keep locals informed through other media means. Using fact sheets worked, but information was not updated and was not very visible. While locals were given some opportunities to get current information, many do not have access to the Internet and others still could not attend nightly briefings.
5. Establish and use local resources inside and outside of the Unified Command structure. Though many locals were involved in the cleanup process, many businesses and organizations were not included. Many of the resources that were flown in at considerable expense were available locally and not used.

6. Station resources and trained personnel in remote communities to respond to incidents quickly when “weather windows” are available.

Other general suggestions to communities:

1. Create a “seed” bank of local species to aid in preventing local extinctions, while establishing a record of local diversity. This would also be useful in observing coastal impacts on present species and the introduction of non-native species.
2. Create an intertidal resource map observing distribution, abundance, and diversity of intertidal organisms. This would be useful in determining the impacts of oil spills and could also be used as a long-term monitor of the health of the ecosystem.

Topical Recommendations

In addition to the general lessons learned, specific topics and issues were addressed for the focus of the three days. For each of the round-tables, community members, oil spill responders, and members from other organization were asked for topic-specific comments on the lessons learned good and bad.

Impact of oil spills on wildlife— Several organizations took part in this discussion, including: the Alaska Maritime National Wildlife Refuge, U.S. Fish and Wildlife Service, Alaska Sea Grant, Polaris Environmental, the NOAA Office of Response and Restoration (Hazmat), and the Alaska Oceans Program.

What went well (wildlife)?

1. Contingency planning evolved over time with agencies and organizations working together to compile all available information.
2. Chris Woodley (USCG), the Unified Command’s community liaison, was locally respected and trusted and worked well to connect the Unified Command structure and community.

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3. The *Tiglux* (AMNWR) research platform was rapidly deployed and an Unalaskan Tribal member was allowed serve as an escort/liaison.
4. City of Unalaska was helpful in providing volunteers and facilities; for example, the salmon hatchery was used as a bird stabilization laboratory.
5. Unified Command met with community elders to discuss wildlife and anthropology

What could have been done better (wildlife)?

1. Several of the resources needed for wildlife response were not immediately available and took time to ramp up.
2. Discontinuity between government agencies involved in wildlife response confused community members. Because each entity in the Unified Command (Federal, State, and Responsible Party) had a representative environmental contractor, in addition to International Bird Rescue and Research Center, U.S. Fish and Wildlife, and the Alaska Maritime National Wildlife Refuge, the community didn't know to whom or where to turn for guidance.
3. Needed better documentation for communicating with the public. Although some wildlife fact sheets were put up, they were not updated and distributed. Subsistence warnings were delayed beyond the subsistence seasons.
4. Needed bird stabilization kits staged in local areas. This would have allowed for a much faster response with a potential to save more birds.
5. Locals did not sufficiently understand the Unified Command structure nor how the wildlife/environment component fit in.
6. Locals need training on other "spills" materials, such as cargo (soybeans), rats, etc.
7. The turnover rate for response personnel appeared to be continuous. This disrupted established relationships and slowed communication.

8. Need to involve community members in hands-on activities that didn't necessarily require special training (e.g., logistics, wildlife observations). Community volunteers were more than willing but were never resourced.
9. Communicate to the public better and sooner on injury assessment efforts — public wants to know that resources are being studied now and into future. (NRDA process seems secretive and takes a long time.)
10. Community felt like information was being kept from them. Be more open/honest about what information can and cannot be shared now and later and why.
11. Need to communicate better and sooner with stakeholders about what is being done on local lands with permission.
12. Keep steady momentum on updating community on progress, study findings, etc., on a regular basis (despite appearance that interest had declined) and different media/venues.
13. Translate technical information into general layman's terms to understand NRDA data collection. Need more communication to public and landowners.

Impact of oil spills on fisheries — Fisheries round-tables addressed many of the same points as the wildlife round-tables, but state and federal response seemed to occupy most of the discussion. Organizations taking part in this discussion, included: Alaska Department of Fish and Game, U.S. Fish and Wildlife Service, Alaska DEC, NOAA Office of Response and Restoration (Hazmat), City of Unalaska Natural Resources, UniSea, Inc., and University of Alaska Anchorage Institute of Social and Economic Research.

What went well (fisheries)?

1. By pairing Alaska Department of Environmental Conservation with seafood processors, DEC agents were positioned well to respond to processor issues and look for signs of contamination.

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2. The fisheries work group was established early and included the key locally stationed state and federal fisheries managers.
3. Water quality sampling program initiated. Response had evolved significantly from the *Kuroshima* spill.
4. Alaska DEC environmental contractors, NUKA, worked well with the community by interacting and involving key members for input.
5. Press releases were proactive and helped to get information to those who could not attend nightly briefings.
6. Locally respected and owned salvage organization (Magone Marine) was involved early and used throughout.
7. Eventually, the Unified Command began to accept cultural/traditional knowledge of fisheries information.

