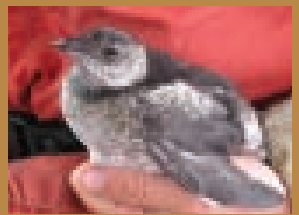
Exxon Valdez Oil Spill Trustee Council
2009 Status Report

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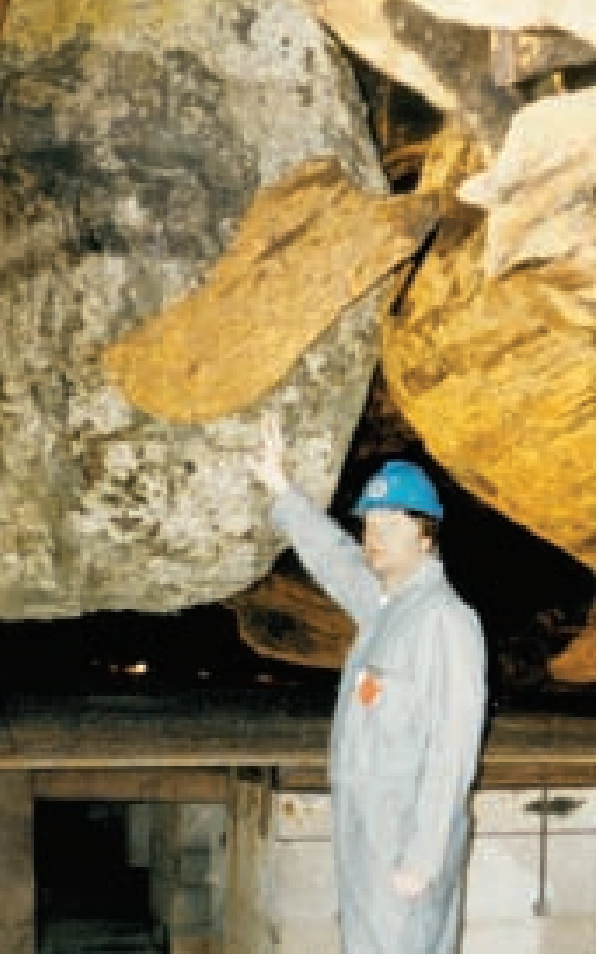
Visitors today experience the spectacular scenery and wildlife of Prince William Sound and the North Gulf of Alaska. While they will likely see little visible sign of the oil spill, the area has not fully recovered.

Cover photo: While the overall sea otter population in western Prince William Sound has recovered, local populations in areas that were heavily oiled by the spill have yet to recover.

Back cover photo: The bald eagle was the first of the injured resources to be declared recovered. By 1996, the population of bald eagles in Prince William Sound was estimated at 6,000, matching the area's pre-spill population.



Craig Tillery inspects a boulder-sized piece of Bligh Reef caught in the torn hull of the Exxon Valdez tanker.

FOREWORD

For certain events, you remember where you were when you heard the news. Like many Alaskans, I can remember how, where, and when I first learned of the *Exxon Valdez* oil spill and I recall my first reactions to the news: curiosity as to what this meant for Prince William Sound and interest in how the legal issues and inevitable litigation would play out. Mostly I had the reactions of a detached and curious, but uninformed, observer. But within a short time I found myself in a helicopter landing in a cove on an island in Prince William Sound at the heart of the oil spill. I will never forget what I saw and heard and smelled. The juxtaposition of the idyllic beauty of the Sound, in which I had spent many weeks kayaking in previous years, and the noisy, smelly, industrial scene before me was overwhelming. I remember two reactions at that time: sadness and anger. There was never again detachment or idle curiosity.

Over the last 20 years, we have made significant progress in restoration of areas impacted by the spill: permanently protecting crucial habitat; increasing our knowledge of the marine ecosystem; and developing new tools for better management of these vital resources. Visitors to Prince William Sound and the North Gulf Coast of Alaska today again experience spectacular scenery and abundant wildlife and see little evidence of the spill. Yet the area has not fully recovered. In some areas, *Exxon Valdez* oil still remains and is toxic. Some injured species have yet to recover to pre-spill levels. This long-term damage was not expected at the time of the spill and was only just starting to be recognized in 1999, at the 10th Anniversary.

At that time, the majority of species injured by the spill were still struggling with low numbers, such as the depressed herring populations, but it was expected that the ecosystem would recover naturally over time. Now, in 2009, as we reach the end of the second decade, many of these areas and species of concern remain. As we learn more, the picture of recovery is more complicated than was first appreciated.

It is unfortunate that it takes a disaster of this magnitude to shake us from our complacency and make us see how greatly nature has blessed us here in Alaska and elsewhere in our great country, and to understand how easily and quickly humans can despoil it. Such an environmental disaster makes us realize how much we depend on our natural world and how much harm reckless acts can inflict on our lives and the lives of our families. It is important that we remember and learn from such events. It is in that spirit that we present this 20th Anniversary Status Report.

Unlike prior annual reports, which have focused on the details of the Trustee Council's work in the preceding year, this 20th Anniversary Status Report seeks to present a broader overview of the spill, the subsequent settlement, the Restoration Plan and the Trustee Council's work in research, monitoring, restoration, and habitat protection. It also discusses the effect of the spill on human communities and the improvements to spill prevention and response that have taken place since the spill.

Craig Tillery
Deputy Attorney General
Alaska Department of Law

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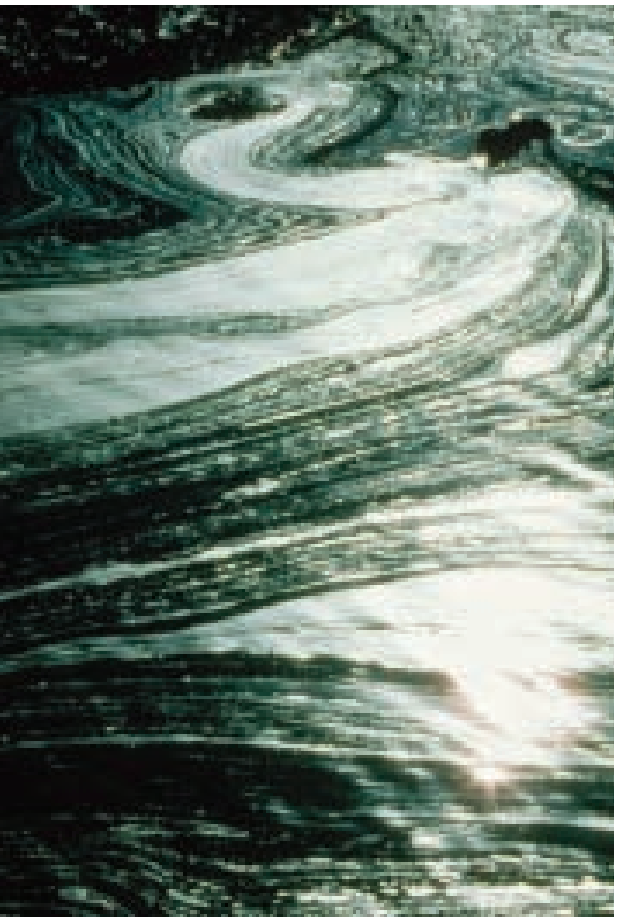
The massive cleanup effort mobilized more than 10,000 people, 1,000 vehicles, and 100 airplanes into an environment that prior to the spill was pristine and largely uninhabited.



An Exxon Valdez oil slick is carried by the ocean current.

THE SPILL, THE SETTLEMENT, AND THE RESTORATION PLAN

Alaska North Slope crude oil is produced along the northern coast of Alaska in various fields such as Prudhoe Bay and Kuparuk. The oil is a heavy crude that is highly toxic and slow to disperse when released into the environment. North Slope crude oil is gathered in Prudhoe Bay and sent 800 miles through the Trans-Alaska Pipeline to the Alyeska Marine Terminal located in Valdez, Alaska. From there the oil is loaded on tankers and shipped south through Prince William Sound. Most of the oil ends up in Washington, California, or Texas, where it is refined and distributed for use. For the first 12 years of operation this system—while not without problems—avoided disaster. To a large extent, the shippers of the oil, citizens in the nearby communities, and government regulators grew complacent. But in the early morning hours of March 24, 1989, this complacency was shattered.

The Spill

Early in the morning on Good Friday, March 24, 1989, the *Exxon Valdez* struck Bligh Reef in Prince William Sound. The grounding ripped the bottom of the single-hulled vessel, resulting in the rupture of 11 of the vessel's crude oil tanks and the release of nearly 11 million gallons of crude oil into the environment. It was, and still is, the largest oil spill in United States waters.

For almost three days following the spill, the weather in the Sound was unusually quiet. However, Alyeska Pipeline Company, the initial responder under the terms of the Prince William Sound oil spill contingency plan, was not ready and few pieces of equipment were in the area in a timely manner. By the evening of March 24 only two skimmers, both of which were full at the time, were motoring aimlessly around the growing oil slick. There was little or no containment boom deployed. A test burn was conducted, which worked to some extent, but the water content of the oily mousse soon made burning impractical or impossible. Dispersants were a primary response tool and were tested with somewhat inconclusive results, but neither Exxon Corporation nor Alyeska had sufficient dispersant or the equipment to adequately deploy it.

On the evening of March 26, a severe winter storm blew into the Sound. The oil slick went from a relatively compact mass to a widely dispersed collection of patches and streaks, and response vessels were forced to run for shelter in the face of the storm. The oil soon hit the beaches in hundreds of places, overwhelming any efforts to stop it, with a few notable exceptions such as in Sawmill Bay.

Over the next five-and-a-half months the cleanup operations grew exponentially, ultimately becoming the largest private project in Alaska since construction of the Trans-Alaska Pipeline. At one point more than 11,000 people were working on cleanup. According to Exxon Corporation's count, more than one thousand miles of beach were treated that summer. Additional cleanup continued for the next three summers through 1992.

Damage Assessment

Assessing the extent of the environmental damage caused by the spill was extremely difficult for a number of reasons: Most importantly, there was little baseline information about the natural resources in the spill area. Even where data existed, such as with commercially harvested salmon runs in the area, the natural variation in those data made pre-spill and post-spill comparisons difficult. Thus, a rather crude measure—body carcass—became a primary yardstick for describing the damage to the public.

Carcass counts often understated the actual losses, since animal carcasses sank or were never discovered in the huge geographic area covered by the spill. Based on extrapolated studies, scientists estimate the total loss of murres at 250,000—about 40% of the pre-spill population—even though only about 21,000 murre carcasses were found. In some cases no carcasses were found and evidence of injury is circumstantial. For example, no oiled killer whale carcasses were found, but scientists observed that 14 out of the 36 killer whales in the resident Prince William Sound pod disappeared in 1989 and 1990.

Sub-lethal injuries to natural resources were also observed. Following the spill, wild pink salmon, which spawn in intertidal areas as well as in streams, spawned in an oiled intertidal zone, swam through oiled waters and ingested oil particles and oiled prey as they foraged in the Sound and emigrated to the sea. As a result, post-spill studies indicated two types of injury: reduced growth rates in juvenile salmon from oiled areas of Prince William Sound and increased egg mortality in oiled versus unoiled streams.

We know there is injury from the spill, but the question remains to what extent. There is large natural variability in some marine resources which makes it difficult to quantify impacts. In the years immediately preceding the spill, the return of wild pink salmon to the Sound varied from a high of 23.5 million fish in 1984 to a low of 2.1 million in 1988. Since the spill, the return has varied from a high of 17 million in 2005 to a low of 1.3 in 2002. In 2007 the estimated return was 11.6 million fish. While we can monitor growth and egg mortality

An estimated 250,000 seabirds were killed by oil in the weeks and months following the spill.

The Exxon Valdez tanker sits hard aground on Bligh Reef, spilling oil into Prince William Sound.

Carcasses recovered after the spill included: 1,000 sea otters, 151 bald eagles, 838 cormorants, 1,100 marbled murrelets, and over 33,189 other birds.

rates to assess recovery, it is very difficult, in light of the natural variability, to determine the effect on the run attributable to the spill.

