1993

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Edward Scott Bosse
The University of Montana

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THROUGH GRIZZLIES' EYES:
ASSESSING THE EFFECTS OF SALMON FISHERIES ENHANCEMENT ON
BROWN BEARS IN ALASKA'S McNEIL-PAINT RIVER ECOSYSTEM

by
Edward Scott Bosse
B.A., University of Vermont, 1987

Presented in partial fulfillment of the requirements
for the degree of Master of Science in Environmental Studies

University of Montana
1993

Approved by

[Signatures]
Chair, Board of Examiners

[Signature]
Dean, Graduate School

[Signature]
Date
Nov. 30, 1993
Nature’s object in making animals and plants might possibly be first of all the happiness of each one of them, not the creation of all for the happiness of one.

- John Muir

Be watchful, and strengthen the things which remain, that are ready to die.

- Revelations
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<td>Finding of No Significant Impact</td>
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<td>FRED</td>
<td>Fisheries Rehabilitation, Enhancement, and Development</td>
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Figure 1. State of Alaska (inset), with Cook Inlet and surrounding lands highlighted.
Figure 2. Lower reaches of the McNeil and Paint Rivers, and Mikfik Creek flowing into Kamishak Bay.
INTRODUCTION

On an August evening in 1992, I found myself drinking in the fading warmth of Indian summer on a windswept beach a hundred miles southwest of Homer, Alaska. It was a peaceful time to be along the McNeil River—the fireweed that had lit up the hillsides a month earlier had since begun to wither, and the bear-viewers that had come here from all over the world had tapered off so that only a few of us remained. In the mud in front of me the day-old tracks of a sow grizzly and her lone cub slowly filled with seawater as the incoming tide flooded the shoreline. To the west the sun was setting the highest slopes of the Chigmit Mountains ablaze with an emerald fire before disappearing into the frigid waters of the Bering Sea. A jag of silvers flushed into the lagoon sniffing the water for their natal home, but for the most part, the salmon of the McNeil River had by this time either completed their journey or had been caught in the jaws of bears or talons of eagles.

For the past two summers I had come to Kamishak Bay to commercial fish for salmon with Dave Blossom aboard his 38-foot seiner, the Kay Suzanne, but this time I came for a different reason. As part of my graduate studies, I had chosen to write about the effects that a major salmon enhancement project in the Paint River system would have on a neighboring population of brown bears that annually concentrates along the McNeil
River (figure 1). The McNeil bears are unique more for their numbers than anything else; upwards of one hundred of them come to gorge on spawning salmon at the McNeil River Falls every summer, and it is a common sight during the peak of the chum run to see more than forty bears at once from the viewing area along the river. But they are also special because they are habituated to humans more than any other population of bears on earth. Bears are frequently observed feeding, grooming, mating, nursing, playing, and fighting from a distance of less than twenty feet, yet no one in the 26-year history of the sanctuary has ever been mauled by one. The McNeil River State Game Sanctuary is consequently known as the best place in the world to observe free-ranging brown bears and study their behavior in an untrammeled setting.

Fish biologists within the Alaska Department of Fish and Game (ADFG) have recognized the potential for salmon enhancement in the Paint River system since the mid-1960's. The Paint River is the first major drainage north of the McNeil, and its outlet in Akjemguiga Cove is three miles from the McNeil River falls (figure 2). Preventing Pacific salmon from utilizing the spawning habitat of the Paint River drainage are two impassable waterfalls; one that plunges 37 feet near the mouth of the river (plate 9), and another smaller one at the outlet of the Paint River Lakes. From 1980-83, ADFG biologists released several thousand pink salmon fry above the Paint River Falls to see if they would survive the trip over the falls and imprint on the Paint River. This resulted in an unexpectedly small population of pinks establishing themselves in the intertidal zone at the mouth of the river (Quimby and Dudiak 1985). Since 1986, ADFG has annually stocked Upper and Lower Paint River Lakes with approximately 1-2 million sockeye fry in hopes that they would begin returning to the Paint River by 1991, but as of 1993 less than a thousand fish out of an expected 23,000 had shown up (Bucher and Hammarstrom 1993, 40). In 1988, the Cook Inlet Aquaculture Association (CIAA), an organization of commercial fishers seeking to enhance and protect regional salmon stocks, obtained the
funding and permits required to construct a $2.8 million fish ladder that would allow three species of salmon (sockeye, pink, and chum) to bypass the mainstem falls and establish self-sustaining runs of fish that could be harvested by the seine fleet. If everything works out as planned, annual runs of over 1.7 million salmon will return to the Paint River system by the year 2002, bringing an estimated $4 million a year to the lower Cook Inlet seine fleet (Tom Walker, personal communication, July 1992). Construction of the fish ladder commenced in June 1991 and was completed four months later (plates 11-12).

Commercial salmon fishers in lower Cook Inlet have looked to the Paint River enhancement project as a means of reviving a depressed fishery that crashed following the 1989 Exxon Valdez oil spill in Prince William Sound. Most fishers blame the oil spill for the run failures that have plagued the fishery since that time, but fish biologists speculate the decline is likely due to a combination of factors including; poor ocean feeding conditions, competition from hatchery-bred fish, increased predation from tomcod and pollock, habitat destruction from clearcut logging, springtime flooding and ice-scouring (which washes away salmon eggs), high seas driftnetting, and interception by Alaskan shore-based fisheries (Wes Bucher, personal communication, 2 September 1992). The vast majority of fishers in the seine fleet believe the most promising way out is to enhance every stream and lake system in lower Cook Inlet with hatchery-bred salmon in concert with an aggressive habitat protection and restoration program. After all, that is what fishers in adjacent Prince William Sound did when their pink salmon fishery failed in the 1970's, and that fishery went on to become one of Alaska's richest and most reliable salmon fisheries, until the Valdez spill.

Concerned that a major new salmon fishery would draw brown bears out of the McNeil Sanctuary and onto unprotected state lands along the Paint River, a coalition of five environmental groups led by the Friends of McNeil River sued the US Army Corps of
Engineers (the permitting agency) and the US Department of Commerce, Economic Development Administration (which provided federal money for the ladder) in April 1991 in order to halt construction of the fish ladder until an adequate environmental assessment could be completed. The plaintiffs, later joined by the National Park Service, US Fish and Wildlife Service, bear biologists, and wildlife advocates from around the world, contended that the Paint River enhancement project would draw human-habituated bears from the McNeil River falls to the Paint River drainage where they would be slaughtered by hunters and made increasingly vulnerable to defense of life and property (DLP) kills. Additionally, environmentalists and biologists feared the Paint River salmon runs would eventually destroy existing wild runs, and increased numbers of fishers in Kamishak Bay would endanger resident wildlife and degrade the wilderness qualities of McNeil Cove.

In response to environmentalists' concerns and public outcry over the Paint River fish ladder project, the Alaska Legislature passed a compromise bill in June, 1991 that allowed the Paint River project to proceed while affording some protection to McNeil River bears. House Bill 306 expanded the McNeil River State Game Sanctuary by 29,000 acres to include the lower reaches of the Paint River where most salmon are expected to spawn, and created a new 132,000-acre refuge to protect bears using the upper Paint River drainage (Hullen 1991b, 2[B]) (figure 5). While HB 306 legislatively banned bear hunting in the sanctuary for the first time, it left the new McNeil River State Game Refuge open to hunting and mining after several multiple-use groups threatened a lawsuit to stop construction on the fish ladder. Following two years of unsuccessful litigation, the lawsuit over the fish ladder ended with all parties agreeing on a stipulation of dismissal in April 1993.

As a member of the seine fleet and one who fished for the Blossom family, I was inundated with pro-fish ladder propaganda. Both Dave Blossom and his brother, Doug,
serve on the Cook Inlet Aquaculture Association Board of Directors, and their father, Doug Sr., was one of the original promoters of the Paint River project nearly twenty years ago. At the time, he proposed the Air Force be allowed to bomb the falls to allow fish access to the river (Doug Blossom Sr., personal communication, July 1992). Seiners pointed out that the chum run upon which McNeil's bears prey would not exist were it not for a group of fishers who blasted the McNeil River falls in the early 1930's. (In fact, it was the upper falls of Mikfik Creek, and not the McNeil River falls, which were altered.) They argued that McNeil River brown bears would thrive with the new Paint River salmon runs, and that the project was unique because it promoted both fisheries development and environmental conservation. Fishers branded the environmentalists who tried to block construction of the fish ladder as elitists who sought only to preserve their own bear-viewing opportunities and cared little for the bears themselves. Environmentalists, they believed, had a clear agenda; they wanted McNeil to be managed as a pristine wilderness; one that did not include a commercial fishing fleet stealing salmon from bears.

