Life After the *Exxon Valdez* Oil Spill: Impacts, Conflicts, and Management Plans in Prince William Sound

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No one expected any problems as the *Exxon Valdez* left the Alyeska Pipeline Terminal at 9:12 p.m., on March 23, 1989. The 987-foot ship, second newest in Exxon Shipping Company's 20-tanker fleet, was loaded with 53,094,510 gallons (1,264,155 barrels) of North Slope crude oil bound for Long Beach, California (State of Alaska). Tankers carrying North Slope crude oil had safely traveled the Prince William Sound more than 8,700 times in the 12 years since oil began flowing through the trans-Alaska pipeline, with no major disasters and few serious incidents. This experience gave little reason to suspect future disaster, but less than three hours later, for reasons that still remain unclear, the *Exxon Valdez* grounded at Bligh Reef at 12:04 am on March 24th, rupturing eight of its 11 cargo tanks and spewing some 10.8 million gallons of crude oil into Prince William Sound (State of Alaska). This spill has impacted Alaska's environment and community aspects such as tourism in many ways, and will for many years to come.

The *Exxon Valdez* accident is widely considered the number one spill worldwide in terms of damage to the environment. The timing of the spill, the remote and spectacular location, the thousands of miles of rugged and wild shoreline, and the abundance of wildlife in the region combined to make it an environmental disaster well beyond the scope of other spills (Zhu,Xuequing, et al. 2004). No human lives were lost as a direct result of the disaster, but there were a few deaths associated with the cleanup.

Indirectly, however, the human and natural losses were great. Fisheries, subsistence livelihoods, tourism, and wildlife were, and still are, affected greatly because of this accident. Lingering injuries continue to plague some injured species while others are fully recovered. For many, the most important loss is the aesthetic sense that something sacred in the relatively unspoiled land and waters of Alaska had been ruined. The carcasses of more than 35,000 birds and 1,000 sea otters were found after the spill, but since most carcasses sink, this is considered to be a small fraction of the actual death toll. The best estimates are: 250,000 seabirds, 2,800 sea otters, 300 harbor seals, 250 bald eagles, up to 22 killer whales, and billions of salmon and herring eggs (State of Alaska).

Some of the techniques used in attempt to clean the spilled oil were hot water treatments, high-pressure cold water treatments, mechanical cleanup, and bioremediation. Hot water treatment was popular until it was determined that the treatment could be causing more damage than the oil. Small organisms were being cooked by the hot water. High-pressure cold water treatment and hot water involved dozens of people holding fire hoses and spraying the beaches. The water, with floating oil, would trickle down to the shore. The oil would be trapped within several layers of boom and either be scooped up, sucked up, or absorbed using special oil-absorbent materials. Many beaches were fertilized to promote growth of microscopic bacteria that eat the hydrocarbons. Known as bioremediation, this method was successful on several beaches where the oil was not too thick. A few solvents and chemical agents were used, although none extensively (Zhu,Xuequing, et al. 2004).

Captain Hazelwood's activities in the town bars that day and on the ship that night became a key focus of accident inquiries, the cause of a state criminal prosecution, and the basis of widespread media sensation (State of Alaska). Without intending to minimize the impact of Hazelwood's actions, however, one basic conclusion is that the grounding at Bligh Reef represents much more than the error of a possibly drunken captain, it was the result of "the gradual degradation of oversight and safety practices that had been intended to safeguard the inevitable mistakes of human beings" (State of Alaska). The National Transportation Safety Board investigated the accident and determined that the probable cause of the grounding were the following: The failure of the third mate to properly maneuver the vessel, possibly due to fatigue and excessive workload; the failure of the master to provide a proper navigation watch, possibly due to impairment from alcohol; the failure of Exxon Shipping Company to supervise the master and provide a rested and sufficient crew for the *Exxon Valdez*; the failure of the U.S. Coast Guard to provide an effective vessel traffic system; the lack of effective pilot and escort services (State of Alaska).

One of the most effective international treaties on marine pollution is the International Convention for the Prevention of Pollution from Ships, 1973, 1978 (referred to as MARPOL 73/78) (Cutter &Renwick 2004). This treaty attempts to reduce pollution from ships, including oil, chemicals, and plastics. Also as a response to the *Exxon Valdez* spill in 1989, the International Convention on Oil Pollution Preparedness, Response, and Cooperation was signed. This treaty sets requirements for oil spill emergency plans and mechanisms for cooperation between transboundary spills, and an annex on hazardous substances also includes protocols for handling these types of

materials. Finally, the United Nations Environment Program (UNEP) Regional Seas effort has been instrumental in developing regional action plans for marine pollution from ocean dumping, oil spills, and land-based sources (Cutter & Renwick 2004).