In sum, while we know there was injury to individual species, there was much uncertainty as to the exact amount of that injury and the uncertainty remains today. In addition, how the marine ecosystem functions as a system was not studied at all prior to the spill. Nor were some species such as the important forage fish capelin and sand lance.

THE SETTLEMENT WITH EXXON CORPORATION AND USE OF THE $900 MILLION CIVIL SETTLEMENT

The settlement among the State of Alaska, the United States government and Exxon Corporation was approved by the U.S. District Court on October 9, 1991. It resolved various criminal charges against Exxon Corporation as well as civil claims brought by the federal and state governments for recovery of natural resource damages resulting from the oil spill. The settlement had three distinct parts:

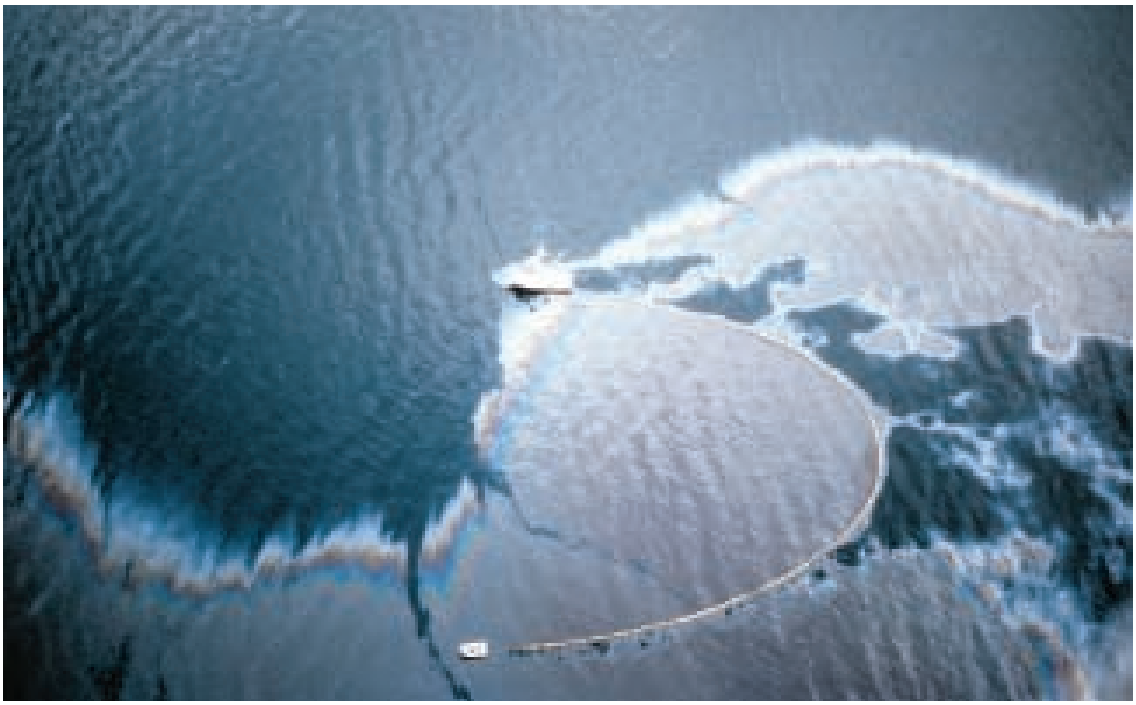
Criminal Plea Agreement. Exxon Corporation was fined $150 million, the largest fine ever imposed for an environmental crime. The court forgave $125 million of that fine in recognition of the Corporation's cooperation in cleaning up the spill and paying certain private claims. Of the remaining $25 million, $12 million went to the North American Wetlands Conservation Fund and $13 million went to the National Victims of Crime Fund.

Cleanup crews and equipment create an industrial scene on a remote beach.

Criminal Restitution. As restitution for the injuries caused to the fish, wildlife, and lands of the spill region, Exxon Corporation agreed to pay $100 million. This money was divided evenly between the federal and state governments.

Civil Settlement. Exxon Corporation agreed to pay $900 million, with annual payments over a 10-year period. The final payment was received in September 2001. The settlement also contained a "reopener window" between September 1, 2002 and September 1, 2006, during which the governments could make a claim for up to an additional $100 million. The reopener provision was included to address injuries from the spill that were not known or foreseeable from information available or reasonably available at the time of the settlement in 1991. Any funds received as a result of a reopener claim must be used to restore resources that suffered a substantial loss or decline as a result of the spill.

Reopener Claim. On June 1, 2006, the United States and the State of Alaska notified Exxon Corporation, pursuant to the reopener provision in the civil settlement, that additional restoration would be necessary to address injuries that were not foreseen at the time of the 1991 settlement. The governments have demanded that Exxon fund restoration projects, estimated at $92 million, based on the continued presence of oil in the habitats of Prince William Sound and Gulf of Alaska beaches.



The cleanup took four summers and cost approximately $2 billion dollars.

The *Exxon Valdez* Oil Spill Trustee Council

The *Exxon Valdez* Oil Spill Trustee Council (Trustee Council) was formed to oversee restoration of the injured ecosystem through the use of the $900 million civil settlement. The Trustee Council consists of three state and three federal trustees (or their designees):

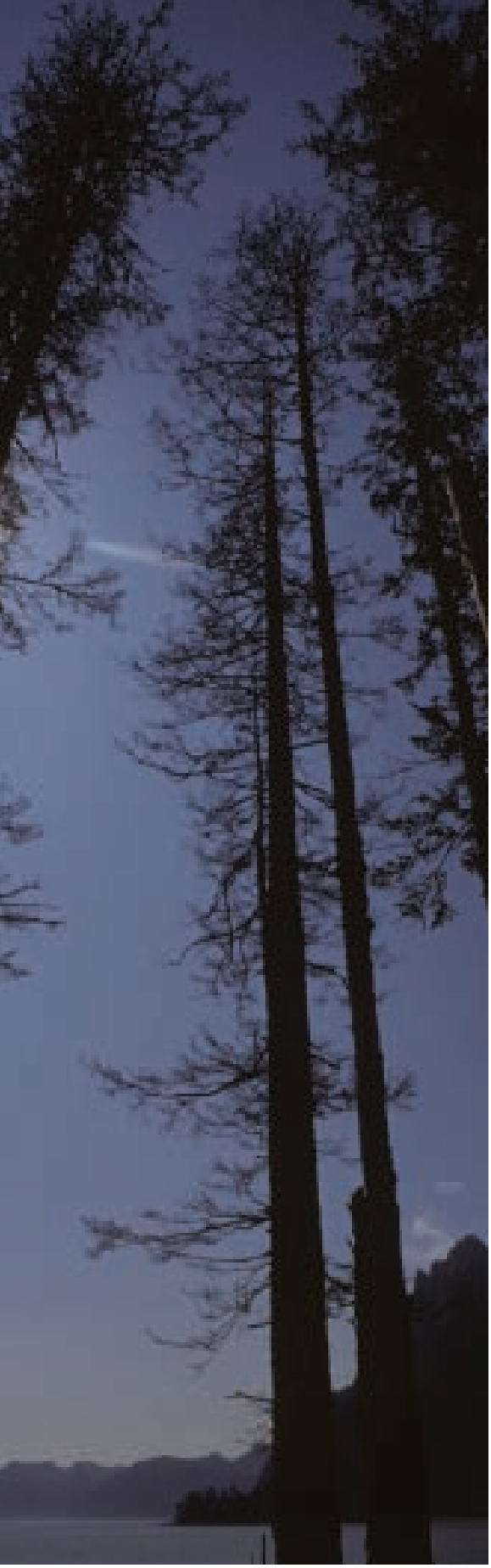
State
Denby Lloyd, Commissioner, Department of Fish and Game
Larry Hartig, Commissioner, Department of Environmental Conservation
Talis Colberg, Attorney General, Department of Law

Federal
Rowan Gould (Designee) Secretary, Department of the Interior
Jim Balsiger (Designee) Director, National Oceanic & Atmospheric Administration
Joe Meade (Designee) Secretary, Department of Agriculture

The Public Advisory Committee

The Public Advisory Committee advises the Trustee Council on decisions relating to allocation of funds, restoration activities, and long-term monitoring and research activities. As of January 2009, the group consisted of members chosen to reflect a balanced representation from the public at large, as well as members from selected principal interests.

Patience Anderson, Subsistence
Torie Baker, Marine Transportation
Amanda Bauer, Commercial Tourism
Jason Brune, Public at Large
Kurt Eilo, Sport Hunting and Fishing
Larry Evanoff, Native Landowners
Gary Fandrei, Aquaculture/Mariculture
John French, Regional Monitoring
Jennifer Gibbins, Conservation and Environmental
Sue Johnson, Tribal Government
Bill Rosetti, Science/Technical
Stacy Studebaker, Recreational Users
JoAnn Vlasoff, Public at Large
Open, Commercial Fishing
Open, Local Government



USES OF THE CIVIL SETTLEMENT (IN MILLIONS)

The following table accounts for how settlement funds have been used (in millions) as of September 30, 2008.

Total Revenue	**$996.1**
Exxon Payments	$900.8
Interest/Earnings (Minus Fees Plus Recoveries)	$95.3
Reimbursements for Damage Assessments and Response	**$216.4**
Governments (includes Litigation and Cleanup)	$176.5
Exxon (Cleanup during 1991 and 1992)	$39.9
Research, Monitoring and General Restoration (FY92–FY08)	**$178.0**
FY92-FY07 Work Plans – Restoration Program Projects	$173.0
FY08 Work Plans – Restoration Program Projects	$5.0
Habitat Protection Program	**$375.4**
Large Parcel and Small Parcel habitat protection programs (past expenditures, outstanding offers, estimated future commitments and parcel evaluation costs)	
Large Parcel Acquisition	$347.9
Small Parcel Acquisition *	$23.1
Due Diligence Activities	$4.4
Annual Program Development and Implementation (FY92-08)	**$44.7**
FY92-FY07 Annual Program Development and Implementation	$42.3
FY07-FY08 Annual Program Development and Implementation	$2.4
Investment Trust Fund Balance as of September 30, 2008	**$177.6**
Research Investment Sub-Account	$102.0
Habitat Investment Sub-Account	$34.4
Koniag Investment Sub-Account	$41.2

* Includes sale pending for lands along Kenai River.

Note: FY08 Numbers are pre-audit numbers. Audit was not complete at the time of printing.

The Restoration Plan seeks to provide a balance of restoration activities including direct restoration, research and monitoring, and habitat protection.

THE RESTORATION PLAN

The Trustee Council adopted a Restoration Plan in 1994 after an extensive public process that included meetings in 22 spill-area communities, as well as in Anchorage, Fairbanks and Juneau. More than 2,000 people participated in the meetings or provided written comments.

Reimbursements

As part of the Settlement Agreement, $176.5 million went to reimburse the federal and state governments for costs incurred conducting spill response, damage assessment, and litigation related to the spill. Another $39.9 million reimbursed Exxon Corporation for cleanup work that took place after the civil settlement was reached. The remaining funds were dedicated to implementation of the Restoration Plan, which consists of the following parts:

Research, Monitoring, and General Restoration

Surveys and other monitoring of fish and wildlife in the spill region provide basic information to determine population trends, productivity, and health. Research increases our knowledge about the biological needs of individual species and how each contributes to the Gulf of Alaska ecosystem. Research also provides new information and better tools for effective management of fish and wildlife. General restoration includes projects to protect archaeological resources, improve subsistence resources, enhance salmon streams, reduce marine pollution, and restore damaged habitats.