In order to escape the one perspective I had been exposed to, I knew I needed to return to Kamishak Bay wearing a different set of glasses. This time, I would come to McNeil solely to observe bears, not to catch fish, and my peers would consist of bear enthusiasts and professional wildlife photographers instead of commercial fishers hell-bent on filling their fish holds. I wanted to see what the McNeil experience meant to them; whether it shattered old myths about bears, or if it led to a strong conservation ethic that would eventually help save bears everywhere. And there was still that all-important question that commercial fishers had posed; Who was this sanctuary for? Was it for bears, or for the people who came here to photograph them? More than anything, I realized the time had come to listen to what the river had to say. Did any one of us fit into this magnificent setting more than anyone else? Was it possible for humans to be a part of this ecosystem without eventually dominating it and tearing it apart? I left realizing that
the sanctuary and the bears that defined it had inestimable worth long after the last photo was taken, after the last of the fishing boats had returned to Homer. I was beginning to look at the Paint River conflict through the eyes of the one creature that stood to lose the most out of the whole deal. Rarely had anyone considered the possibility that this place be preserved for bears and no one else.

It has been said before that the Paint River conflict is a microcosm of a larger battle that rages throughout Alaska and places like it. It pits natural resource development against disappearing wildlife, unrestrained growth versus sustainable economic development, and ultimately, wilderness against civilization. Predictably, the coalition of environmental groups that filed the lawsuit portrayed themselves as the sole defenders of brown bears in the sanctuary, while commercial fishers were painted as villains who sought only to fill their fish holds regardless of costs to bears. As occurs in all too many environmental conflicts, there was to be a good side and an evil side, with little room in between. Yet there I was, both a proud commercial fisher and a strong wilderness advocate.

Like many Alaskans who make their living out on the edge of the frontier, I have always had a special reverence towards grizzlies. As John McPhee writes in his 1977 book, *Coming into the Country*:

> The sight of the [grizzly] bear stirred me like nothing else the country could contain. What mattered was not so much the bear himself as what the bear implied. He was the predominant thing in that country, and for him to be in it at all meant that there had to be more country like it in every direction and more of the same kind of country all around that. He implied a world. He was an affirmation to the rest of the earth that his kind of place was extant (McPhee 1977, 60).

In the four summers I had spent in Alaska, however, I had also come to love the commercial fisher’s way of life. The fishing families that had let me into their lives; the Blossoms, Fritzs, Bossicks, and McElroys, were all free-spirited, self-reliant,
resourceful, intelligent, and most importantly, still very much connected to nature in a way most of our society is not. Commercial fishing is not an easy way to make a living, especially in lower Cook Inlet, yet it offers the rare opportunity to become a part of the wilderness in which one works. I became enmeshed with the Paint River controversy because I wanted to see for myself whether it was possible to be a commercial fisher while still remaining faithful to my environmental ideals.

There are Paint River projects in the blueprints all over Alaska. Every time a new mine is proposed, a new timber sale announced, a new oil lease offered, or a new tourist development planned, Alaskans face the same basic questions that I was forced to confront with the Paint River fish ladder: Is this project absolutely necessary for the people who live there? Is there any way to achieve the same ends without permanently degrading the natural environment? What are the risks involved? And perhaps most importantly, what would be lost in a worst case scenario? The basic principle behind sustainable economic development is that the pursuit of exhaustible natural resources such as gold, trees, oil, or salmon, should not be allowed to undermine the environmental resources that make up a region's economic base. There are many development projects that are both worthy and environmentally benign, but many others are not. My mission in researching this paper was to find out which category the Paint River project fell into.
Long before the first commercial fishers arrived on the eastern coastline of the Alaska Peninsula, the myriad of rivers and streams flowing into Kamishak Bay served as an important ecocenter for brown bears (*Ursus arctos middendorffi*) and a diverse range of salmon-dependent wildlife. Although nearly every stretch of flowing water containing anadromous fish runs (*Oncorhynchus* spp.) attracted foraging brown bears during the snow-free months, one river in particular, the McNeil, stood out for its unusually large gathering of fishing bears. During the peak of the chum salmon (*O. keta*) run in mid-July, upwards of 70 bears regularly fish at the McNeil River Falls and as many as 50-80 more utilize the surrounding hillsides, beaches, and tidal flats (Larry Aumiller, personal communication, 18 August 1992). Brown bears, normally solitary animals, congregate along the lower reaches of the McNeil primarily because migrating chum and silver (*O. kisutch*) salmon concentrate in large numbers along a shallow 300-foot long stretch of rapids and pools where it is easy for bears to catch fish, and also because there are no other nearby rivers that offer comparable fishing opportunities. It is at these falls one mile upriver from where the McNeil empties into Kamishak Bay where bear researchers, wildlife photographers, and eco-tourists have come since the 1950's to witness a wildlife spectacle unequalled anywhere in the world.
Figure 3. Kamishak Bay and surrounding area, with McNeil and Paint Rivers identified.
Located approximately 100 miles southwest of Homer, the Kamishak Bay drainage is bordered on the north by Iniskin Bay, on the south by Cape Douglas, on the east by 4000-foot Augustine Volcano, and on the west by the Aleutian Range (figure 3). The landscape surrounding Kamishak Bay is characterized by treeless, snow-covered mountains, rolling brush-covered hills, three major river systems (McNeil, Paint, and Kamishak), a maze of swift, opalescent streams, and numerous lakes, ponds, hummocks, sloughs, and coastal estuaries (plates 3-6). The interface of the land and sea is spectacular, and features towering conglomerate rock escarpments, sheer waterfalls, and long stretches of sandy beach. Both McNeil Head and Chenik Head rise nearly 800 vertical feet from the grayish-green waters of Kamishak Bay. During low tides, a series of tidal mudflats that serve as important feeding habitat for bears extend nearly a mile into Kamishak Bay. Offshore, scores of islets and submerged reefs make the shallow waters of Kamishak some of the most dangerous for commercial fishers in all of Cook Inlet. Kamishak comes from the Russian Guba Kamchatskaya, meaning "shallows where the land ends." Due to its rugged topography, remoteness, and incessant storms that pound the Aleutian chain, the area surrounding Kamishak Bay is virtually uninhabited with the exception of commercial fishers and bear biologists who live there periodically from May to September.

Of the estimated 31,000 brown bears (U. arctos) that inhabit Alaska, approximately 7-8,000 call the Alaska Peninsula home, and about 2,000 of those live within Katmai National Park and Preserve and the vicinity of Kamishak Bay (Dick Sellers, personal communication, 21 October 1993). Coastal brown bears (U. arctos middendorffi) and grizzly bears (U. arctos horribilus) are both members of the same species, however differences in their habitat and diets have allowed the former to attain a size easily twice as large as their interior counterparts. The relatively mild climate, lush vegetation, and abundance of salmon streams along coastal regions are all factors which contribute to the
brown bear's large size, sometimes in excess of 1200 pounds (Bledsoe 1987, 6). Other than bears, wildlife populations in Kamishak Bay are not particularly abundant relative to other areas in lower Cook Inlet and the Gulf of Alaska. The exception to that rule is when salmon are running from early June through September. During these times, large numbers of predators including harbor seals (Phoca vitulina), Steller sea lions (Eumetopias jubatus), sea otters (Enhydra lutris), Beluga whales (Delphinapterus leucas), orcas (Orcinus orca), porpoises (Phocoena phocoena), wolves (Canis lupus), coyotes (Canis latrans), and bald eagles (Haliaeetus leucocephalus) are found along streams and river outlets feeding or scavenging upon migrating fish. Significant populations of anadromous fish can be found in the Douglas, Kamishak, Little Kamishak, and McNeil Rivers and in Mikfik, Chenik, Amakdedori, and Bruin Bay creeks. The largest river system in the area, the Paint, currently does not contain any natural stocks of anadromous fish due to the presence of a waterfall near its mouth. Over 130 species of birds have been documented in the sanctuary, mostly along the seaside cliffs bordering McNeil Cove and on Nordyke Island, home to thousands of glaucous-winged gulls (Larus glaucescens) and other seabirds (Aumiller, Matt, and Sinnott 1991).

Encompassing just over 113,000 acres, the McNeil River State Game Sanctuary protects only a small fraction of the home range of most brown bears that visit the falls during the summer months. A bear's home range is that area which an adult bear uses to fulfill all of its requirements (e.g., food, cover, and water) for all seasons on an annual or multi-year basis (King 1938). Home ranges of brown bears in Alaska vary depending on differences in the distribution, abundance, and availability of resources such as food and den sites, topography, cultural transmission (learning), human disturbances, and bear density (Jonkel 1987). In general, bears' home ranges are smallest on the coast where multiple runs of salmon are present, and largest in the interior, where food sources are less concentrated. One study conducted on the Alaska Peninsula showed
the home ranges of individual bears varying from as little as 10 square miles to as much as 800 square miles (Glenn and Miller 1980). In 1989, two bears that were tagged in coastal areas of Katmai National Park and Preserve in June were found feeding 70 miles to the north at the McNeil River Falls in July and August (ADFG 1991b, 14).