The *Exxon Valdez* oil spill (EVOS) in Prince William Sound, released a minimum of 11 million gallons of Alaskan crude oil into one of the largest and most productive estuaries in North America. The amount of spilled oil is roughly equivalent to 125 Olympic-sized swimming pools (State of Alaska). During the summer of 1989, the Alaskan Department of Environmental Conservation (ADEC) estimated that 149 km of shoreline in Prince William Sound were heavily oiled and 459 km were at least lightly oiled. A year later a survey showed oiling had decreased 73 percent. Two years later in 1991, and interagency survey estimated only 1.4 km of shoreline to be heavily oiled. By 1992, the estimate of heavily oiled shoreline was only 0.2 km. After 3 years of unprecedented efforts to clean the polluted beaches and subsequent surveys showing declining contamination, it was expected that natural processes would disperse any remaining oil (Short, Jeff, et al. 2001).

In 1993, the EVOS Trustee Council funded an additional survey that estimated 7 km of shoreline were still contaminated with subsurface oil (State of Alaska). Smaller-scale studies dealing with restoration of oiled mussel beds and continued clean-up efforts conducted between 1995 and 1999 showed that oil was surprisingly persistent and often in a relatively unweathered state, containing high concentrations of toxic and biologically available polycyclic aromatic hydrocarbons (State of Alaska). Long-term monitoring in the oiled areas has also shown that fauna from higher trophic levels such as sea otters and

sea ducks still have not recovered. It appears now that the remaining oil deposits may have become a chronic source of low-level oil pollution within the spill-affected area.

Concerns were generated by the public and scientific communities about the oil's possibly continuing effects on humans and local plants because a significant survey of Prince William Sound had not been conducted since 1993, and the cumulative extent of the remaining oil was unknown (State of Alaska). The perception of the amount of oil remaining on the beaches varied widely, and without an accurate assessment of the extent of the remaining oil, subsistence food-gatherers, consumers of commercial fish products from the area, and tourists have used mostly anecdotal evidence as the basis for economic decisions regarding resource utilization in the affected area. Scientists and resource managers have also lacked accurate tests of the amount of remaining oil in the Sound.

The Auke Bay Laboratory with funding from the EVOS Trustee Council, took on the task of testing the shorelines to measure the amount of oil remaining in the intertidal zone of Prince William Sound. They also worked on determining the rate of decline of oil on the affected beaches, estimating the persistence of the remaining oil, and correlating the remaining oil with geomorphological features (Short, Jeff, et al. 2001). Previous attempts to estimate the oil remaining on beaches affected by the *Exxon Valdez* oil spill have relied mainly on Shoreline Contamination Assessment Teams (SCAT), field teams that perform comprehensive foot surveys of impacted beaches. The SCAT survey crews estimated oiled areas based mostly on visual clues at the surface, and although SCAT were useful for directly cleanup efforts immediately after the spill, it was

determined that the SCAT methods would not be useful for producing a quantitative estimate of subsurface oil contamination 12 years after the spill (Short, Jeff, et al. 2001).

Subsurface oil is of greater concern than surface oil. Subsurface oil can remain dormant for many years before being dispersed and is more liquid, still toxic, and may become biologically available (Oil Spill... 2002). Burrowing animals or severe storms that rework the beach and reintroduce unweathered oil into the water causes many problems. Results of the summer shoreline survey showed that the oil remaining on the surface of the Prince William Sound beaches is weathered and mostly hardened into an "asphalt-like layer", and are not as readily available to biota, although some softer forms do cause sheens in tide pools. A survey indicated that a total area of approximately 20 acres of shorelines in the Sound are still contaminated with oil. Oil was found at 58 percent of the 91 sites tested and is estimated to have the linear equivalent of 5.8 km of contaminated shoreline (Oil Spill… 2002). The overall 20-acre estimate of oil-contaminated beaches was more than twice the estimate from the EVOS Trustee Council survey done in 1993. Most of the oil found in 2001 was classified as lightly oiled, but was still easily observed once it was uncovered. It was sheening, had a strong odor, was sticky, and did not require the aid of a mechanical or chemical analysis for positive identification (State of Alaska).

Several other important points were evident in the addition to the estimated area of remaining oiled beaches. For example, surface oil was determined to be not a good indicator of subsurface oil. Twenty subsurface pits were classified as heavily oiled. Oil saturated all of the interstitial spaces and was extremely repugnant. The worst pits

exhibited an oil mixture that resembled oil encountered in 1989 a few weeks after the spill, highly odiferous, lightly weathered, and very fluid. Subsurface oil was also found at a lower tide height than expected (between 0 and 6 feet), in contrast to the surface oil, which was found mostly at the highest levels of the beach. This is significant because the pits with the most oil were found low in the intertidal zone, closest to the zone of biological production, and indicate that the estimates were conservative at best (Zhu,Xuequing, et al. 2004).