Habitat Protection

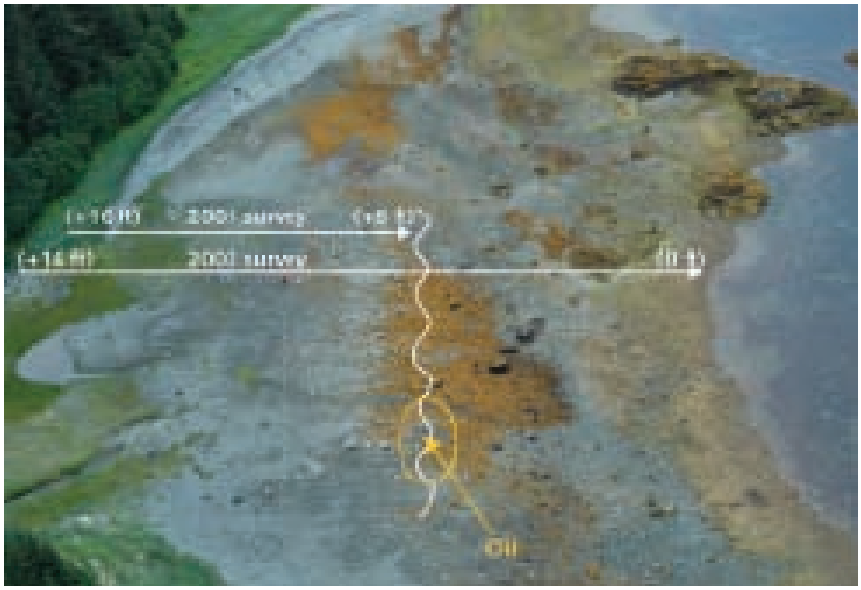
Protection of habitat helps prevent additional injury to species due to intrusive development or loss of habitat. The Trustee Council accomplishes this by providing funds to government agencies to acquire title or conservation easements on land important for the restoration of resources and services injured by the spill.

Restoration Reserve

This savings account was established in recognition that full recovery from the known effects of the spill would not occur for decades. The reserve fund has been used to support long-term restoration activities after the final payment was received from Exxon Corporation in September, 2001.

Science Management, Public Information and Administration

This component of the budget includes management of the annual work plan and habitat programs, scientific oversight of research, monitoring, and restoration projects, agency coordination, and overall administrative costs. It also includes the cost of public meetings, publications, and other means of disseminating information to the public.



THE STATUS OF RESTORATION

Surveys of subsurface Exxon Valdez oil in the intertidal zone.

OIL REMAINS: THE PERSISTENCE, TOXICITY AND IMPACT OF *EXXON VALDEZ* OIL

Visitors today experience the spectacular scenery and wildlife of Prince William Sound and the North Gulf of Alaska. However, one of the most stunning revelations of Trustee Council-funded monitoring over the last ten years is that *Exxon Valdez* oil persists in the environment and, in places, is nearly as toxic as it was the first few weeks after the spill.

This was not expected at the time of the spill or even ten years later. In 1999, beaches in the Sound appeared clean on the surface. Some subsurface oil had been reported in a few places, but it was expected to decrease over time and most importantly, to have lost its toxicity due to weathering. A few species were not recovering at the expected rate in some areas, but continuing exposure to oil was not suspected as the primary cause.

In 2001, researchers at the Auke Bay Laboratories, NOAA Fisheries, conducted a survey of the mid-to-upper intertidal in areas of Prince William Sound that were heavily or moderately oiled in 1989. Researchers dug over 9,000 pits, at 91 sites, over a 95-day field season. Over half the sites were contaminated with *Exxon Valdez* oil. Oil was found at different levels of intensity from light sheening; to oil droplets; to heavy oil where the pit would literally fill with oil. They estimated that approximately 16,000 gallons of oil remained. The survey also showed a trend of an increasing number of oiled pits as they surveyed lower into the intertidal zone, indicating that there was more oil to be found lower down the beach. In 2003, additional surveys determined that while the majority of subsurface oil was in the mid-intertidal, a significant amount was also in the lower intertidal. The revised estimate of oil was now approximately 21,000 gallons. Additional surveys outside Prince William Sound have documented lingering oil on the Kenai Peninsula and the Katmai coast, over 450 miles away.

The amount of *Exxon Valdez* oil remaining substantially exceeds the sum total of all previous oil pollution on beaches in Prince William Sound, including oil spilled during the 1964 earthquake. This *Exxon Valdez* oil is decreasing at a rate of 0-4% per year, with only a 5% chance that the rate is as high as 4%. At this rate, the remaining oil will

Facing Page: Oil from Exxon Valdez persists in a shallow pit dug on a beach in Prince William Sound, summer 2004.

take decades and possibly centuries to disappear entirely.

All of the subsurface oil fingerprinted back to the source oil of the *Exxon Valdez*. Slightly weathered, the lightest fraction of aromatic hydrocarbons (single ring compounds like benzene and toluene) was missing, but most of the 2-4 ring polycyclic aromatic hydrocarbons (PAH) were intact and therefore toxic, and in the same proportions as *Exxon Valdez* oil collected in the first weeks of the spill.

In the weeks following the spill, oil often lay in some of the semi-enclosed bays for days to weeks, going up and down with the tides twice a day. With the daily stranding of the oil in the intertidal zone, some was pulled down into the sediments by the capillary action of the fine sediments beneath the coarse cobbles. The cleanup efforts and natural processes, particularly in the winter, cleaned the oil out of the top 2-3 inches, where oxygen and water can flow, but did little to affect the large patches of oil farther below the surface.

The lower half of the intertidal zone is the biologically-rich area where mussels, clams and other marine life are found in greatest abundance. This raised the question of bioavailability—were animals such as sea otters and harlequin ducks who feed in the intertidal, as well as the species that reside there, being chronically exposed to toxic PAH? In 1996-1998, the Nearshore Vertebrate Project investigated why the populations of several species on Northern Knight Island, which had been heavily oiled, were not recovering. Contrary to anticipated results, food availability was not a limiting factor. Instead, various vertebrate species showed elevated P450 levels compared to non-oiled areas; elevated levels of the enzyme P450 can be induced through exposure to oil. A series of studies in 2004, using passive samplers, also demonstrated that subsurface oil patches still leaked PAH and stimulated a P450 response in fish. Harlequin ducks have continued to show elevated levels through 2007. The elevated levels of P450 would have diminished following initial exposure to oil. Therefore, continuing elevated levels of P450 aren't attributable to the initial impacts of the spill, but indicate a continuing exposure to oil.

Case Study: Sea Otters

Oiled sea otters were the icons of the spill and its effects, and remain one of the area's most compelling animals. While overall population numbers in western Prince William Sound have recovered, local populations in heavily-oiled areas have not recovered as quickly.

Photo © Randy Davis, Texas A&M

Sea otters excavate pits while foraging for food, including their preferred food item, clams. Sometimes these pits are excavated in the intertidal zone. Using depth recording instruments, researchers have looked at the data from more than 10 million dives. These data have shown that sea otter diving activities within the intertidal zone are centered around the zero tide elevation up to +1-2 feet above that. Although they have a fur coat, sea otters lack the thick, insulating layer of blubber found in other marine mammals. Thus, they rely on a high caloric intake to maintain their body temperature. To do this, otters must consume about 25% of their body weight each day. This requires each

At high tide, sea otters digging pits for clams create sediment plumes.

otter to dig thousands of pits each year.

Sea otters usually have very small home ranges, typically consisting of a few square kilometers. In these small ranges, it is unlikely the otters are avoiding areas of lingering oil when foraging. Unfortunately, where clam beds and lingering oil patches overlap, it is likely that digging pits continues to expose sea otters to oil. The otters digging activities do reduce the amount of subsurface oil in the long term: in the process of digging a pit, sediments and the subsurface oil are released and re-suspended in the water and exposed to weathering.

Implications

Current Trustee Council-funded studies monitor environmental damage from the remaining oil. Additional studies have been funded to determine where in the spill-affected area subsurface oil may persist, and what, if anything, to do about it.

Following the oil and its impacts over the past 20 years has changed our understanding of the long-term damage from an oil spill. Because of the scope and duration of the restoration program, lingering oil and its effects were discovered and tracked. As a result, we know that risk assessment for future spills must consider what the total damages will be over a longer period of time, rather than only the acute damages in the days and weeks following a spill. Beaches in the Gulf of Alaska are unique because of their composition and structure and the lack of waves and winter storm action. This, along with the colder temperatures, is partly why oil has persisted and remained toxic here. The potential for long-term damage remains wherever oil persists after an oil spill, whether it is buried in the ocean bottom, marshes, mangroves, or in other non-dynamic habitats.

At low tide, hundreds of sea otter pits are revealed on a single beach in Prince William Sound.

Photo © Matkin/NGOS

The AB resident and ATI transient killer whale groups have suffered long-term damage from the initial exposure to Exxon Valdez oil.

LONG-TERM EFFECTS OF INITIAL EXPOSURE TO OIL

In addition to the continued impacts of lingering oil discussed above, several species have not demonstrated full recovery from the initial damage caused by the spill. The status of killer whales is a clear example of these long-term effects.

Case Study: Killer Whales

Killer whales are individually identifiable and fortunately in Prince William Sound they were photographed starting in 1984, five years prior to the spill. Thus, researchers knew the numbers and associations of the whales at the time of the spill. Two groups of killer whales were photographed in slicks of oil in the weeks following the spill. These two groups lost approximately 40% of their numbers by 1990, and an additional five whales after 1990. One of these, the AB pod, is a "resident" fish-eating group of killer whales, and does show some signs of recovery. The second group is a small, unique population known as "AT1." They are "transient" killer whales that feed on marine mammals. They show no signs of recovery and continue to decline.

The losses to killer whale populations resulted primarily from the initial, acute exposures to the spill. Most carcasses were not found following the spill—which was not surprising since killer whale carcasses are known to sink—but the missing individuals have never been seen or photographed again. It is thought that the damage to killer whales from the spill, like many of the mortalities of other marine mammals, was caused by the inhalation of the oil's toxic fumes, as all of these species had to breath air from a few inches above the slick.

Whale pods are integral, matrilineal families. So a spill that kills any of the key members of the pod, especially reproductive-age or older females, can have far reaching consequences. The reproductive capacity of the pod was reduced by the loss of females which even under ideal conditions have a low reproductive rate, with only about half of newborn calves surviving. Since pods are

matrilineal, the loss of these females means that the leaders of the pod are also lost. Some of the females that disappeared following the spill also had young offspring that died in the first few years after the spill, likely due to the loss of their mothers. In addition, the AB pod has shown signs of an unusual social breakdown within the group, with one matrilineal group leaving to join a different pod. This is a phenomenon not seen in any other resident pod in the North Pacific.

Resident killer whales in Alaska have generally been increasing since the 1980s. However, the recovery of the AB pod is slower than the growth of other fish-eating pods in Prince William Sound or in Southeast Alaska. Their full recovery to pre-spill levels will likely take an additional decade or more, if their recovery is not further compromised. For the transient AT1 population, there appears to be no hope for recovery. There has not been a successful recruitment to the pod since prior to the spill. This unique population will likely become extinct as the remaining members continue to age and die.

STATUS OF INJURED RESOURCES AND SERVICES

In November 1994, the Trustee Council adopted an official list of resources and services injured by the spill as part of its Restoration Plan. When the Restoration Plan was first drafted, the distinction between the effects of the spill and the effects of other natural or human-caused stressors on injured natural resources or services was not clearly delineated. The spill was recent, the impact to the spill-area ecosystem was profound, and adverse effects of the oil on biological resources were readily apparent. As time passes, however, the ability to distinguish the effects of the oil from other factors affecting fish and wildlife populations becomes more difficult.