Larry Aumiller, who has managed the McNeil River Sanctuary since 1976 and can identify most of McNeil's bears by their physical appearance and personalities, estimates that 120-150 bears currently spend at least part of their summer fishing at the falls (Larry Aumiller, personal communication, 18 August 1992). The greatest number of bears ever observed at the viewing area at one time was 65, with another 32 individuals known to be in the area that day (ADFG 1991b, 13). Although this translates into a bear density of 450 bears per square mile at the falls proper, the average density of bears throughout the sanctuary is estimated to be between 1 and 2 bears per square mile (ADFG 1991b, 13). This compares to a bear density of 1.4 bears/square mile on the Pacific coast of Katmai National Park and Preserve (ADFG 1991b, 13), .5 bears/square mile at Black Lake on the Alaska Peninsula (Miller and Sellers 1990), 1.6 bears/square mile on Kodiak Island (Troyer and Hensel 1964), .86 bears/square mile in Denali National Park (Dean 1976), and .02 bears/square mile in the Brooks Range (Curatolo and Reynolds 1982). In the lower 48 states, the only two ecosystems that contain significant populations of grizzlies; Glacier and Yellowstone, have bear densities of .12 bears/square mile (Martinka 1974) and .03 bears/square mile (Craighead et al. 1974), respectively (Appendix 1). Due to the fact that bear populations seem to have stabilized in recent years while salmon and other prolific food sources are not fully utilized, it is believed that the only limiting factors standing in the way of a growing bear population are the availability of food in areas of low social stress, intraspecific predation (bears killing other bears), and hunter-caused mortality (David Johnson, letter to Col. John Pierce, November 1991).
The annual pilgrimage of brown bears to McNeil Falls begins every spring when bears emerge from their dens in the mountains surrounding the sanctuary. Although biologists have yet to survey the region for denning areas, the most likely den sites are thought to be at elevations between 1,000-1,500 feet in the nearby Chenik and Middle Mountains (Lentfer et al. 1972). Here, deep winter snows provide warming insulation for hibernating bears well into spring.* Weakened and hungry after not having consumed food or water for nearly six months, bears come to feed on the sprouting grasses, forbs, and sedges (*Carex langlii*) that flourish along the mudflats surrounding McNeil Lagoon and other nearby estuaries. These plants, the first to appear in the spring, provide the first reliable protein source for McNeil's bears and make up most of their diet until an early run of sockeye salmon (*O. nerka*) returns to nearby Mikfik Creek during the first week of June. Being opportunistic feeders, brown bears in the Kamishak Bay region also spend time in the spring digging for arctic ground squirrels (*Citellus parryi*) and scavenging for beached whales, seals and sea lions; seaweed, clams, roots, and tubers (Bledsoe 1987, 9). Occasionally they may bring down a moose (*Alces alces*) or caribou calf (*Rangifer arcticus*) in the surrounding hills. Bears are frequently observed foraging along Amakdedori Beach, Chenik Lagoon, Amakdedulia Cove, Horseshoe Cove, and Akumwarvik Bay.

As spring gradually gives way to summer in early June, anywhere from 10-20 brown bears in the area converge upon the lower falls of Mikfik Creek to feed on an early run of oil-rich sockeye salmon (figure 2). Once that run diminishes, most bears in the vicinity are drawn to the lower mile-long stretch of the McNeil River when hordes of migrating chum salmon begin to move upstream to spawn in early July. Although the

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*Because their body temperatures remain at near-normal levels throughout the winter, brown bears are not considered to be true hibernators. In fact, brown bears sometimes awaken and leave their dens to feed during the winter months.
McNeil meanders for nearly 20 miles from its glacial source in the Chigmit Mountains to its outlet in Kamishak Bay, 90 percent of its spawning salmon occur within the one mile that separates the lagoon from the falls (ADFG 1991b, 4). Fish biologists speculate that one of the major reasons for so few salmon in the headwaters is that brown bears have had a near-constant presence at the falls since prehistoric times. Since chum salmon are relatively slow swimmers, they are easy prey for bears and rarely are able to make it past the falls and into the upper river. Between 1985-89, bears caught more than 90% of the salmon returning to the McNeil River to spawn (Aumiller 1989, 6). Many commercial fishers believe there are now too many bears along the river, and that their growing presence has helped to turn what was once a profitable fishery into what is now a marginal one.

Only the more dominant bears, usually large males or sows with cubs, claim the choice fishing spots amongst the shallow pools and riffles composing the falls proper (plate 1). Most socially-intolerant bears (usually very large, old boars that have survived by avoiding heavily-hunted coastal areas) utilize the falls only at night when humans and other bears have left the observation area (Bledsoe 1987, 24). During the day, juveniles can be found fishing in the deeper, slower parts of the river downstream, scavenging on nearby beaches, or bedded down on the grassy hillsides and alder thickets on the north side of the falls.

Fishing techniques vary wildly among McNeil's bears. The most common and seemingly effective means is for a bear to position itself near the brink of a shallow falls, catching a fish in its jaws as it leaps from one pool to another or pinning it against the bottom with its sharp claws. Other techniques observed while visiting the falls include snorkelling, when a bear submerges everything but its ears while looking for fish; diving underwater, where the bear literally disappears into a deep pool and resurfaces several seconds later with a salmon; and, least effective but certainly the most
entertaining, diving off a rock in a full-sprawl. Most adolescent bears observed at the falls and along the lower river fish by running into the water at full gallop and swiping and biting at anything remotely looking like an exposed dorsal fin. Often times they are more successful stealing a salmon from their mother or another unsuspecting bear.

Catch rates among bears fishing the falls depend on several factors including run strength, time of day, tides, water level, fishing techniques employed, number of bears present, species of salmon, and experience (Larry Aumiller, personal communication, 18 August 1992). Generally, bears fishing at the McNeil River Falls have an easy time catching large numbers of fish due to the fact that the series of falls and pools at McNeil are shallow and occur in a concentrated area, and because chum salmon are relatively weak swimmers. While visiting the falls in August 1992, one large sow named Melody captured and consumed 20 silver salmon in a period of 6 hours. At 5-7 pounds per salmon, that amounts to more than a hundred pound intake in one afternoon of fishing. Larry Aumiller reported that during the peak of the chum salmon run in 1984, a large boar named Groucho captured 91 fish in one 8-hour observation period, with each fish weighing an average of 7-9 pounds. During these times, when salmon are bountiful and easier to catch, most bears will eat only the most palatable and nutritious parts of the fish, which include the eggs in females, the skin, the top of the head, viscera, and some flesh (Bledsoe 1987, 67). Virtually all the leftover scraps are quickly consumed by the glaucous-winged gulls and bald eagles that are omnipresent during busy fishing periods.

Sometime in late August, after the last of McNeil's chum salmon have spawned and a small run of cohos has begun to enter the river, most of the bears remaining in the sanctuary begin searching for food elsewhere. Several McNeil River bears have been observed fishing for late-summer sockeyes along the Battle, Kulik, and Kokhonak rivers in Katmai National Park, while others move to the Kamishak and Douglas rivers to feed on late-running silvers (ADFG 1991b, 3). After the salmon have disappeared, the profusion
of sugar-rich berries that flourish in the rolling hills overlooking Kamishak Bay serve as another important food source for hyperphagic* bears. Blueberries (*Vaccinium uliginosum*), salmonberries (*Rubus spectabilis*), thimbleberries (*Rubus parviflorus*), huckleberries (*Vaccinium membranaceum*), and crowberries (*Empetrum nigrum*) provide the final infusion of calories bears need before the snowline creeps down to sea level sometime in early November (Bledsoe 1987, 192). The bears that survive the fall hunting season then disperse into the surrounding mountains to dig their dens and complete their annual cycle.

Prior to the arrival of commercial fishers and itinerant prospectors, the Kamishak Bay coastline was inhabited by Native Alaskans who subsisted on salmon, shellfish, and marine mammals such as seals, sea lions, and an occasional whale. Although little is known about how the resident Aleuts interacted with brown bears in the Kamishak region, it is believed that they rarely hunted bears for any other reason than ritual, thus they probably had little effect on bear populations. The first non-Natives to arrive and settle on the Alaska Peninsula were Russians who came in search of marine mammals for their fur and oil in the late 1700's. Commercial hunting efforts in this part of Alaska focused almost exclusively on sea otters and northern fur seals, but once these species were driven to the brink of extinction, brown bears were sought for their hides. Because the Russians had already established themselves on nearby Kodiak Island, most brown bear hunting that took place during this time likely occurred there and not in the area around Kamishak Bay (Walker and Aumiller 1993, 49).

Perhaps the single greatest natural event that influenced brown bear populations in the Kamishak Bay region at the time was the cataclysmic eruption of Novarupta Volcano in 1912. So violent was the eruption that it caused nearby Mt. Katmai

* Hyperphagia refers to the stage when bears must consume enormous amounts of calories to put on winter fat.
to collapse and deposited more than 50 feet of ash in the Valley of 10,000 Smokes and up to 10 inches in the nearby Kodiak Archipelago (Lochalsh 1987). The heavy ashfall around Kamishak Bay provided the nutrients that later allowed dense thickets of alder (*Alnus sinuata*) and willow (*Salix lasiandra*) to overtake the hillsides near the McNeil River and provide ideal cover for brown bears (Walker and Aumiller 1993, 49). Today, the alders are so thick that the only way one can get from the McNeil River to the Paint River is to crawl on all fours through a network of bear trails.