In the case of the *Exxon Valdez* spill, it took more than four summers of cleanup efforts before the effort was called off. Not all beaches were cleaned and some beaches remain oiled today. At its peak the cleanup effort included 10,000 workers, about 1,000 boats and roughly 100 airplanes and helicopters, known as Exxon's army, navy, and air force. It is widely believed, however, that wave action from winter storms did more to clean the beaches than all the human effort involved (State of Alaska). Exxon says it spent about $2.1 billion on the cleanup effort, but they failed to mention that the people of Alaska and the ones visiting the area would feel the impacts for many years to come and would receive little or no compensation for their losses.

Not only was the natural environment hurt by the spill, but so were the Native peoples of Alaska and their livelihoods. Many conflicts have arisen since the impact in 1989, and even seventeen years later the people have not seen an end to the quarrel. Conflicts involving local fishermen suffering declining fish numbers and declining wildlife populations in normally primitive, unused areas due to displaced visitors are just a couple examples of many occurring issues in the Prince William Sound area. For

example, once-reliable markets have been lost to farmed salmon, and canneries have closed. Salmon prices went as high as $2.70 a pound during the late 1980s, but have fallen to one-fourth that level (Picou & Gill 2000). In 1994, an Anchorage jury found Exxon had acted recklessly and awarded damages of $5 billion, most of it to commercial and native Alaskan fishermen, in the second-largest jury verdict in American history, but the Plaintiffs have yet to see a penny of the money because Exxon has been appealing the charges for the last seventeen years. This obviously creates enormous conflicts for families that depend on this revenue to survive. Alaska Natives in the spill area had never experienced environmental pollution and contamination to such a degree prior to the spill. Contamination was viewed as "the intrusion of unknown chemical pollutants into the very fabric of Alaska Natives' spiritual beliefs and day-to-day behavior" (Picou & Gill 2000). A sense of fear, anger, and depression spread along with the oil throughout the Native communities because now their land and food were unsafe to use or consume; some families could even smell the fumes from the crash site and were worried for their health.

The oil spill destroyed more than economic resources, it ruined the cultural foundation of Native life. This could be considered one of the largest conflicts following the spill, because Alaska Native subsistence culture is based on a personal relationship with the environment. Not only does the environment have sacred qualities for Alaska Natives of the area such as Eskimo, Aleut, Athapaskan, Eyak, and Tlingit groups, but their survival depends on the well-being of the ecosystem and the maintenance of cultural subsistence (Picou & Gill 2000). Villages were deliberately located in places where a high convergence of wildlife occurred, especially fish and marine mammals, and the

towns of Cordova, Whittier, Valdez, Kodiak, and urban areas such as Juneau, Fairbanks, and Anchorage, where the majority of Native people live, were horribly impacted by the spill. A smaller number of Alaska Natives reside in isolated coastal villages such as Chenega Bay, Tatitlek, Nanwalek, Port Graham, Akhiok, Karluk, Ouzinkie, Old Harbor and Larsen Bay. However, because of their proximity to the actual grounding site of the *Exxon Valdez,* the Prince William Sound communities of Tatitlek and Chenega Bay suffered particularly severe disruption from the accident (Picou & Gill 2000). The Exxon Valdez Oil Spill (EVOS) Trustee Council maintains the status of subsistence activities as an *injured service* of Prince William Sound (Picou & Gill 2000).

The subsistence lifestyle of Alaska Natives represents one of the last, core elements of their remaining cultural identity. Most other elements have been lost due to contact with the Western culture. Natives were forced to learn in boarding schools, and through time their languages, attitudes, and ideas have been lost to Westernized ones. This is why their identity with the environment, the only semi-permanent entity they had, was threatened when the *Exxon Valdez* ran aground on Bligh Reef. Natives experienced a further loss of traditional ability in the aftermath of the oil spill as they were often forced to rely on outside authorities for food safety. Many villages faced severe food shortages and disruptions of cultural traditions involving social relations, sharing, and transmission of knowledge and values because families could not use the contaminated lands, and could not take their children out to their customary places to teach their way of life (Picou & Gill 2000). Competition for resources with sport hunters and fishers as well as potential displacement from favored harvest areas by increased recreation also adds a

considerable potential to change subsistence following the spill (Randy Gimblett, University of Arizona, Personal Communication).