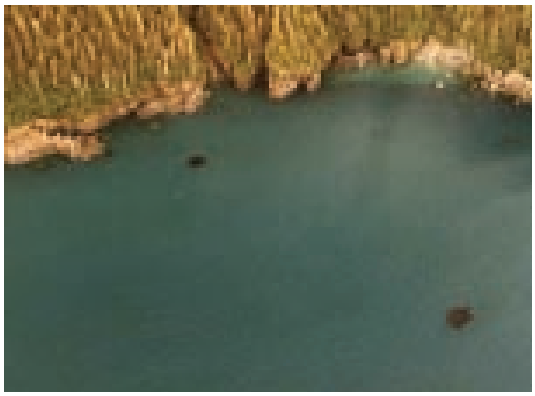
Through hundreds of studies conducted over the past 20 years, we have come to understand that the Prince William Sound ecosystem is incredibly complex and the interactions between a changing environment and the injured resources and services are only beginning to be understood. For example, seabirds will have difficulty recovering without the recovery of herring, which is a vital food source; species in the intertidal zone will continue to be compromised until we can determine the amount and distribution of lingering oil; and human services cannot be recovered until rockfish, herring, and cutthroat trout are recovered. These complexities, and the difficulties in measuring continuing impacts from the spill, mean that determinations about the status of a resource or service contain some inherent uncertainty.

Now, 20 years after the spill, there are two species that continue to be listed as "not recovered," ten species and four services listed as "recovering" (including Barrow's goldeneyes, added to the list in 2008 based on their continuing exposure to oil), five listed as "unknown," and ten listed as "recovered." (See chart on Page 16).

Pacific Herring Population in Prince William Sound Remains Depressed

Herring were affected in 1989 by the spill, and the herring numbers in Prince William Sound are still too low to sustain a commercial fishery. The 1989 year class had the lowest recruitment ever measured. However, that alone does not explain the present low populations of Prince William Sound herring. Their population crash was detected in 1993, some three years after the spill. In addition, herring populations historically fluctuate and can be affected by a myriad of factors. Due to these factors, there continues to be debate as to when the decline started and whether it was directly linked to the spill.

The population of herring in Prince William Sound is still too low to sustain a commercial fishery.



Schools of herring, which appear as dark spots in the water, ball together in response to predators.

While the cause of the continued decline in Prince William Sound herring populations remains uncertain, it is certain that the Sound cannot be considered recovered until healthy herring populations have returned. Herring harvests had always been a vital resource for human communities in the Sound prior to the spill. Herring also provide crucial biological links between species within the ecosystem. Forage fish, such as herring, connect the production of algae and zooplankton to large predators such as other fish, birds and marine mammals. The recovery of some seabird populations is likely affected by the depressed herring population. Herring, rich in natural oils, contain significant amounts of energy. The oceanic ecosystem and its inhabitants rely on such energy transfers, and herring, even with the depressed numbers of today, are likely to play a critical role in energy transfer to other species.

Herring recovery is a current focus of Trustee Council studies. The vital role herring play for both human and marine animal communities is clear, but the path to restoring this important species is uncertain. Herring populations are driven by complicated forces, including disease, predation, and oceanographic dynamics. Any proposed restoration for this species will require a careful understanding of these complex dynamics.

STATUS OF INJURED RESOURCES AND SERVICES

Recovering: Substantive progress is being made toward recovery objectives. The amount of progress and time needed to achieve recovery vary depending on the resource.

- Barrows Goldeneyes
- Black Oystercatchers
- Harlequin Ducks
- Killer Whales
- Sea Otters
- Clams
- Mussels
- Sediments
- Intertidal Communities
- Designated Wilderness

Recovered: Recovery objectives have been met.

- Archaeological Resources
- Bald Eagles
- Common Loons
- Common Murres
- Cormorants
- Harbor Seals
- Pink Salmon
- Sockeye Salmon
- Dolly Varden
- River Otters

Not Recovering: Resources are showing little or no clear improvement since spill injuries occurred.

- Pacific Herring
- Pigeon Guillemots

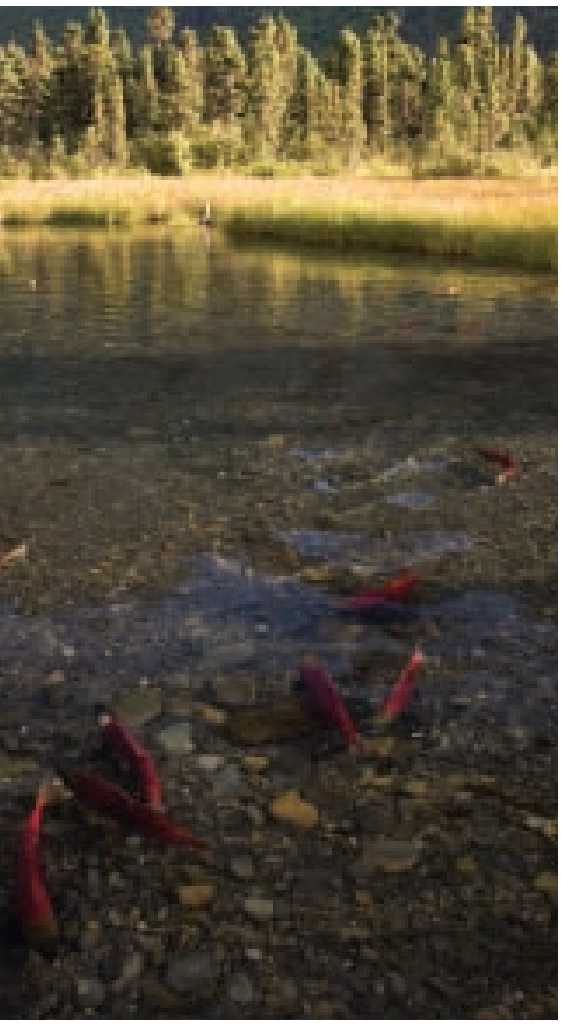
Recovery Unknown: Limited data on life history or extent of injury; current research inconclusive or not complete.

- Kittlitz's Murrelets
- Marbled Murrelets
- Cutthroat Trout
- Rock Fish
- Subtidal Communities

Human Services: which depend on natural resources were also injured by the oil spill. The services below are categorized as "recovering" until the resources upon which they depend are recovered.

- Commercial Fishing
- Passive Use
- Recreation and Tourism
- Subsistence

Facing Page: Thick-billed murres rest on a rocky cliff in the Gulf of Alaska. Murres were considered recovered by 1997.



Trustee Council-funded studies of the effects of the Exxon Valdez oil spill on salmon, especially at critical life stages, has fundamentally changed our understanding of oil toxicity.

RESEARCH, MONITORING, AND RESTORATION

The Leap in Knowledge and Why It Matters

In 1991, the Trustee Council was formed to restore Prince William Sound and the Gulf of Alaska to the "healthy, productive, world-renowned ecosystem" that existed before the spill. The Trustee Council recognized that there was little direct intervention that could be done, such as rearing and releasing seabirds. In an effort to protect habitat important to injured species, they developed a habitat protection program that purchased lands or established conservation easements. Recognizing that the sea cannot be protected through acquisitions, another strategy for long-term protection was adopted, using research and monitoring to increase knowledge of the injured species. The resulting knowledge was used to develop tools to support sound management decisions for the health of those populations and the people who depend on them.

Since the *Exxon Valdez* settlement in 1991, hundreds of peer-reviewed research, monitoring, and general restoration projects have been completed. The magnitude of the restoration program has resulted in a leap in knowledge about the marine environment. It has established baseline information for many species that was not available before the spill as well as significant improvements in the tools that fish and wildlife managers use to evaluate the populations of injured species.

This gain in scientific knowledge and practical management tools is of increasing value in light of the accelerated effects of climate change in Alaska. Specifically, the additional knowledge gained through these projects assists in detecting and tracking vital oceanographic and atmospheric changes, and has greatly contributed to the development of adaptive management strategies and tools to deal with this rapidly changing marine ecosystem.

UNDERSTANDING THE MARINE ECOSYSTEM

In the 1994 Restoration Plan, the Trustee Council outlined an ecosystem approach to restoration. Even before the Plan was final, however, they began investing funds in an organized effort to better understand the marine ecosystem. This approach has provided and continues to provide more information on fish, marine birds, and mammals than ever anticipated. These projects benefit commercial and sport fisheries, aquaculture, subsistence, recreation, and

tourism. Most prominent among them are three ecosystem-scale projects known primarily by their acronyms, SEA, APEX, NVP, and the current suite of projects focusing on herring and their role in the ecosystem.

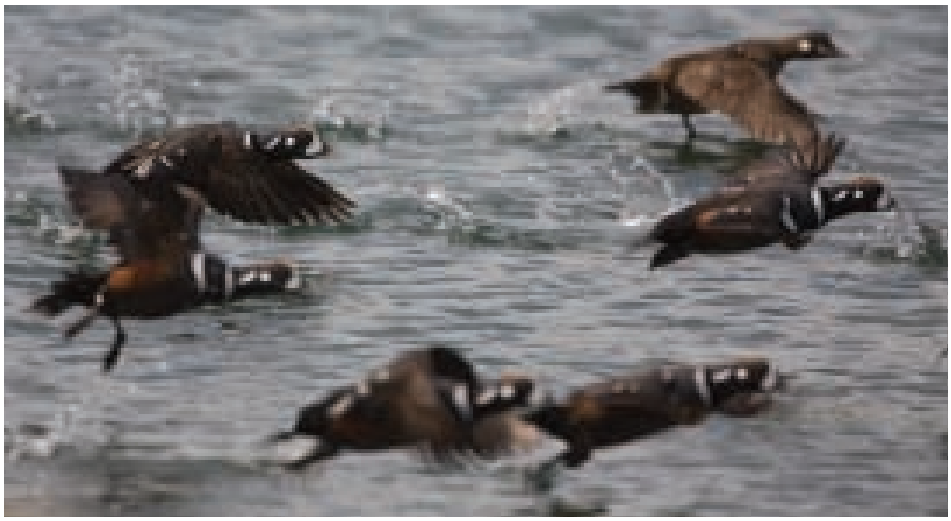
The Sound Ecosystem Assessment (SEA) project was the largest project undertaken by the Trustee Council, funded at $22.4 million over a six-year period (from 1994-2000). SEA had dozens of integrated components designed to obtain a clear understanding of the factors that influence productivity of pink salmon and Pacific herring in Prince William Sound. It was conceived in 1993 in Cordova, Alaska by scientists working with the fishing community after the Sound suffered a collapse of the herring fishery and erratic returns of wild and hatchery pink salmon. This project produced vital information about the survival of juvenile salmon and herring and demonstrated the variable effects of wind and ocean currents on plankton, the tiny plants and animals at the very base of the food chain. SEA provided new insights into ocean currents, winds, nutrients, salinity, temperatures, and mixing, and how these physical factors influence plant and animal plankton, prey, and predators in the food web.

The Alaska Predator Ecosystem Experiment (APEX) investigated the lack of recovery in seabirds injured by the spill. When this study began in 1994, none of the seven seabird species on the injured resources list was considered recovered. This eight-year, $9.7 million project looked at the availability of forage fish and a wide-range of ecological processes to understand the lack of recovery. The data gathered was critical in advancing knowledge of how seabirds select their food and in determining the effect of lower-quality food sources on reproduction. This experiment also helped to define the importance of herring, a high quality food source for seabirds, in the restoration of the Prince William Sound ecosystem.

Scientific Collaboration, Integration, and Peer Review

In order to ensure the highest quality research and monitoring, the Trustee Council requires that all research be independently peer-reviewed. The Trustee Council also encourages researchers to collaborate and where possible, integrate studies. This has promoted a new level of cooperation across agencies, non-governmental organizations, and academic institutions. EVOSTC-funded researchers share data sets and results in a collaborative climate.

Seabird populations were dramatically reduced by the oil spill. Subsequent studies have increased our understanding of the ecosystem dynamics between seabirds and their food sources, as well as providing 20-year data sets from which to track future population shifts.



Depressed populations of harlequin ducks and other species in northern Knight Island led to the discovery of the continued effects of lingering oil.