The other event that would dramatically change the Kamishak Bay ecosystem was the arrival of commercial fishers as early as 1890. Although they came to this remote coastline searching for schools of salmon and herring, the fishers who prowled the waters of Kamishak also took a heavy toll on brown bears. According to Steve Zawistowski, who seined in Kamishak Bay for twenty years beginning in 1932, "Fishermen would shoot every bear they saw, and bragged about the numbers at the end of the season (Walker and Aumiller 1993, 49)." One early Alaskan territorial governor even declared that, "Alaska will never make progress until we eliminate brown and grizzly bears (Walker and Aumiller 1993, 52)." In the early 1970's ADFG game biologists found several old cyanide setguns that had been placed along the banks of the McNeil River with the intent of killing brown bears. The reason most commercial fishers killed bears and other predatory wildlife was because they ate fish, cutting into their profits. Practically every predator that fed on salmon had a bounty placed on it by the federal and territorial governments. Bald eagles, harbor seals, Dolly Varden, rainbow trout, wolverines, wolves, and coyotes were all viewed by fishers as voracious competitors (Walker and Aumiller 1993, 52). To this day, several fishers in the lower Cook Inlet seine fleet shoot harbor seals, sea otters, and Steller sea lions when they swim into their sets, and routinely kill Dolly Varden (*Salvelinus malma*), sand sharks (*Squalus acanthias*), tomcod (*Microgadus proximus*), and pollock (*Theragra chalcogramma*) when they come up in their seines.
If commercial fishers had a bad reputation for killing bears around Kamishak Bay, the man for whom the McNeil River State Game Sanctuary is named had one that may have been even worse. Charlie McNeil arrived in Kamishak in 1904 searching for precious mineral deposits, and spent the following twenty years homesteading along the McNeil River, extracting small amounts of low-grade gold and copper ore from his Reward and Ridgeway claims along the Paint River, searching in vain for an oil deposit along the Douglas River, and killing brown bears in order to pay off his mining debts. When he wasn't staking a new mining claim or hunting bears for their hides and skulls, McNeil worked for the US Bureau of Commercial Fisheries as a streamguard. His responsibilities included shooting seals (because they preyed upon salmon), trapping fur-bearing animals, and monitoring the salmon runs on the Mikkik, Little Kamishak, Chenik, and Amakdedori drainages to assess spawning numbers and deter commercial fishers from creek-robbing (Walker 1992, 5[K]).

Wanton bear-killing by commercial fishers and the likes of Charlie McNeil kept brown bear populations from expanding from the turn of the century well into the 1930's. The era of "Bruin Menace" came to a close in the 1940's as increasing numbers of people travelled across Cook Inlet to hunt and photograph the bears that converged along the McNeil River. Legendary Alaskan bear guide Slim Moore visited the McNeil River Falls while on a hunting expedition in the latter part of that decade, but after his clients killed two bears he lamented, "After going there, I didn't think it right that those bears should be hunted. It didn't seem sporting (Walker and Aumiller 1993, 52)." Moore would later advocate sanctuary status for the bears. Former territorial legislator Steve McCutcheon journeyed across the Inlet to photograph bears in 1953 and reported, "The first morning we were there, the fog began to lift and out across the flats and hills we could count seventy bears all at the same time (Walker and Aumiller 1993, 52)." Upon witnessing the congregation of bears, he, too, was compelled to write the US Congress and territorial
wildlife agency asking that McNeil's bears be protected. After filming bears fishing at the McNeil Falls in 1954, biologist Cecil Rhode wrote an article about the bears that appeared in *National Geographic*, but he purposely kept the location a secret for fear hunters would converge there (Rhode 1954). Soon after, however, increasing numbers of hunters, photographers, and wildlife enthusiasts from Alaska and the world over flew to Kamishak Bay to see the unique phenomenon. The river of bears had been discovered. On July 1, 1955, the Alaska Game Commission closed the entire McNeil River drainage to bear hunting and designated it the McNeil River Reserve (Sinnott 1992, 1).

Following the hunting closure, bear populations in the McNeil River drainage slowly began to rebound. In 1957, the US Fish and Wildlife Service sent the first conservation officer, Ivan Marx, over to McNeil to enforce the ban on hunting in the new reserve. During his second season, Marx became one of the first and only documented victims of a bear attack in the McNeil Reserve, and wrote:

> A large sow bear with new cubs charged me in the alders... She started her charge at 20 feet so I threw myself down on my back and lay still with my rifle pointed up at her chest. Al Hooker was running and trying to get his rifle off his pack and she forgot me. She ran across my legs and took after him. He fell down just as I started to shoot. At this instant she whirled and ran back over me to her cubs and reared up, then left. Either while grabbing at me or stepping on me, her claws cut a large gash in my knee, two of her claws went through my pants. My leg is stiff but I think I won't have to go to town (Walker and Aumiller 1993, 68).

In addition to his mission to stop all poaching at the falls, Marx guarded the area from creek-robbers,* observed bear activities and numbers, and recorded commercial fisher's attitudes about bears while they were anchored in McNeil Lagoon. The most common remarks fishers made were that the bears killed too many salmon, and they suggested bounties be placed on the bears to keep their numbers in check. "We don't want them to

* Creek-robbers are commercial fishers who illegally set their nets across creek mouths during the peak of salmon runs.
become extinct," commercial fishers said, "but we don't need too many (Walker and Aumiller 1993, 59)." It would prove nearly impossible to convince local fishers to leave the bears alone.

The 1960's and early 1970's proved to be disastrous years not only for lower Cook Inlet fishers, but for McNeil River bears as well. With the exceptions of the 1965-66 fishing seasons, salmon returns to both Bristol Bay and lower Cook Inlet were extremely weak. Consequently, McNeil River brown bears dispersed throughout the area looking for alternative food sources and their reproduction rates fell. In addition to several consecutive years of poor salmon returns, McNeil River bears became the objects of over a decade's worth of intensive wildlife research that commenced in 1960. Between 1963-73 the ADFG Division of Wildlife Conservation and researchers from Utah State University darted, immobilized, and marked 60 McNeil River bears in order to learn more about their reproduction, sex and age composition, movement, and mortality (Sinnott 1992, 2). In the first four years of research, eight bears were known to have died from tranquilizer drug overdoses (Sernalyn and Etorphine), and one bear drowned while immobilized (Walker and Aumiller 1993, 59). It did not take long for biologists to discover that the stress associated with capturing and handling the bears was taking a heavy toll on the sanctuary's behavioral conditioning program. Bear numbers were falling precipitously, and wildlife photographers complained about the highly-visible ear tags and neck collars that adorned them. In 1973, the state terminated the research program, declaring that the study objectives had been met (Sinnott 1992, 2).

Two other important factors contributed to bear declines at McNeil during this period. First, visitation to the falls was uncontrolled and continually increasing. Photographers set up blinds on the center rock at the falls, sport fishers competed with bears for salmon, floatplanes took off and landed in the lower stretches of the river where juvenile bears fish, and bears entered campsites and ransacked tents as a result of
improperly-stored food. On two separate occasions, once in 1969, and again in 1970, bears were shot and killed by photographers who got too close to sows with cubs. In both instances, the cubs later had to be destroyed (Walker and Aumiller 1993, 61). Meanwhile, trophy hunters on the Alaska Peninsula were killing record numbers of brown bears. The average number of bears harvested in game management unit 9A (Kamishak Bay) more than tripled between 1966-1976, and the harvest in GMU 9B (which includes prime denning habitat to the north and west of the McNeil Sanctuary) more than doubled in the same period (ADFG 1992) (Appendix 2). Consequently, by the end of the 1972 season, bear numbers at the falls fell from an average of 25-30 to as few as twelve (Faro and Eide 1974).

One of the few positive things to come out of this era in McNeil's history was the creation of the McNeil River State Game Sanctuary (MRSGS) in 1967. Introduced by State legislator and long-time commercial fisher Clem Tillion, the bill establishing the sanctuary derived its support from an unlikely coalition of hunters, fishers, biologists, and photographers. The purpose of the new sanctuary was, "to provide for the permanent protection of brown bear and other wildlife populations and their vital habitat in the area of the McNeil River so that these resources may be preserved for scientific, esthetic, and educational purposes (Lew Pamplin, letter to Don Collinsworth, February 1988)."