Subsistence behavior was additionally disrupted because many Natives helped with the Exxon-sponsored cleanup activities and had less time to engage in seasonal subsistence activities. To illustrate this concern, the following statements from Alaska Natives clearly demonstrate how cultural traditions were affected:

> Our elders feel helpless. They cannot do all the activities of gathering food and preparing for the winter. And most of all, they cannot teach their young ones the Native way. How will the children learn the values and the ways if the water is dead? If the water is dead, maybe we are dead, our heritage, our tradition, our ways of life and living and relating to nature and each other (Picou & Gill 2000).

> When we worry about losing our subsistence way of life, we worry about losing our identity ... It's that spirit that makes you who you are, makes you think the way you do and act the way you do and how you perceive the world and relate to the land. Ninety-five percent of our cultural tradition now is subsistence ... it's what we have left of our tradition (Picou & Gill 2000).

Many recreationists using Prince William Sound do not understand the harvest traditions and rights of subsistence users in Alaska, and therefore, the potential for conflict is significant.

Management planning and studies in the spill regions have been ongoing for over a decade to determine environmental impacts from the oil contamination itself, and from other social impacts following the EVOS such as visitor displacement. The Chugach National Forest (CNF) is working on a project to monitor the development of a carrying capacity document to manage recreation in Prince William Sound. Even though the EVOS displaced visitors immediately following the disaster, Alaska's tourism is increasing rapidly now that the oil is not directly seen, and the Sound and surrounding communities are being impacted. As these recreational use levels increase in Prince William Sound, it is unavoidable that encounter levels and associated impacts will increase (Randy Gimblett, University of Arizona, Personal Communication). Local fishermen and hunters are being displaced to new areas they wouldn't have used in the past due to oil contamination, and arising conflicts between visitors and locals are inevitable. These conflicts between different user groups are often occurring because the Natives feel that they lost their personal lands to the EVOS, and now they are also losing yields from other nearby lands due to the increase in float plane tours, cruises, and other industries that have been created to bring in revenue after the productivity of fishing has dropped radically.

The tourism impacts in this area are fairly difficult to control. For example, essentially any Native with a float plane can take others out to see areas that would not normally be disturbed. If Natives could still generate their income solely from their fishing or hunting practices, they would perhaps not be participating in these other businesses that are creating environmental degradation to new areas. With further

environmental assessments and evaluations of the quality of visitor experiences in the surrounding EVOS areas, such topics can be assessed, and improved management plans can help both the environmental factors and social implications created by these issues.

The CNF is presently focusing its efforts to achieve an understanding of the spatial and temporal patterns of recreation use in Prince William Sound in order to better inform management objectives and ensure they are based on current and projected levels of use (Randy Gimblett, University of Arizona, Personal Communication). For future management of the Sound, the CNF should consider a risk management approach to determine if use levels exceed standards for such aspects as environment, recreation, safety, social and economic criteria (Randy Gimblett, University of Arizona, Personal Communication). This approach could be used to construct or adapt management alternatives. The new information will optimistically assist in the creation of new strategies that will fit into the objectives defined by the EVOS, and will determine whether or not the management plan that has already been established for maintaining a high quality experience through the Recreation Opportunity Spectrum (ROS) framework accurately reflects these management standards (Randy Gimblett, University of Arizona, Personal Communication).

A project proposal by Dr. H. Randy Gimblett, of The University of Arizona, states how these tourism conflicts can be monitored and assessed by using Recreation Behavior Simulator (RBSim), a software program fully integrated with ArcMap that has been specifically developed for studying recreation problems. RBSim would be just one of the important tools to "evaluate and expand upon existing management objectives

related to quality wilderness experience that involves both locals and visitors" (Randy Gimblett, University of Arizona, Personal Communication). Another important component of Dr. Gimblett's project would involve working with local focus groups to gain an understanding of what could improve experiences in the affected regions and to decrease or assess acknowledged conflicts. The information from the focus groups will provide more information for establishing appropriate management techniques and alternatives.

Prior work has been done for the management of the Sound, and it has been very useful. However, other studies haven't specifically evaluated the quality of visitor experience, and even though Dr. Gimbletts's proposal was explained in little detail here, his, among a few others, are now being addressed. These new projects are very important because the public hears about more common topics like the wildlife that was harmed by the EVOS, and the majority of the citizens of the continental U.S. have probably pushed the old news from their minds, but the EVOS is still a major issue that needs attention. The rapidly increasing tourism to Prince William Sound and the lingering detrimental effects of the EVOS will never be forgotten, especially by Natives. Their lifestyles have been altered significantly; not only has the environment suffered great losses, but so have the peoples of Alaska. All of the components of EVOS repercussions need to be accounted for and continuously re-evaluated to appropriately manage impacted areas such as Prince William Sound.

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