The Nearshore Vertebrate Predator (NVP) project was a six-year study (1995-2001) of factors limiting recovery of four indicator species that use the nearshore environment. The possible factors included: food availability, continued damage from oil, and population demographics. The $6.4 million project focused on two fish-eaters, river otters and pigeon guillemots, and two species that feed on shellfish and other invertebrates, harlequin ducks and sea otters. Nearshore areas were the hardest hit by the *Exxon Valdez* oil, which clung to beaches and polluted waters on each succeeding tide. When this project was designed, all four predators exhibited signs of stress in oiled areas. For sea otters and harlequin ducks, long-term effects continued in the oiled areas, as shown by the lack of population recovery in these areas, and symptoms of oil exposure in harlequin ducks. At the time, researchers predicted that food was the most likely factor limiting recovery, but their studies proved that it was not. When large quantities of lingering oil were discovered in 2001, it became clear that there was linkage between known effects and the remaining oil.

Integrated Herring Restoration

The lack of recovery of Prince William Sound herring continues to be of major concern to the people who live in the region, scientists, and the Trustee Council. Herring are an injured species and are essential to other species injured by the spill. Therefore, the Trustee Council has initiated a herring restoration effort that utilizes an ecosystem approach.

Recovery of herring is a complex task, as the causes for the lack of recovery are poorly understood and herring play a critical role in the ecosystem. Thus, the precautionary principle to "first do no harm" is of primary importance.

Research into herring issues has been initiated, while a recovery plan with a myriad of alternatives is being developed. The alternatives range from increased research to better understand and manage herring to direct intervention activities such as supplementation and increased harvest of competitors and predators. None of these potential actions are trivial, some are controversial, and all will require time and effort to evaluate costs and effectiveness.

UNDERSTANDING THE PARTS OF THE ECOSYSTEM: FISH, WILDLIFE, AND OTHER PROJECTS

Along with ecosystem-wide projects, numerous targeted studies have also yielded significant new information about species impacted by the spill and management tools. For example, before the spill, long-term killer whale datasets were from studies of whales in British Columbia, Canada. As a result of Trustee Council funding, we now know more about Prince William Sound and Gulf of Alaska killer whales than other populations, including how they bioaccumulate toxins. Targeted studies have also resulted in a dramatic increase in knowledge about sea otters, sea ducks, and other species. The following is a list of some of the more recent efforts and other noteworthy projects.

Sea Bird Surveys Provide Long-term Data and Effects

The area affected by the *Exxon Valdez* oil spill supports a high abundance and diversity of marine birds throughout the year. Approximately one

million marine birds inhabited the area prior to the spill, of which an estimated 100,000 to 300,000 initially died. The Trustee Council has funded marine bird research and monitoring projects since 1990, which have provided important insights into the ecology of seabirds, as well as the process of recovery from the oil spill. In turn, these data provide a window into the health and recovery status of the ecosystem as a whole. For example, research and monitoring of the harlequin duck have indicated the unanticipated duration of exposure to lingering oil in the nearshore zone, as well as the subsequent effects on individuals and populations. This work has been important for understanding the consequences of chronic exposure to residual oil still available to birds and mammals in the spill area, long after the immediate, acute effects are over. In addition to documenting the processes and constraints to recovery from the spill, the research and monitoring funded by the Trustee Council, have provided datasets that serve as benchmarks to detect future changes in the ecosystem.

High-Pressure Beach Washing Damages Clams and the Beach

Hardshell clams were devastated during the spill and the following cleanup. At the time of the spill, the push was to remove as much oil as quickly as possible, a difficult task in the remote Alaskan environment. High-pressure washing was often conducted to remove oil from beaches. Although it was unknown at the time, this approach removed the fine sediments from the beach and altered the physical structure or "armoring" of the beach. The initial injury to hardshell clams came with waves of toxic oil mixed in the water, but was then exacerbated by the subsequent pressure washing. The pressurized washing also broke apart the interlocking cobble layers near the surface which protect the fine sediments from storm action. Studies in 2002 found that these early injuries continue as many of these habitats have not recovered. This affects not only clams, but also the sea otters, other animals, and people that rely on clams for food. It now appears that nature will require several more years, possibly decades in some areas, to restore the clam habitat, and thus the clams.

Researchers continue to monitor recovery of marine birds injured by the spill, including black oystercatchers being tracked with radio telemetry in 2007.

"Bar Codes" Protect Wild Salmon Stocks

In the early 1970s, pink salmon runs in Prince William Sound had crashed. An aggressive enhancement program was developed that included the construction of hatcheries. By 1986, there were five hatcheries operating in Prince William Sound, releasing hundreds of millions of salmon annually. These hatcheries needed to be able to distinguish hatchery-raised fish from wild fish, to be sure that not too many wild fish were being caught. Fisheries managers began marking the hatchery fish with coded wire tags, but inserting and reading coded wire tags is time consuming, expensive and requires a large sample size.

The Trustee Council provided funding to provide Prince William Sound hatcheries with heaters to create thermal marks on pink salmon otoliths. Otoliths are hard, bone-like structures located directly behind the brain of bony fishes. Visible rings on thin cross-sections can be used to age fish. Thermal marks are created by heating the water temperatures when the fish are embryos to produce distinct bar code-like patterns on the otolith. The marks are preserved in the otoliths of adult fish. They are relatively inexpensive to apply and all fish in a hatchery can be marked without harm. The use of thermal marking (instead of wire tags) provides fisheries managers more accurate information at a reduced cost, allows fishers to target hatchery fish, and ensures that wild stocks are not overfished. Thermal marking has been used by researchers to identify Prince William Sound salmon in the high seas and to investigate factors that influence marine survival. Because so many Alaskan hatcheries are located in Prince William Sound, this investment led to significant results.

Research has led to the development and adoption of new tools to improve management of salmon and other species.

Remote Cameras Tested and In Use

The use of remote video camera technology has proved to be a cost-effective way to monitor fish and wildlife in the field, as well as a strong tool for public education. The Trustee Council sponsored two pilot programs using remote video cameras, one to count salmon in streams and one to monitor seabirds in the Barren Islands. The seabird project included live video feeds to the Pratt Museum in Homer, where specialists monitored common murres and helped educate visitors about seabird and forage-fish ecology.

Remote video escapement recorders were deployed in 1999 to count sockeye salmon on Delight Creek, East Nuka Bay; and in 2000 to count chum and pink salmon on Port Dick Creek, Port Dick Bay (outer coast of the Kenai Peninsula). The

camera used time-lapse video which allowed technicians to review 1,100 hours of escapement information in approximately 42 hours. The camera count documented 85-87% of the salmon counted at a weir, demonstrating it could be an accurate and cost-effective alternative to aerial surveys and weirs. Researchers have continued to improve upon the original design and today remote-video escapement recorders are being used by state and federal agencies to monitor salmon escapement at various locations throughout Alaska, the continental United States, and Canada.

Shift in Forage Fish Documented

In 1994, Trustee Council-funded researchers studied a 40-year dataset compiled from trawl surveys to analyze the changing makeup of the north Gulf ecosystem. By meshing datasets from two different agencies, researchers identified a major shift in the types of prey available for many common predators. High-fat species such as capelin, sand lance, and eulachon declined sharply around 1978-80, while more lean fish such as flounder, pollock, and cod increased dramatically during this same period. Coincidentally, these studies were concurrent with measurements of atmospheric change being conducted by other scientists. This allowed the researchers to determine that this biological shift in the forage base coincided with a shift in atmospheric pressure and a two-degree Centigrade increase in the water temperature. This study documented an ecosystem-level effect from the "regime shift" in temperature and other factors, and linked it to the North Pacific Oscillation. While two degrees may not seem like very much, it has big effects, and it takes long-term data sets to find and quantify the significance of what would seem to be small changes.

The change in the availability of quality forage fish may mean less growth and reproduction by the species that use these fish as their forage base. The impact becomes critical if the predator species are dependent on a particular forage fish, especially when trying to support the vulnerable phases in the life history of the predator species, such as juveniles. This ecosystem information provides essential context to the Trustee Council's efforts to restore resources impacted by the spill. It also contributes to a significant advancement of our understanding of oceanographic and atmospheric systems in the North Pacific.

Bioaccumulation and Biomagnification of Toxins in the Marine Food Chain

Work supported by the Trustee Council has contributed significantly to the understanding of how chlorinated hydrocarbons, including polychlorobyphenyls (PCBs) and DDT derivatives, bioaccumulate and biomagnify as they move up the marine food chain from phytoplankton to copepods to fish to seals to killer whales. These hydrocarbons are fat-soluble and are not generally metabolized. Instead, they accumulate in the blubber of marine mammals with the result that killer whales have many thousands of times the level of toxins than plankton (measured in parts per million or ppm).

Researchers have documented that transient whales and resident whales in the Gulf of Alaska are genetically distinct populations. While some transients travel throughout the Gulf and are known to prey mostly on marine mammals, residents usually have a more limited range and prey primarily on fish. Because of this, transient killer whales have 10 times or more the concentration of toxins than resident populations. Levels of PCBs average over 300 ppm and DDT levels over 400 ppm in transient killer whales. Calves had especially high levels of contaminants, indicating that contaminants are being passed from mother to offspring.

DIRECT RESTORATION AND INFRASTRUCTURE PROJECTS

The Trustee Council funds restoration projects that directly benefit injured resources by improving habitat of injured species or preventing additional damage to these critical habitats. The following examples illustrate the diversity and scope of these projects.

Streambank Restoration on the Kenai and Russian Rivers

In 1999, sections of the streambanks of the Kenai and Russian Rivers had extensive damage, causing erosion and other impacts to river habitat essential for salmon spawning. Streambank damage

Streambank restoration on the Kenai and Russian Rivers improved public access, restored trampled river banks and protected heavily used areas from further degradation.

on the Kenai River totaled approximately 19 miles of the river's 166-mile length, including 5.4 river miles of public land. Similar impacts had also occurred along the Russian River. The Trustee Council provided funding to an interagency and private sector partnership to replace and protect streambank vegetation and redirect public access so that sport fishing and other recreational activities could take place with minimal impact to fish and wildlife habitat. Over the three-year period from 1997-2000, 12 separate projects were completed. Trails were constructed or upgraded; streambanks were revegetated; elevated, light penetrating walkways and stairways into the rivers were constructed; and signs and interpretive displays were placed at strategic locations. The results are dramatic. Without the interpretive signs along the walkway, visitors today would have a hard time imagining the damage that existed before the restoration. This successful effort has prompted similar efforts in other areas along this well-loved and important fisheries corridor.

Little Waterfall Creek Enhancements

In order to boost the numbers of pink and coho salmon in Kodiak-area waters, the Trustee Council funded improvements to a bypass at Little Waterfall Creek. By upgrading the fish ladder, more salmon are able to reach spawning habitat in the upper portions of the Creek. Within two years after completion of the project, the number of salmon using the ladder tripled from 20% to 59%. The ladder continues to be used by returning salmon.

Restoration Enhances Subsistence Resources

Several projects have also focused on supplementing subsistence resources for communities in the spill area. For example, the Trustee Council funded projects to release hatchery-produced king salmon fry near Chenega Bay and coho smolt in Boulder Bay near Tatitlek to create subsistence fisheries. In addition, a coho salmon project on the Kametolook River near Perryville on the Alaska Peninsula is working to strengthen the return to the river.

The Trustee Council also supported an experimental effort to spawn and raise littleneck clams and seed them on beaches in Prince William Sound and lower Cook Inlet. During the course of this project, researchers defined the conditions required to successfully spawn Alaskan littleneck clams in the hatchery, and raise large numbers of clam larvae and young clams. Large batches of clams have been raised in the hatchery and some of these have been placed on beaches near villages where subsistence users might harvest them in the future.

New Facilities Stop Marine Pollution at Its Source

Marine pollution is an additional source of environmental stress that can hinder the recovery of injured species. In order to reduce pollutants entering Prince William Sound and the Gulf of Alaska, the Trustee Council funded the development of comprehensive plans to stop marine pollution at its source for communities in the Sound, Kodiak Borough, and lower Cook Inlet. They subsequently funded implementation of the plan with construction of "environmental operating stations" in Cordova, Valdez, Tatitlek, Chenega Bay, and Whittier. Staged implementation of similar projects has occurred in Kodiak Island communities. These waste management programs are designed to reduce chronic sources of marine pollution by providing facilities and services to properly dispose of used oil, household hazardous waste, and scrap metals.