According to Tillion, now Alaska's Fish Czar under Gov. Wally Hickel, the legislation was introduced, "in part because I feared that if hunters wounded bears, the bears would end up hurting a photographer. Also I felt there should be a compromise for hunters and photographers. There should be some places you can go to just see the bears and not have to worry about them (Walker and Aumiller 1993, 59)." In 1968, the hunting closure imposed by the Alaska Board of Game was expanded to include all waters flowing into McNeil Cove, thus adding the Mikfik Creek drainage to areas already off-limits to bear hunters (Sinnott 1992, 1).
The watershed year in the evolution of the McNeil River State Game Sanctuary was 1973, when the permitting system long advocated by ADFG game biologist Jim Faro went into effect. In addition to limiting the number of visitors to the falls to 10 per day during the months of July and August, the new set of regulations denied access to the north side of the McNeil River where human-intolerant bears and sows with cubs often bed down during the day. In 1974, ADFG hired biologist Walt Cunningham to enforce the new regulations and lecture visitors on bear safety. During that same year the Alaska Board of Game banned hunting on state lands surrounding the sanctuary by emergency order due to what were considered excessive harvest rates in past years (Walker and Aumiller 1993, 64).

Upon Larry Aumiller's arrival at McNeil in 1976, a host of additional actions were taken in a desperate attempt to bring bears back to their former numbers. A trail leading to the bear-viewing area was built, visitors were prohibited from roaming at will; they were to be accompanied by an ADFG biologist when visiting the falls, food was more carefully stored, unburnable trash was flown out of the sanctuary, and sport fishing was banned within a half mile of the falls (Walker and Aumiller 1993, 64). Bears also benefitted from two administrative actions that were taken in 1978. First, the permit period was extended to include the latter half of June when a small group of bears fished the Mikfik sockeye run, and secondly, adjacent Katmai National Monument was expanded northward to encompass the areas south and west of the sanctuary (Sinnott 1992, 1).

In 1980, the landmark Alaska National Interest Lands Conservation Act (ANILCA) reclassified Katmai National Monument as Katmai National Park and Preserve, and in 1985 the Alaska Board of Game banned bear hunting on all state lands to the south and east of the McNeil River Sanctuary, thus protecting brown bears in an area of more than 4 million contiguous acres (Sinnott 1992, 1). As a result of these actions, the only coastal area between Katmai and Lake Clark National Parks left open to bear hunting was a
75,000-acre swath of undesignated state land located to the north of the McNeil River Sanctuary, where the Paint River flows.

Due to a combination of three factors; decreased brown bear harvest rates throughout the Alaska Peninsula, a new set of management guidelines that encouraged sanctuary use by bears, and increased salmon escapements in western Cook Inlet rivers and streams, the brown bear population in the McNeil River State Game Sanctuary doubled in the ten years that had passed since the permit system had been implemented and reached record levels in the mid-1980's (ADFG, letter to Col. John Pierce, 20 November 1991) (Appendix 3).
Since arriving in Kamishak Bay, commercial fishers have been determined to transform what had always been a marginal fishery into a reliable salmon-producer like the one in neighboring Bristol Bay, the largest sockeye fishery in the world. Historically, only a few rivers and streams in the area produced strong runs of salmon on a consistent basis. In some years, Cottonwood and Iniskin Bays produced chum runs in excess of 40,000 fish (Bucher and Hammarstrom 1993, 118), and Bruin Bay occasionally supported annual runs of 100,000 or more pink salmon (Bucher and Hammarstrom 1993, 116). Prior to the 1940's, Mikfik and Chenik Creeks saw strong sockeye returns, but those runs have since been subject to wild fluctuations (Bucher and Hammarstrom 1993, 110). Due to a relatively harsh set of environmental conditions that exist in lower Cook Inlet, salmon-bearing systems there tend to produce huge runs of fish in some years, and practically no fish in others. Through a combination of lake-stockling, lake fertilization, and removal of migrational barriers, commercial fishers have sought to increase salmon numbers so that even in poor return years enough fish come back to allow a commercial harvest.

The first recorded attempts at enhancing Kamishak Bay salmon runs were made by Charlie McNeil in the early 1920's. During his tenure as a streamguard, McNeil built a "sluice" out of rock and sod to funnel sockeye salmon up and over a set of falls on
Mikfik Creek, and he later sought to blast a fish ladder up the Paint River Falls, but was
denied permission when he demanded exclusive rights to the salmon there (Walker and
Aumiller 1993, 48). Following McNeil's departure from Kamishak in 1924, commercial
fishers continued in their efforts to enhance Mikfik Creek. In 1932, the US Bureau of
Fisheries reported the following activity under the heading of stream development:

The most important work of this nature was done at the upper falls in
McNeil Creek (Mikfik Creek), Kamishak Bay. Here a fishway was blasted out of
the solid conglomerate rock through which the fish can pass into the creek above.
The fish can now ascend this permanent fishway without difficulty from a large,
deep hole in the stream bed at the base of the falls. Prior to this improvement,
many fish perished in their attempt to ascend this obstruction.
The run, which ordinarily lasts but a few days, was on during the time the
fishway was being blasted out of the rock at the upper falls. Hence, the ascending
fish were easily observed. It is estimated that between 15 and 20 thousand reds
passed to the the spawning grounds of the lake situated about three miles from the
mouth of the stream (US Bureau of Fisheries 1932, 5).

In addition to the work that was being done at Mikfik, commercial fishers
blasted a fishway along Chenik Creek, which spills into Kamishak Bay five miles north of
McNeil Lagoon. According to the streamguard who was present at the time:

At Chenik Creek falls some blasting was done to improve the work
accomplished at this point during the year 1926. Much temporary work and
attention is yet required at these falls each year, in order to confine the flow of
water into a channel of sufficient depth for the fish to enter during the lower
stages of the tide. Also, to provide a suitable resting pool for the fish at the base
of the upper falls. Owing to the excessive heavy run of salmon at this stream this
year, great difficulty was experienced in preventing a serious loss of fish through
overcrowding in the resting pool (US Bureau of Fisheries 1932, 3).

Mainly because of rampant creek-robbing and poor fisheries management,
the Mikfik and Chenik sockeye runs nearly disappeared in the ensuing decades. Stories
still make the rounds in the seine fleet about how entire runs of salmon were wiped out
when renegade fishers strung their nets across stream mouths during the peak of the
salmon runs. Consequently, in 14 of the 23 years between 1959-1981 there was virtually
no commercial salmon fishery in the Mikfik system, and the average annual sockeye harvest during that period was just over a thousand fish (Bucher and Hammarstrom 1993, 110) (Appendix 4). By 1952, wild runs that had once numbered close to 150,000 sockeyes in Chenik Creek were so weak the fishery had to be shut down indefinitely, and by the mid-1970's the annual return to the system was fewer than 500 fish (Bucher and Hammarstrom 1993, 36). After nearly a century of overfishing, Kamishak Bay had turned into a biological desert.

In the early 1980's, the same sockeye runs that once stood on the brink of extinction suddenly and unexpectedly began returning to their natal streams in droves. After having been closed down because of inadequate escapement the year before, the seine fleet landed nearly 18,000 Mikfik-bound sockeyes in 1982, and another 35,000 fish made it past fisher's nets to spawn. By 1985, the Mikfik sockeye run had climbed to a record 87,000 fish. Similar trends were occurring in the Chenik system. In 1986, commercial fishers harvested 111,300 Chenik-bound sockeyes, a 1000% increase over the year before, and for the next five years the sockeye catch averaged 86,500 fish (Bucher and Hammarstrom 1993, 110).

Three factors contributed to the dramatic rebound in Kamishak's salmon stocks. First, salmon fisheries in the area were managed more conservatively than they had been in the past. Escapement goals were increased in an effort to boost production, and commercial fish biologists were spending a greater amount of time flying the rivers and streams to come up with more accurate assessments of spawning numbers. Secondly, because there were more boats fishing in the area, and more ADFG planes flying up and down the beaches, the era of creek-robbing that had decimated local salmon populations over the past fifty years had for the most part come to an end. Even more important than these changes, however, was the ambitious sockeye salmon enhancement program that had
been undertaken by ADFG's Fisheries Rehabilitation, Enhancement, and Development (FRED) Division (Wes Bucher, personal communication, 2 September 1992).

Beginning in 1978, nearly every stream and lake system in lower Cook Inlet that had enhancement potential was either being enhanced or under limnological and pre-stocking evaluations. In Kamishak Bay alone, sockeye enhancement projects were proceeding in Chenik, Kirchner, Bruin Bay, Ursus Cove, and the Paint River lakes (Bucher and Morrison 1991, 32). In 1986, the Cook Inlet Aquaculture Association chiselled a "pool and jump" fish ladder into the mouth of Chenik Creek and fertilized Chenik Lake to provide more food for sockeye smolts, and in 1988 they began stocking Chenik Lake with 2-3 million sockeye fry in an effort to bolster natural production (Bucher and Hammarstrom 1993, 128). By 1992, 80-85% of the total LCI sockeye harvest came from enhancement projects in Kamishak and Kachemak Bays, contributing close to $1 million to the otherwise-depressed lower Cook Inlet seine fishery (Bucher and Hammarstrom 1993, 32) (Appendix 5).