Many of the lessons learned described at the Impacts of Oil Spills on Fisheries round-table seemed to focus on how much things had improved since the M/V *Kuroshima* spill in 1997. The input from state and federal responders, as well as seafood processors, brought to light that there was still a potential to improve efforts in certain areas.

What could have been done better (fisheries)?

1. Supply Alaska DEC training materials in remote areas for processors to have on hand.
2. Increase knowledge of response regulations and how those regulations impact locals.
3. Create a list of contact personnel to call in the case of an oil spill. Perhaps have an on-call, community-based issues committee to represent the whole.
4. Include more locals on beach walks and introduce things to look for, such as oiled animals and tar balls.
5. Get booming done quicker and more effectively. With extreme weather, the Aleutian Islands present a

very difficult situation to deal with an oil spill. Wind and weather need to be considered when booming. Many pictures and video clips showed oil being blown right over booms.

6. Communities such as Unalaska need to prioritize sensitive areas and make contingency plans for equipment needs and storage potential.
7. Need to formalize technical research that will aid processors in preventing contamination.
8. Need to know cargo inventory of passing vessels to be able to determine potential impact.

Impact of oil spills on communities — For the community round-table discussion, topics included psychological response to disasters, human health issues, and monitoring of subsistence organisms. Several organizations took part in this discussion, including: Mississippi State University Social Science Research Center, U.S. Fish and Wildlife Service, Alaska Ocean Observing System, the Qawalangin Tribe, Unalaska Convention and Visitors Bureau, and the Southwest Alaska Municipal Conference.

What went well (communities)?

1. Use of the annual Unalaska health fair to get oil spill contamination and response information out proved to be a wonderful success.
2. Eventually, the environmental unit of the Unified Command began involving local birders to look for oiled birds. Although locals were not trained in oiled-bird capture, they worked well to relay information so those who had the training could extend their scope.
3. By using locals from Unalaska and other communities in the cleanup, other community members were able to get trusted information about the sites.
4. HAZWOPER training was provided on several days and was made available to all who wanted to get involved in the cleanup.

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5. On the whole, the oil spill strengthened relationships between many organizations and the community (i.e., Alaska Maritime National Wildlife Refuge and people of Unalaska).
6. Responsible party was and continues to be responsible for the oil spill.
7. Subsistence science work group working with local biologists and tribes allowed local input and experience to be shared.

What could have been done better (communities)?

1. Need to address concerns about local fishing activities and closed areas. The community was never fully addressed as to where they could and could not go. Misperceptions that areas were “entirely closed” to subsistence fishing confused many. Better/different communication routes might have solved (local Native fishing organizations, ADF&G, TV, radio, newspaper, postings).
2. Need to address locals in plain language that will not turn away interested locals. Many felt overwhelmed and chose not to participate.
3. Need to take into account considerations for differences in Native and non-Native cultural communication.
4. Need to get health/safety information out to subsistence users quickly and accurately. The subsistence science work group worked very hard to collect dosage and contamination information on subsistence foods, but information was not made available to the public.
5. Need to establish baseline data of potentially effected subsistence organisms and explain how and when contamination should no longer be a concern.

Look to the Future

While future oil spills cannot be predicted, we hope that with this publication, we have highlighted some of the consid-

erations that need to be addressed in terms of the impacts of oil spills on wildlife, fisheries, and communities. We cannot stress enough the importance of prevention and preparedness, but understand that with increased shipping traffic, seasonal extremes in weather, and inconsistencies in communication efforts, we have quite a challenge ahead of us.

Thanks to Organizers, Sponsors, and Presenting Organizations — Aleutian Life Forum

Organizers:

Reid Brewer (Alaska Sea Grant Marine Advisory Program, UAF) • Sheryl Johnson (The Grand Aleutian Hotel) • Rick Kniazowski (Unalaska/Port of Dutch Harbor, Convention and Visitors Bureau) • Rick Harwell (City of Unalaska, Parks, Culture, and Recreation Department)

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Presenting Organizations:

Alaska Maritime National Wildlife Refuge, Alaska Ocean Observing System, Alaska Oceans Program, Alaska Sea Grant Marine Advisory Program UAF, Alaska Dept. of Fish and Game, Anchorage *Daily News*, City of Unalaska, Alaska Dept. of Environmental Conservation, International Bird Rescue and Research Center, Polaris Environmental, Prince William Sound RCAC, Mississippi State University, National Marine Fisheries Service, NOAA Office of Response and Restoration Hazmat, Qawalangin Tribe, Southwest Alaska Municipal Conference, Unalaska Parks, Culture, and Recreation Dept., Unalaska Convention and Visitors Bureau, UniSea Inc., University of Alaska Anchorage, University of Alaska Fairbanks/College of Rural Alaska, U.S. Coast Guard, U.S. Fish and Wildlife Service.