Alutiiq Museum and Archaeological Collections

The Trustee Council provided construction funds for the Alutiiq Museum and Archaeological Repository in Kodiak, to protect archaeological resources and educate the public about Alutiiq culture. Chugachmiut, a non-profit organization serving the Native people of the Chugach region, was funded to develop a regional archaeological repository in Seward and local displays in Chenega Bay, Tatitlek, Cordova, Valdez, Port Graham, Nanwalek and Seldovia.

Alaska SeaLife Center

The Alaska SeaLife Center opened its doors May 2, 1998. This facility provides public education about the marine environment, marine research facilities, and rehabilitation of injured marine mammals and seabirds. Visitors not only view fish, seabirds, and marine mammals in natural-looking environments, but can also watch scientists conducting hands-on research. The Trustee Council provided funding for the research portions of the facility necessary for the restoration program.

PRESERVING AND PROVIDING ACCESS TO INFORMATION

Alaska Marine Science Symposium

This Symposium began as a forum for Trustee Council-funded researchers to share their findings and results and has evolved into the premier marine science forum in Alaska. Held annually in January, it extends over four days and showcases ocean research from the Gulf of Alaska and Prince William Sound, to the Bering Sea and the Arctic Ocean. More than 75 oral presentations and 100 posters were presented in 2009.

EVOS Trustee Council Provides Project Information Online

The Trustee Council maintains an online clearinghouse that provides access to restoration, monitoring and restoration projects. Researchers around the world are able to download data to share with peers, project updates, draft findings and peer-reviewed, final reports. This valuable scientific resource documented 1,300 projects as of January 2009 and receives 5,000 web hits a month.

ARLIS Preserves and Provides Access to Resource Information

Shortly after the *Exxon Valdez* oil spill, it became clear that a great deal of information would be generated as a result of cleanup efforts, damage assessment, and restoration activities. Recognizing the need to preserve this valuable information and make it available, the Trustee Council established the Oil Spill Public Information Center (OSPIC) in 1990. In 1995, the Trustee Council partnered with six state and federal agencies and a university institute, all with libraries focused on Alaska natural resources, to consolidate their library collections and staff into one location and in October 1997, Alaska Resources Library and Information Services (ARLIS) opened its doors.

ARLIS is home to the most comprehensive collection of its kind, served by highly qualified staff specializing in resource related information. The collection includes 250,000 books, 700 journals, 400 electronic journals and databases, countless maps, photographs, CDs and DVDs, and environmental education materials. Additionally, thousands of full-text publications are available through the ARLIS catalog at www.arlis.org and print materials and media are loaned worldwide through interlibrary loan.

The Trustee Council's pioneering partnership in ARLIS ensures permanent preservation of and continuing access to this incomparable legacy of knowledge.

Highlights of Library Service

- 145,000 reference questions answered
- 33,000 EVOS reference questions (since 1990)
- 347,000 visitors
- 131,000 interlibrary loans

2008

- 12% of ARLIS questions were EVOS related
- 19% of items loaned to other libraries were EVOS materials
- 57% of items loaned to Alaska libraries were EVOS materials

Many species injured by the spill, such as this black oystercatcher, require coastal or upland habitat for nesting.

HABITAT PROTECTION STRATEGY

The protection of habitat has been a significant component of the *Exxon Valdez* oil spill restoration program. The acquisition of private lands, or partial interest in private lands, assists in the recovery of species injured by the spill by removing the threat posed by impacts from development, such as real estate and logging. By purchasing land throughout the spill area, the Trustee Council ensures that key habitats for injured resources will not be further damaged from the impacts of development activities, such as speculative real estate development and logging, which were significant threats at the time of the spill.

Salmon restoration efforts in the Pacific Northwest have shown that a healthy riparian habitat—those areas along streams where salmon spawn, feed and rear their young—is essential to the health of the fishery. If the habitat required for these life stages is compromised, depleted salmon populations cannot recover. This lesson extends to other injured birds, fish, and mammals that nest, feed, molt, over-winter, and seek shelter in the spill area, and to the recovery of the services that depend upon them.

Habitat acquisition as a restoration strategy received overwhelming support by the scientific community and the public. In response to a request for comments on restoration alternatives, more than 90% of the respondents said that habitat protection and acquisition should be part of the Restoration Plan. A systematic process was developed to ensure that habitat protection actions would provide restoration benefits and proceeded in three stages: Imminent Threat, Large Parcel and Small Parcel. The Imminent Threat program resulted in the protection of lands within Kachemak Bay State Park, and the Seal Bay and Tonki Cape parcels located on Northern Afognak Island which have since become Afognak Island State Park. Work on five other identified parcels continued under the Large Parcel program.

Large Parcel Program

Following these initial efforts, 90 owners of large parcels (those greater than 1,000 acres) located within the spill area were contacted to determine their interest in participating in the Trustee Council's efforts. More than 850,000 acres were evaluated to determine their potential to benefit the recovery of resources and services injured by the *Exxon Valdez* oil spill.

The following Threshold Criteria were, and with slight modifications continue to be, applied to all parcels:

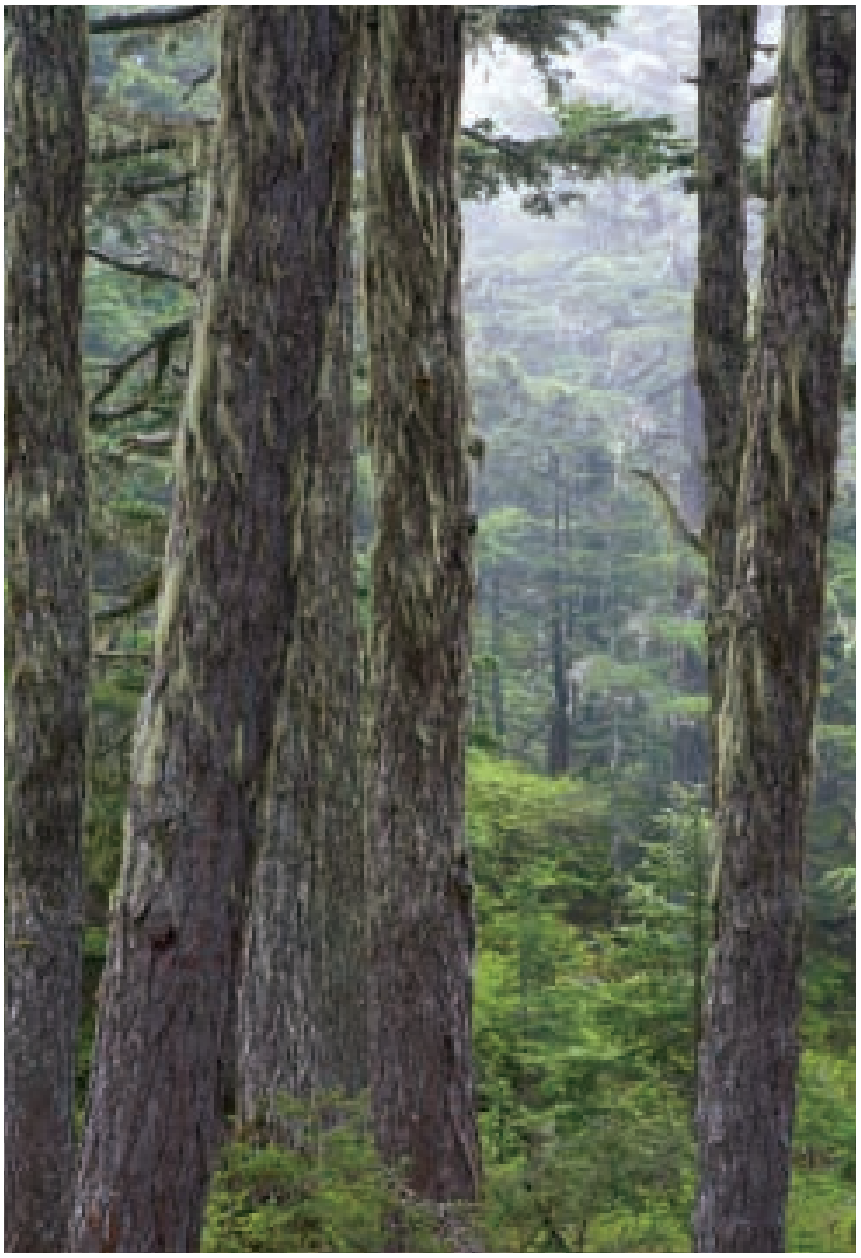
- There is a willing seller of the parcel or property right;
- The parcel contains key habitats that are linked to, replace, provide the equivalent of, or substitute for injured resources or services based on scientific data or other relevant information;

- The seller acknowledges that the governments can purchase the parcel or property rights only at or below fair market value;
- Recovery of the injured resource or service would benefit from protection in addition to that provided by the owner and applicable laws and regulations; and
- The acquired property rights could reasonably be incorporated into public land management systems.

In 1994, the Trustee Council committed to conceptual acquisition packages with eight large parcel landowners. Further negotiations with landowners resulted in creative habitat protection measures that include fee-simple purchases, conservation easements, timber easements, retained development sites and shareholder home sites, and protection of culturally important areas. The negotiated protection packages provide a high level of benefit for injured resources and services, native shareholders, and the public. Most agreements provide for public access for camping, hunting and fishing, restrict development, and provide for continued subsistence uses while providing economic benefits to native corporations and local communities. Native corporation shareholder approval, required before sale, ranged from 81% to 88%.

Small Parcel Program

The Small Parcel Program was designed to recognize the special qualities and strategic values of smaller tracts of land. Small parcels, which are usually less than 1,000 acres, are often located in coves, along important stretches of rivers, at the mouths of streams, adjacent to tidelands or other important habitat, adjacent to or within parks and refuges, and may be located close to spill-area communities. This program allows the Trustee Council to focus on the strategic nature of these small parcels in the context of larger areas, considering such attributes as access, special resource values such as haulouts for rookeries, and benefits to management that would accrue with consistent oversight and compatible land use activities. The small parcel program continues to attract nominations.



Mature spruce forest has been protected, providing habitat for species such as marbled murrelets, which nest in old growth forests.

Prince William Sound

In the eastern portion of the Sound, negotiations with Eyak Corporation in 1995 resulted in the purchase of approximately 2,000 acres of timber rights along the north shore of Orca Narrows, an area slated for timber harvest located close to the town of Cordova. Subsequent negotiations with the Eyak Corporation resulted in the protection of an additional 76,138 acres involving a combination of fee simple acquisition and the acquisition of timber rights to protect habitat important to many of the

The coastal ecosystem extends from the mountains to the sea, and includes significant wetland habitats.

resources and services injured by the spill.

Negotiations with the Tatitlek Corporation have resulted in the protection of more than 70,000 acres: 33,981 acres were acquired as a fee simple purchase and 38,148 acres were protected using a variety of conservation easements that allowed Tatitlek shareholders to retain ownership and use of Bligh Island, an area valued for its cultural significance and subsistence value.

In the western portion of the Sound, negotiations with the Chenega Corporation resulted in the protection of 60,000 acres managed by the U.S. Forest Service and the State of Alaska. A combination of fee simple acquisitions and conservation easements were used to achieve the Council's objectives yet provide opportunities for Chenega to develop ecotourism and lodge sites in the immediate area.

In total, agreements with the Chenega, Tatitlek and Eyak corporations resulted in protection of more than 200,000 acres, 48% through fee simple acquisition. Approximately 40% of the area is protected through conservation and timber easements managed primarily by the U.S. Forest Service. The State of Alaska acquired and manages smaller areas of these packages as well as several small parcels that complement the popular State Marine Park System. In addition, 175 acres were protected in strategically located small parcels located in or near the City of Valdez.