As the number of salmon returning to Mikfik and Chenik Creeks skyrocketed in the early 1980's, so too did the number of commercial fishers and brown bears who visited McNeil Cove in search of them. Prior to the 1982 season, only four boats made the journey across the Cook Inlet to fish the Mikfik sockeye run, but sockeye returns have since become strong enough to attract 15-20 boats to McNeil Cove in any given year (Wes Bucher, personal communication, 2 September 1992). Today, if a fisher can catch enough fish in Mikfik to pay for his expenses and maybe a new outboard for his skiff, it is considered to be a successful trip. With so many boats competing for what remains a marginal number of salmon, it is mainly a time to test out new boat engines and seines before the season shifts into high gear in Chenik in mid-July.

While the size of the seine fleet grew, the number of bears fishing along Mikfik Creek increased from what had been only 5 or 6 in the 1970's to as many as 20 a
decade later (Lew Pamplin, memorandum to Don Collinsworth, February 1988).

Consequently, the number of bear-watchers travelling to McNeil during June increased from zero to as many as 40 between 1982-87 (Sherwonit 1988, 1[E]). It was only a matter of time before conflict erupted between commercial fishers, bears, and bear-viewers. Rarely had one user group ever tolerated the presence of another when there were fish to be caught and money to be made.

The most serious clashes between commercial fishers and brown bears occurred within the confines of McNeil Lagoon (figure 2), where subadult and human-intolerant bears often fish for salmon and graze on protein-rich sedges at the same time commercial fishers are making sets in the lower reaches of Mikfik Creek. During the period 1982-88, some of the negative interactions that occurred between commercial fishers and bears within the sanctuary included: subadult and intolerant bears being displaced by noisy fishing boats, bears obtaining fish from unattended nets and jitneys, bears becoming entangled in nets, fishers shooting at aggressive bears, and even fishers feeding bears. In addition to these conflicts, sanctuary visitors repeatedly complained that McNeil's wilderness setting was being degraded by the sight of up to twenty boats anchored only a hundred yards from camp, the sounds of loud generators and engines operating at all hours of the night, and the daily presence of low-flying spotter planes buzzing up and down the coast. Commercial fishers were also accused of having all-night beach parties, hiking around McNeil Lagoon without permits, and dumping trash overboard. Sanctuary manager Larry Aumiller documented many of the conflicts that took place between commercial fishers, bears, and bear-viewers from 1982-1988:

1982 Field Season
This year with the early run of red salmon in Mikfik Creek added to the normal chum salmon fishing there were more boats fishing or anchored in McNeil Cove than I'd ever seen before. All of the problems of garbage, noise, fishermen wandering beaches and encountering bears, etc. was the worst I'd seen in my time
at the sanctuary. It may be worth while to consider making an official department request to the various fishing vessels that they not anchor at the sanctuary unless they absolutely need to for fishing purposes or bad weather. There were a number of vessels at various times during the 1982 season that anchored at McNeil while they were waiting for another area to open or because they wanted to bear watch (Aumiller 1982, 1).

1983 Field Season
The problems documented last year with the fishing fleet and their associated noise, garbage, and fisherman-bear interaction continued this year. McNeil River has apparently become a convenient place to anchor and wait for other fish openings even if the fishing activity at McNeil is not open or worth fishing. In 1976 there were 14 boat days as compared to 82 boat days last season and approximately that this year. I would recommend at the minimum having available a handout to give to fishermen upon their arrival informing them of the sanctuary's rules and philosophy (Aumiller 1983, 4).

1984 Field Season
This year the commercial fishing fleet was once again well represented at McNeil River. Ninety-nine boat days were chalked up over a 35 day period. After last year's meeting in Homer, I expected very few problems and this was the case with one exception, the June fisheries on Mikfik Creek. On 4 and 5 June, 3000 red salmon went up Mikfik Creek. As a result the area management biologist in Homer (Tom Schroeder) not only opened the fishery, but he allowed the boats to fish in any manner or means they wished as he did not want any more fish to escape. It is those methods that caused the problems. Initially 3-4 boats went as far up the creek as the tide would allow and made seine sets. Then one, and sometimes two boats stretched nets all the way across the creek, leaving them between tides. It was inevitable that bears would be attracted to those very accessible nets which were full of fish. The problem was compounded by a jinny from one of those boats that was left unattended, full of fish, on three successive tides. At least five different bears responded to this welfare program, three becoming very regular, and one later very demanding when fish were withheld. It was immediately obvious this was a problem and I called the commercial fish biologist in Homer (Tom Schroeder) to ask if there was another way to handle it. He simply said, 'I don't want one more fish up the creek, . . . I don't know about bear problems.'

The last three years have seen increasing problems with the fisheries on Mikfik, the vast majority of which involve fishing upstream from the existing markers. It's creating a situation that is each year more dangerous as the bears involved are mostly the same ones. . . . One fisherman carried a shotgun this year for the first time. I used cracker shells several times to keep bears off of boats or out of nets, and it is getting harder and harder to make those bears do what you wish. The main problem is the bears are the same ones we deal with on an eye-to-eye level every day for 5-6 weeks after the fishermen leave. Bad habits learned from any human tend to carry over (Aumiller 1984, 1-2).

1985 Field Season
In 1985 significant problems again occurred with the commercial fishery in June. An informal gentlemen's agreement, in effect in 1983 and 1984,
between the commercial fishermen and myself and a more formal 'gentlemen's agreement' reached last fall between the Game Division and Commercial Fisheries Division were ultimately disregarded by the fishermen when they impacted their devised method of catching fish. The problems that are occurring essentially involve allowing bears access to nets and boats full of dead or dying fish.

Starting on the high tide Friday, 6/14, the fishermen blocked the creek with normal seines. In the following 14 days, 14 separate violations of the 'gentlemen's agreement' occurred involving four boats; the Terry Lane, Mugwump, Shiloh, and Arctic Fox. These violations included letting jitneys and skiffs full of fish go dry, leaving a seine that was full of fish laying across the creek at low tide, and blocking the creek with a net at high tide.

I've spent the last ten summers working with these fishermen and I felt I had a good working relationship until this year. It had been friendly and they had generally been cooperative, at least they always had an acceptable excuse for any indiscretions. This year, it became painfully obvious that our working relationship was not near what I thought it was. Open aggression and hostility surfaced that left me shocked and bewildered. They apparently see me (and the sanctuary) as an undesirable hindrance to their right to make a living. Fishermen's attitudes have never been worse and the situation with the bears has steadily gotten worse since 1982. In my opinion, it is just a matter of time until a human or bear is hurt or killed with the situation as it is. At the very least, a bear having been caught in a net will have to be destroyed, a situation that almost occurred this year.

I would recommend that the fishermen are not allowed to fish in the lagoon. Anything less than simply not allowing fishing in the lagoon would I believe result in a system that the fishermen can find cracks in, and if history is a lesson, will exploit to their advantage.

Secondly, I believe the fishermen should be treated as all other visitors during their non-fishing activities. Examples of such activity by the fishermen this year included sport fishing in Mikfik, going up in a skiff to both Mikfik and McNeil to bear watch, cooking campfires on the beach, walking wherever and whenever they wanted to without an ADFG staffmember along, and at least two trips to a ground-nesting bald eagle—the last trip of which involved shooting at a bear to scare it away (Aumiller 1985, 1-3).

1986 Field Season

Attitudes among the fishermen vary greatly ranging from cooperation to the opposite extreme summed up by a quote from the skipper on the Terry Lane on 6/15—"I don't care what you tell me, I'm here to catch fish and I'd love to be the test case in court and we'll see how you bear-lovers fare."

There needs to be given to Game Division some regulatory power to deal with the few fishermen who refuse to cooperate. When the Commercial Fish Division representative is here he/she can threaten to close the fishery. Even the power to eject a particular boat from the sanctuary would suffice. There should be a rule saying that in all non-fishing related activity, fishermen must comply with all the regulations that any other visitor to the Sanctuary must comply with. In the past, fishermen have sighted guns in on the beach, walked up to and disturbed a ground-nesting bald eagle, allowed bears on boats (for pictures), and done a fair bit of spooking bears in various ways (Aumiller 1986, 3).
1988 Field Season

The usual violations of sanctuary rules occurred (dogs on the beach, cooking fires, garbage-dumping, etc.). A more serious violation occurred in late July when a boat went dry about 150 meters outside of the lagoon with approximately 2000 fish netted. Prior to our return from the Falls, the skipper shot at an approaching bear. When Larry (Aumiller) spoke with him, the skipper stated that he would kill any bear that came near his boat. Larry stayed with the boat and discouraged 3 bears until the tide came in and the boat would float. In addition to this incident there were three other occasions on which bears approached and/or contacted nets on boats that were dry in the Lagoon. These bears were discouraged by shouting fishermen.

Fishermen's attitudes toward the sanctuary seemed to be as poor or poorer than in the years past. Some possible causes might be the perceived loss of the McNeil Lake enhancement project and the restrictions on Mikfik Lagoon openings (Aumiller 1988, 6).

In response to the frequency and severity of the conflicts that were occurring between commercial fishers and bears, the ADFG Game and Commercial Fish Divisions got together and produced a set of management guidelines for the Mikfik sockeye fishery in 1986. The most significant changes that emerged from this plan included:

1. The lagoon would be opened to fishing only if necessary to harvest surplus fish.

2. Mikfik Creek could be blocked only if the 5,000 fish escapement goal was assured.

3. If it was necessary to block the creek, ADFG would provide and tend a single small mesh seine. No unnecessary human activity would occur around the net. If the net trapped too many fish and/or bears became entangled in the net, it would be removed.

4. Vessels should make their sets and remove fish from the creek area as quickly as possible.

5. Vessel operators would do everything possible to keep from going dry, being stranded, or being unable to get out of the creek when they have fish on board. If vessels with fish on board became stranded up the creek or on the flats, fishing times inside the regulatory markers would be regulated to minimize the possibility of stranded vessels. If vessels continued to become stranded, fishing inside the regulatory markers would be closed.

6. Fishers would have to abide by all the same regulations that were imposed upon sanctuary visitors while fishing in or otherwise using McNeil Lagoon. Examples of such regulations included prohibitions on sportfishing in restricted areas, feeding bears, approaching bears, letting pets loose on the
beach, dumping garbage, cooking over open fires on the beach, and discarding unwanted fish in the lagoon (Ken Florey, letter to Mikfik sockeye fishermen, 19 February 1986).

Although the new set of guidelines was far from popular with the seine fleet, it seemed to reduce the number of conflicts between commercial fishers and bears during the ensuing season. Unfortunately, the truce did not last. In September 1986, ADFG commercial fish biologist Tom Schroeder and two of his friends journeyed to McNeil River aboard the Bruin Bay to sport fish and go moose hunting, the latter of which is illegal in the sanctuary. In addition to violating the sanctuary’s no-hunting ordinance, the group was caught fishing in a closed area of the river without fishing licenses, and all had failed to obtain the necessary permits required to enter the sanctuary. When Larry Aumiller called Mr. Schroeder on these infractions, he pleaded ignorance with regard to fishing in the closed area and claimed he was given permission to moose hunt in the sanctuary by ADFG biologist Dave Holdermann, when in fact he was not (Greg Bos, memorandum to John Hilsinger, 31 October 1986). In an internal memo sent to Schroeder’s supervisor by Game Management Coordinator Greg Bos, Bos wrote:

Tom Schroeder is well liked by his "constituency" and he has a strong influence on their behavior. It concerns me then when I hear reports made in public by Tom both in Homer and, during the fishery, on the air disparaging the sanctuary program. Apparently, fish and the good will of fishermen are all that count for Tom; he has little use for bears (Greg Bos, memorandum to John Hilsinger, 31 October 1986).

Mr. Schroeder’s actions sent a clear message to ADFG’s Game Division: McNeil Cove belonged to commercial fishers, bears be damned.

In the spring of 1987, two highly controversial incidents took place during the Mikfik sockeye fishery. In the first, a jitney fishing in McNeil Lagoon spooked a bear that was fishing along Mikfik Creek, causing it to bolt right through a group of bear-watchers (Sherwonit 1988, 1[E]). Luckily the bear was an adolescent and not a sow with
cubs, and no one was injured. The second incident involved a controversial lagoon opening authorized by Tom Schroeder. In short, Mr. Schroeder's directive violated every tenant of an earlier agreement between ADFG's Game and Commercial Fish Divisions. The agreement clearly stated that Mc Neil Lagoon would not be open to fishing unless: 1) a biologist was on hand to monitor the situation; 2) an aerial survey had been conducted to determine numbers of fish, and 3) there was already a build-up of 1000 fish in the stream. The upshot of this episode was that the seine fleet voted to boycott the opening, feeling that the biologist was not acting in the best long-term interest of the fishery (Tom Walker, letter to Don Collinsworth, 1 August 1987).

As a result of these incidents and others, the 1986 Mikfik management guidelines were replaced in 1988 with the more restrictive Mikfik Creek-McNeil Lagoon Fishery Management Plan. This plan did two major things to change the Mikfik sockeye fishery. First, it mandated an increased escapement goal of 5,000-7,000 salmon in order to provide bears with salmon throughout the course of the sockeye run, and secondly, it restricted the times when commercial fishers could fish in McNeil Cove. Whereas previously commercial fishers could make sets outside the lagoon whenever they wanted, the new management plan limited them to two 48-hour periods per week beginning on June 1. Additionally, the lagoon would be opened only after escapement goals were met and a visual survey confirmed at least 500 fish, and they would take place over a 2-hour period surrounding high tide to ensure that no boats would go dry. The 1988 Management Plan also required that seines be fished from boats and not from the beach, and that fishers remain in their boats as much as possible while fishing (Lew Pamplin, memorandum to Don Collinsworth, 18 March 1988).

Predictably, members of the seine fleet were angry as a result of the new rules and regulations that further limited their opportunities to catch fish. Perhaps the most disturbing change presented to them in the 1988 Mikfik Creek-McNeil Lagoon
Fishery Management Plan was the mandated increase in escapement goals to provide bears with more salmon. In their opinion, escapement goals should not have been increased unless there was a noticeable shortage of bears in the sanctuary. A shortage would mean there were less than 45 adult bears visiting the McNeil River Falls, as defined by the 1981 McNeil River Brown Bear Management Plan. Fishers felt that purposely increasing the number of bears along Mikfik Creek would only increase the chances for conflict in the future (Cook Inlet Seiners Association 1988).

At about the same time the new management plan governing their activities in Mikfik was announced, commercial fishers were also upset over an ADFG decision to reject sockeye salmon enhancement plans on the McNeil River. In 1985, area commercial fish biologist Tom Schroeder recommended enhancing the McNeil River with an early run of sockeyes to "mitigate" losses of commercial fishing opportunities in Mikfik and to boost the overall number of salmon that could be harvested in Lower Cook Inlet. He predicted that enhancement work in the McNeil would yield a run of 40,000-80,000 fish, thus increasing the value of the lower Cook Inlet sockeye salmon fishery by up to 20 percent. Both commercial fishers and ADFG commercial fish biologists argued the sockeyes would attract more bears to the sanctuary and feed them in the event of a chum run failure (Sinnott 1992, 3).

Ultimately, the McNeil River sockeye enhancement plan was rejected by ADFG Commissioner Don Collinsworth in 1988 for a wide range of reasons. His primary concern was that since the sockeyes would have to spawn in McNeil Lake, bears would be drawn away from the viewing area at the McNeil River Falls and into other fishing spots along the river where they could not be observed and photographed. Also, the wilderness experience at the sanctuary would have been further compromised by the presence of a significantly larger seine fleet fishing in McNeil Cove and anchoring in McNeil Lagoon. From a fisheries management perspective, it would have been extremely difficult to
harvest McNeil sockeyes without also overfishing the chum run, and there was the remote but real possibility that hatchery-bred sockeyes could transmit diseases to and compete for habitat with the wild chums that were already there. In the event that the introduced sockeyes outcompeted and replaced the resident chum salmon population, the long-term health of the resulting sockeye run would then be dependent upon the stocking budget of ADFG, the success of hatchery production and other demands on the hatchery fry, the survival of sockeyes to maturity, and the success of commercial fishers. In short, it was a very risky proposition to begin with (Don Collinsworth, memorandum to Brian Allee, Lew Pamplin, and Ken Parker, 13 April 1988).

Just as the worst of the conflicts between commercial fishers and brown bears in Mikfik were beginning to abate in 1988, new ones were arising to the north in Chenik Lagoon and along Amakdedori Beach. As a result of the extremely successful enhancement program that began producing strong sockeye runs destined for Chenik Creek in 1986, 5-10 bears started fishing at the mouth of the creek and a fleet of about 20 fishing boats began targeting the coastline from Chenik Head north to Amakdedori Beach. Ironically, one of the most popular places for fishers to make their sets also happens to be directly in front of a wilderness lodge that plays host to visitors who come there mainly to photograph bears. While fishing on the Kay Suzanne in July of 1991, we made several sets within 20 yards of the lodge, and often fished for sockeyes at the mouth of Chenik Creek when bears and bear-viewers were present.

Most of the conflicts evident in Chenik are similar to the ones that have occurred within the sanctuary: fishing boats going dry, bears obtaining fish from unattended nets and jitneys, bears charging commercial fishers, and bears being displaced from the mouth of Chenik Creek by fishing boats and low-flying spotter planes. In one potentially tragic incident that took place in July 1987, an employee of the Chenik Wilderness Photography camp was charged by a bear when he attempted to scare it away
from an abandoned jitney smelling of fish (Kirk Johnson, letter to Ken Parker, 19 February 1988). In the month I fished there, commercial fishers were observed feeding salmon to bears along Amakdedori Beach, crowding the mouth of Chenik Creek to photograph bears and bald eagles, dumping trash (including plastics and bilge oil) overboard, and shooting seals in Chenik Lagoon and seabirds on Nordyke Island. Twice during that month the crew of the *Kay Suzanne* created the potential for conflict between humans and bears. One time we intentionally went dry near Chenik Lagoon to repair the jet on our boat (plate 7), and later we made a set during a lagoon opening as the tide was running out. By the time we had gotten off our boat and plunged* all of the fish we could into our seine, the reef we had set on went dry and we were forced to pick all the salmon from our net by hand. We caught nearly 1000 fish in that one set, and were "high boat" for the day.