Kenai Peninsula

Two protection packages that received strong public support are located on the Kenai Peninsula. The first acquisition occurred in 1993, when the state acquired 23,000 acres within Kachemak Bay State Park, across the bay from Homer, to prevent logging of the old-growth maritime forest. The Trustee Council provided $7.5 million for the purchase, and the State of Alaska contributed $7 million from the Exxon criminal settlement and another $7.5 million from its civil settlement with Alyeska Pipeline Service Company.

In 1997, the Trustees funded the purchase of 32,470 acres within Kenai Fjords National Park and adjacent islands within the Alaska Maritime National Wildlife Refuge owned by the English Bay Corporation. This package includes some of the most valuable coastal habitat within the Park, which is the second most popular park in Alaska, behind Denali National Park and Preserve.

Other habitat protection efforts on the Kenai Peninsula have focused on small parcels containing valuable habitat in unique, discrete locations along the Kenai River, Anchor River, Ninilchik, and the shoreline of Cook Inlet. These small parcels are especially important for their riparian habitat and exceptional access opportunities for recreation and sport fishing.

Kodiak Archipelago
(including Afognak and Shuyak Islands)

Shuyak Island State Park quadrupled in size in 1997 when 26,958 acres protected by the Trustee Council were added to the Park along with other state lands. The habitat on Shuyak Island was highly valued for restoration benefits and is very popular for recreational purposes.

Afognak Island State Park was created in 1994 after the Council purchased 41,549 acres surrounding Seal Bay and Tonki Bay. This highly productive coastal habitat was threatened by imminent clear-cut logging of the mature spruce forest. Another 41,350 acres were protected on northern Afognak Island, adjacent to the Kodiak National Wildlife Refuge and Afognak Island State Park. This agreement protects some of the most highly ranked habitat in the spill region, including large buffers around the popular Paul's Lake and Laura Lake. The extremely high economic value of the timber resources on Afognak Island makes protection of the area the most costly in the spill region. Old growth Sitka spruce, valued as good marbled murrelet nesting habitat, is also highly valued for timber. On-going efforts are focused on lands located between these two previous acquisition packages.

Habitat protected on Kodiak Island includes high-value land around Olga Bay and the popular and valuable salmon systems of the Karluk and Sturgeon rivers. The Trustees have protected more than 260,000 acres on the Island, much of it within the Kodiak National Wildlife Refuge. In addition to providing protection for pink and sockeye salmon, harlequin ducks, bald eagles, black oystercatchers, and other injured resources, these acquisitions also help protect habitat important to Kodiak brown bears.

The Trustee Council habitat program has protected more than 300 salmon streams.

The Karluk and Sturgeon rivers were given temporary protection through a non-development easement that expires in 2011 with an option for extension of protection for 10 more years, or provides for a fee simple purchase by the U.S. Fish and Wildlife Service.

Many small parcels located within the Kodiak National Wildlife Refuge were acquired in Uyak Bay, Sitkalidak Straits, Kiliuda Bay and other areas on Southern Kodiak Island.

Black oystercatchers nest on gravel beaches.

HABITAT PROTECTION SUMMARY BY REGION

Region	Acres	Cost	EVOS Trust	Other
Prince William Sound				
Chenega	60,001	$34,000,000	$24,000,000	$10,000,000
Eyak including Orca Narrows	78,138	$48,576,704	$48,576,704	$0
Tatitlek	72,129	$34,719,461	$24,719,461	$10,000,000
Small Parcels	1,467	$3,137,300	$3,137,300	$0
Kenai Peninsula				
English Bay	32,470	$15,156,790	$14,128,074	$1,028,716
Kachemak Bay	$23,702	$22,000,000	$7,500,000	$14,500,000
Small Parcels	5,963	$16,947,100	$16,463,100	$484,000
Kodiak Archipelago				
Afognak Joint Venture	41,376	$73,966,348	$73,966,348	$0
Akhiok-Kaguyak	113,338	$46,000,000	$36,000,000	$10,000,000
Koniag Easement	56,823	$6,854,504	**$6,704,504	$150,000
Koniag Fee	59,674	$26,500,000	$19,500,000	$7,000,000
Old Harbor	31,609	14,541,000	$11,291,000	$3,250,000
Seal Bay	41,549	$39,549,333	$39,549,333	$0
Shuyak	26,958	$42,000,000	$42,000,000	$0
Small Parcels	2,007	$2,889,050	$2,889,050	$0
Total	**647,202**	**$426,837,590**	**$370,424,874**	**$56,412,716**

** Represents the cost of the easement through 2013. Twenty-nine million dollars ($29,000,000) was set aside for the fee purchase of these lands. Annual payments to Koniag are taken from this fund. The balance continues to accrue interest which is payable to Koniag at sale should Koniag chose to sell according to the terms and conditions of the master agreement.

Coastal streams provide salmon spawning beds as well as habitat for shorebirds and other species.

THE FUTURE

Because complete recovery from the oil spill may not occur for decades, and because healthy habitats are essential to the permanent recovery of the spill region, the Trustee Council has taken steps to extend its efforts to protect key habitats. By unanimous resolution in March 1999, the Council set aside $25 million dollars to continue the habitat protection program.

Ongoing Efforts

In March 2008, the Trustee Council authorized the expenditure of $10,000,000 as a contribution to the purchase of three parcels on northern Afognak Island as well as the purchase of three small parcels on the Kenai Peninsula, two parcels on Kodiak

Island and one parcel in Valdez. These transactions, summarized below, are not yet complete and therefore are not reflected in the Summary by Region table.

Habitat protection efforts continue on Northern Afognak Island, in Kenai Fjords National Park, and within the Kodiak Island Refuge.

Protecting the Trustee Council Investment

Parcels acquired using Trustee Council funds are typically managed by a federal or state land management agency. In some cases, title is held by a local government. In all cases a conservation easement is in place to ensure that the lands are managed in perpetuity for the purposes for which they were acquired. The following activities are prohibited on all these acquired lands: changing the topography; dumping trash; using biocides; removing or destroying plants except for subsistence or medicinal use; altering watercourses; using motorized vehicles with the exception of floatplanes; removing or harvesting timber; introducing non-indigenous plants; and building facilities.

Limited facilities such as public use-cabins, weir sites, trails, and campsites may be constructed for research or management purposes. Lands acquired with Trustee Council funds are available to the public for recreation, hunting, fishing, and subsistence uses.

To date, the habitat protection program has committed nearly 400 million dollars to the long-term protection of nearly 650,000 acres of habitat in the spill area.

SUMMARY

The *Exxon Valdez* Oil Spill Trustee Council has successfully completed habitat protection measures with a variety of landowners including native corporations and allottees, native allottees, communities, and many other private individuals. The Trustee Council and the various land management agencies have also partnered with a variety of non-profit organizations such as The Trust for Public Land, the Nature Conservancy, The Conservation Fund, The Rocky Mountain Elk Foundation, The American Land Conservancy, the Kodiak Brown Bear Trust, the Kenai River Sportfishing Association, and the Kachemak Heritage Land Trust. Many of the non-profit organizations working with the Trustee Council have contributed additional grant and private sector funds as well as staff resources.

To date, the habitat protection program has expended or committed nearly $400 million dollars to the protection of habitat and protected more than 647,000 acres in the spill affected area. These funds have provided individuals and corporations with a financial return on their investments and assets and these dollars have then circulated throughout the community. These lands are resource rich and protect riparian habitat, marine mammal haulout areas, bald eagle nests, seabird colony locations, marbled murrelet nesting habitat, subsistence harvest areas as well as cultural resource sites. The lands and interests in lands acquired with settlement funds have been placed in public ownership. In many cases these lands have become parks or have been incorporated into existing parks, forests, and refuges. In all cases these lands are being managed in a manner that will support recovery of injured natural resources and services and provide sustainable and valuable habitat in perpetuity. The habitat protection program has been and continues to be a successful restoration strategy; a strategy with strong public support that leaves a lasting visible legacy of the *Exxon Valdez* oil spill restoration program.

Oil Spill Area Index Map

Lake Clark
National Park
and Preserve

Ken

COOK INLET

Ninilchik

Iliamna

Anchor Point

Iliamna Lake

Homer

Seldovia

Augustine Is

Nanwalek

Port
Graham

Dillingham

Barren Islan

King Salmon

Shuyak Is

Kodiak
NWR

Katmai National
Park and Preserve

Egegik

Becharof
NWR

Afognak
Island

BRISTOL BAY

Becharof Lake

SHELIKOF STRAIT

Ouzinkie

Port Lions

Kodiak

Uyak

Chiniak

Karluk

KODIAK
ISLAND

Alaska
Peninsula
NWR

Kodiak
NWR

Old Harbor

Aniakchak
National

Monument
and Preserve

Akhiok

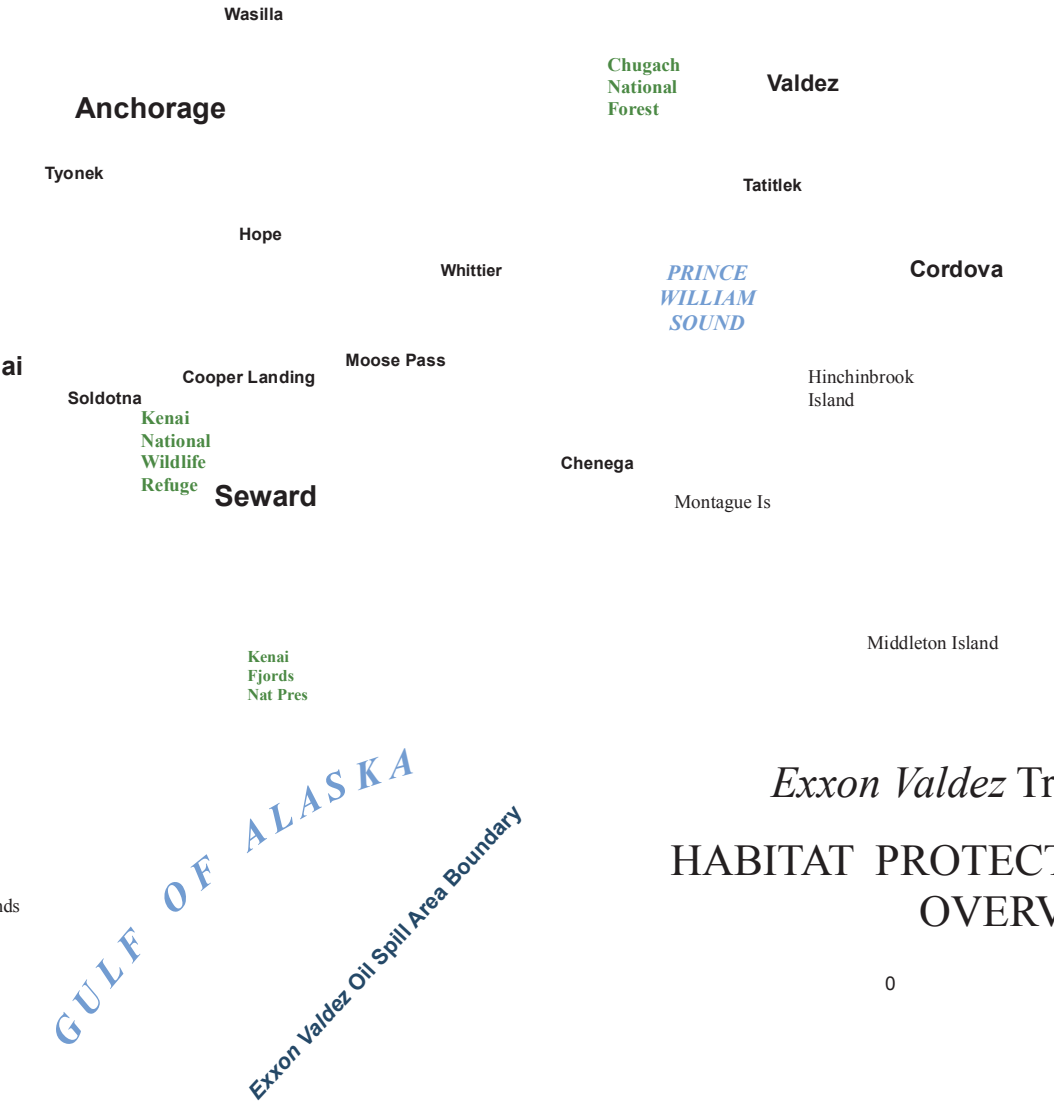
Chignik Lagoon

Chignik

Trinity Islands

Alaska
Peninsula
NWR

Perryville



Exxon Valdez Trustee Council

HABITAT PROTECTION PROGRAM OVERVIEW

0 50 Miles

LEGEND

Oil Spill Area Boundary

Large Parcels

Small Parcels

Federal Lands

- National Forest
- National Parks
- National Wildlife Refuges
- Bureau of Land Management

State, Municipal or Private Lands

- State Lands
- State Parks
- Municipal & Private Lands
- Native Lands
- State & ANCSA Land in Same Section

This map depicts the general location of Trustee Council-funded Imminent Threat, Large Parcel and Small Parcel acquisitions. Acquisitions depicted include fee simple acquisitions, conservation easements, and timber easements. All fee acquisitions provide for public access as do many of the conservation easements. All small parcels were acquired in fee. Additional details regarding these acquisitions, including a description of the rights acquired, can be found in "Exxon Valdez Oil Spill Restoration, Habitat Protection & Acquisition Catalog," prepared for the Trustee Council, February 2007.

This map is a representation of habitat protection acquisitions. For specific legal descriptions and rules and regulations related to use of these lands, consult the appropriate land manager.

Summer tour boats now bring an estimated 106,000 visitors to Prince William Sound.

THE EFFECT ON PEOPLE

The *Exxon Valdez* oil spill had tremendous negative impacts, both culturally and economically, on the people who live in the spill area. The Trustee Council recognizes the enormous stress and economic and cultural dislocation caused by the spill. In an effort to address these losses within the terms of the 1991 settlement requirements, the Trustee Council has devoted a major potion of restoration funds to the restoration of the fish, birds, marine mammals, and archaeological resources that support human communities in the spill area.

The lives of the people who live, work, and recreate in the areas affected by the spill were completely disrupted in the spring and summer of 1989. Commercial fishing families did not fish and their vessels sat dormant. Those people who traditionally subsisted on the fish, shellfish, wildlife, and plants of the region no longer trusted what they were eating and instead turned to high-priced groceries. Recreational use was mostly shut down and the world-wide image of Prince William Sound as a pristine ecosystem was tarnished with oil.

Twenty years later, the spill and the effects of the lingering *Exxon Valdez* oil in the ecosystem, continue to affect the social fabric of native villages and communities throughout the affected area. Subsistence gathering in some intertidal areas has never resumed and commercial herring fisheries remain disrupted.

Recreation and Tourism

Recreation and tourism dramatically declined in 1989 in Prince William Sound, Cook Inlet and the Kenai Peninsula. Injuries to natural resources led resource managers to limit access to hunting and fishing areas, and recreational users, such as kayakers, were prevented from enjoying those beaches that harbored visible oil. Recreation was also affected by changes in human use in response to the spill. Areas that were unoiled became more heavily used as activity was displaced from the oiled areas. Even though visitation has increased since the spill, lingering oil remains on beaches and in some localized areas this remains a concern for recreational users.

Passive Use

In evaluating spill damage, the largest damage in monetary terms came not from the direct use of injured resources by individuals, such as sport or commercial fishing, but rather from the loss felt by people who have not visited the spill area but wish to visit some day; those who have no plans to use the area but want their children to have the opportunity; and those who simply value the fact that unspoiled wilderness exists.

The key to the recovery of this "passive use" is providing the public with current information on the status of injured resources and the progress made towards their recovery.

Subsistence

Fifteen predominantly Alaskan Native communities (with a total population of about 2,200 people) in the spill area rely heavily on harvests of subsistence resources, such as fish, shellfish, seals, deer, and waterfowl. The spill severely disrupted subsistence activities for the people of these villages. The oil spill cleanup affected the harvests by reducing the availability of fish and wildlife, created concern about the possible health effects of eating oiled fish and wildlife, and disrupted the traditional lifestyle. Fears about food safety have diminished

over time, but remain a concern for some.

In 1998, residents of Chenega worked with National Marine Fisheries Service scientists to clean oil from 12 local mussel beds. They assisted Alaska Department of Environmental Conservation staff with removing residual oil from five local beaches used for subsistence. Alaska Native community members also identified sites that they wanted evaluated and participated in the survey work during NOAA's 2001 lingering oil study in Prince William Sound. From 1995-1997, fishery enhancement projects were funded by the Trustee Council in Tatitlek, Chenega Bay, Perryville, and Port Graham.

By 2003, overall subsistence harvests in the villages had returned to pre-spill levels. However, many injured subsistence resources, including clams and mussels, have still not recovered. Spill-area residents therefore report that increased effort and costs are required to achieve subsistence harvests of these resources.

Commercial Fishing

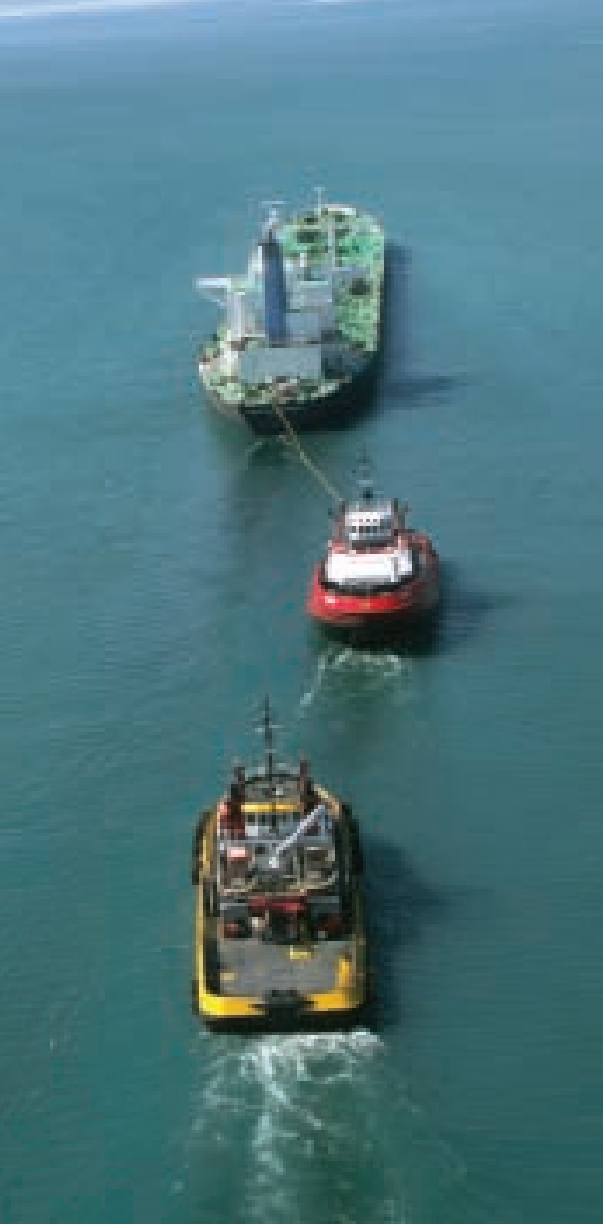
Commercial fishing was injured as a result of the spill's impacts to commercial fish species and through subsequent emergency fishing closures. Fisheries for salmon, herring, crab, shrimp, rockfish and sablefish were closed in 1989 throughout Prince William Sound, Cook Inlet, the outer Kenai coast, Kodiak and the Alaska Peninsula due to oiling. Shrimp and salmon fisheries remained closed in parts of Prince William Sound through 1990.

The most important species that is still experiencing significant problems is Pacific herring. As discussed previously, herring are an ecologically and commercially important species in Prince William Sound. They are central to the marine food web, providing food to marine mammals, birds, invertebrates, and other fish. Herring are also commercially fished for food, bait, sac-roe, and spawn on kelp.

Herring populations were initially damaged by the spill and, for reasons that are not clear, have not rebounded in the subsequent 20 years since the spill. Due to the decreased population, the herring fishery in the Sound has been closed for 13 of the 19 years since the spill. The population began increasing again in 1997 and the fishery was opened briefly in 1997 and 1998. However, the population increase stalled in 1999, and continued disease impacts on the population may be limiting their recovery. The fishery remains closed.

Restoration strategies continue to focus on restoring commercially-important fish populations, developing fishery research techniques, and acquiring and protecting fish habitat.

Commercial seiners wait for fishing season to open in the Cordova small boat harbor.



Two tug boats escort a tanker through the Valdez Narrows.

IMPROVEMENTS TO SPILL PREVENTION AND RESPONSE

One of the major lessons of the *Exxon Valdez* oil spill was that the spill prevention and response capability in Prince William Sound was fundamentally inadequate. Since that time, several significant improvements have been made in oil spill prevention and response planning. Alaska today has the best and safest oil transportation system in the world.

- It is estimated that if the *Exxon Valdez* had had a double-hull structure, the amount of the spill would have been reduced by more than half. As part of the Oil Pollution Act of 1990, Congress required that all tankers in Prince William Sound be double-hulled by the year 2015. All but one tanker now in use in the Sound are already double-hulled, with new tankers built by several companies.
- Two escort vessels now accompany each tanker while passing through the entire Sound. There are now 11 tugs in the system sharing escort duties. They not only watch over the tankers, but are capable of assisting them in the event of an emergency, such as a loss of power or loss of rudder control. Twenty years ago, there was only one escort vessel through Valdez Narrows.
- Specially-trained marine pilots, with considerable experience in the Sound, are now aboard the ship during its entire voyage through the Sound. Weather criteria for safe navigation are also now firmly established.
- The U.S. Coast Guard now monitors every tanker via satellite as they pass through Valdez Narrows and exit the Sound. The new system is so advanced the Coast Guard can actually detect from their control room if a tanker begins to drag its anchor 35 miles away. In 1989, the Coast Guard watched the tankers only through Valdez Narrows and Valdez Arm.
- The location and type of instruments used to monitor winds and seas have been improved to alert the Coast Guard when sailing conditions warrant shutting down tanker traffic.
- The combined ability of skimming systems to remove oil from the water is now ten times greater than it was in 1980, with equipment in place capable of recovering more than 300,000 barrels of oil in 72 hours.
- Even if oil could have been skimmed up in 1989, there was no place to put the oil-water mix. Today, seven barges are available with a capacity to hold 818,000 barrels of recovered oil.

- There are now 49.1 miles of containment boom in Prince William Sound, this is more than ten times the amount available at the time of the *Exxon Valdez* spill.
- Dispersants are now stockpiled for use and systems are in place to apply them from helicopters, airplanes and boats.
- Contingency planning for spills in the Sound include a scenario for a spill of 34 million gallons (809,000 barrels). Drills are held in the Sound each year.

The debate continues over whether a spill the size of the *Exxon Valdez* disaster can be contained and removed once it is on the water. But there is little doubt that today the ability of industry and government to respond is considerably strengthened from 20 years ago.

Complacency is still considered one of the greatest threats to oil spill prevention and response. Therefore, the Alaska Department of Environmental Conservation and Alyeska Pipeline Service Company conduct both scheduled and unannounced drills and participate in regular training exercises in Prince William Sound each year. Community training programs have been established and local fishing fleets have been trained to respond to spill emergencies. In addition, the Prince William Sound Regional Citizens Advisory Council, established by the 1990 Oil Pollution Act, serves as a citizen watchdog over the Alyeska Terminal, the shipping of oil through the Sound, and the government agencies that regulate the industry. A similar citizen's organization watches over oil issues in Cook Inlet.

A prevention and response tug applies direct stopping and turning force to a laden tanker in Port Valdez.

Local fishing boats participate in spill response training, summer 2008.

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