The conflicts that were occurring between commercial fishers and bears eventually got so bad in Chenik that ADFG Game Division Director Lew Pamplin wrote the following in a memorandum to ADFG Commissioner Don Collinsonworth:

> The potential for serious conflicts has intensified greatly in recent years due primarily to some boats going dry in Chenik Lagoon with salmon in nets on board. Unless fishermen truly understand and take preventative actions consistently to reduce conflicts, it is just a matter of time until someone is going to get hurt or killed and/or we start eliminating problem bears (Lew Pamplin, memorandum to Don Collinsonworth, 22 February 1988, 5).

In an attempt to minimize the negative interactions that were occurring between commercial fishers, bears, and bear-viewers during the Chenik fishery, members of the Cook Inlet Siners Association met with the owners of the Chenik Wilderness Camp

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* Plunging refers to the action of "popping" the water with long aluminum poles in order to scare salmon into a seine.
in April 1992 and came up with a set of voluntary guidelines modelled after the McNeil Lagoon-Mikfik Creek Management Plan:

1) Avoid going dry in Chenik Lagoon while fishing. If not possible, remove all fish from nets. ADFG will try to schedule openings following long closures on incoming tides.

2) Do not leave unattended vessels in the Chenik Lagoon. If absolutely necessary, please clean your vessel completely, disinfecting the hold and removing all fish from nets.

3) Minimize spotter activity over the lagoon and the lodge in the consideration of lodge guests.

4) Minimize negative impacts to bears in creek mouth. This is the viewing area utilized by lodge guests. Consideration of guests' viewing experience is requested.

5) Stay out of fresh water. Plunge fish only below the level of tide (in saltwater).

6) Recreational hiking around the creek mouth and stream is not advised, due to possible negative bear/human interaction (CISA Board of Directors, letter to CISA members, 10 April 1992).

As things turned out, the number of bear-fisher conflicts fell sharply the following season because few boats fished in Chenik that July. An outbreak of infectious hematopoietic necrosis (IHN) had spread among juvenile salmon that were earlier stocked in Chenik Lake, and only 12% of the pre-season projection, or about 14,400 fish, were harvested there (Bucher and Hammarstrom 1993, 37). If that wasn't bad enough news for commercial fishers, both Mikfik Creek and the McNeil River were closed to commercial fishing for most of the summer due to run failures, and the enhanced sockeye and pink salmon runs that were predicted to return to Kachemak Bay in record numbers never materialized. With the exception of an enhanced run of 40,000 reds that returned to Kirschner Falls later that summer, the 1992 lower Cook Inlet salmon fishery turned out to be a complete bust.
In the ten years that had elapsed since Nerka started coming back to Kamishak Bay in their former numbers, increasing numbers of commercial salmon fishers, bears, and bear-viewers had descended upon the region's rivers and streams, setting the stage for a series of conflicts that would ultimately turn fishers and bear advocates into bitter enemies. The bottom line was that by 1992 commercial fishers no longer had free reign in Kamishak Bay as they once did. Instead, they were forced to make a series of concessions to bear advocates just in order to retain the privilege of fishing there. The growing wildlife-viewing programs at McNeil and Chenik were bringing ADFG and the State of Alaska a lot of good publicity that began to translate into popular support and political clout. Before anyone in the seine fleet knew what was happening, their traditional fishing grounds had become more valuable as a bear-watching area than as a commercial salmon fishery.
Following the 1988 season, when the seine fleet brought in a record catch worth $8.8 million (Bucher and Hammarstrom 1993, 98), the lower Cook Inlet salmon fishery crashed due to widespread run failures and a collapse in fish prices (Appendices 7-10). The run failures from 1989-92 were unique in that they were universal in scope: Every species of salmon was affected in every part of the fishery, indicating that the decline was probably caused by different factors in different areas (Wes Bucher, personal communication, 2 September 1992). In some areas of the Kamishak Bay district, such as Mikfik and Chenik Creeks, sockeye returns plummeted by 50-75% following the 1988 season, and wild chum returns throughout western Cook Inlet fell by more than 95% (Bucher and Hammarstrom 1993, 101-110). The Tutka Bay pink salmon run, which since 1976 had been lower Cook Inlet's most productive and reliable fishery, declined by 95% between 1988-90 and still shows no signs of recovery (Bucher and Hammarstrom 1993, 116). Had it not been for the aggressive sockeye salmon enhancement programs that had been undertaken in Kamishak and Kachemak Bays, there would have been virtually no harvestable surplus of fish in the lower Cook Inlet salmon fishery during this period.

Salmon numbers likely declined due to a combination of factors: severe flooding and ice-scouring in spawning streams, cold springs, poor ocean feeding
conditions, increased predation by tomcod and pollock near hatchery release sites, accelerated clearcut logging along salmon-bearing streams, and interception by high-seas driftnetters and shore-based fisheries along the Alaskan coast (Wes Bucher, personal communication, 2 September 1992). Still, most commercial fishers blame the 1989 Exxon Valdez oil spill in Prince William Sound for having the greatest impacts. Despite the fact that the spill occurred approximately 300 miles east of lower Cook Inlet, the outer coast of the Kenai Peninsula (which comprises the outer and eastern districts of the fishery) was heavily oiled within a few weeks of the spill, and portions of the Alaska Peninsula 100 miles further to the west were inundated shortly thereafter. Katmai NPP superintendent Ray Bane described the scene on the Katmai coast just to the south of Kamishak Bay in Art Davidson's book, In the Wake of the Exxon Valdez:

It was like losing a friend, like watching a friend die. We saw bear sows with their cubs walking in the oil. The beaches were greasy brown. When the angle of the sun was right, the beaches glistened as if the whole coast had been freshly laquered. In places there was so much oil in the surf that it changed the hydraulics of the waves. Instead of splashing onto the sand, the waves had this leaden quality. They fell with a thud.

Hallo Bay is where it really struck home. We could see the sun hitting this sandy beach. White sand runs for 6 miles. It was one of the most beautiful beaches anywhere—glaciers in the background, escarpments of mountains. But now we could see the entire beach shimmering with oil. Mats of oil stretched as far as we could see, lying in rows where they'd washed up with the tides, one row higher than the next, row after row. And mixed into the matted oil were these little bumps. When we got close, we realized that they were birds (Davidson 1990, 270).

Although fish biologists are hesitant to place total blame on Exxon for the sudden decline in salmon numbers (former area biologist Tom Schroeder quit his job with ADFG for a higher paying position with Exxon immediately following the spill), most agree the oil spill played a contributing role (Wes Bucher, personal communication, 2 September 1992). The two fisheries that were hardest hit by oil slicks, Prince William Sound and
lower Cook Inlet, are also the only major salmon fisheries in Alaska that have suffered from widespread run failures since 1989.

According to ADFG biologist Frank Rue, "Oil toxicity lowers organisms' resistance to disease, reduces reproductive success, inhibits normal growth and development, and interrupts normal biochemical processes and behavioral patterns (Davidson 1990, 179)." Salmon fry and eggs are particularly sensitive to oil pollution. Oil-contaminated water in concentrations as little as 3 parts per million have been known to prevent migration of juvenile salmonids. Due to the March 24 timing of the Valdez spill, both the fry that were released from hatcheries and the adult salmon that were returning to spawn were exposed to large amounts of floating oil from western Prince William Sound to Kodiak Island. Additionally, since outgoing smolt are largely dependent upon healthy plankton populations during their initial weeks in the ocean, any plankton die-offs that were caused by oil pollution would have subsequently killed vast numbers of juvenile salmon.

Even before the Valdez spilled 11 million gallons of toxic North Slope crude into Prince William Sound and the Gulf of Alaska, Cook Inlet fishers were still reeling from the effects of the 125,000-gallon Glacier Bay spill in 1987, and an oil slick from an unknown source that fouled fishing grounds in 1988 (Keeble 1991, 240). Each time an oil spill occurred, either all or part of the fishery was closed down, resulting in devastating financial losses for the majority of fishers who have to make annual boat and permit payments frequently in excess of $20,000. Contrary to popular myth, all commercial salmon fishers in Alaska are not rich, especially those that make their living in lower Cook Inlet. Fishing incomes vary wildly from one fishery to the next, and are dependent upon a number of complex factors including: run sizes, number of permits allocated for the area, species of fish, length of season, gear-type fished, run timing, market competition, quality of fish, and the nature of the stock (wild or hatchery-bred).
Due to these factors, the average fisher in Chignik or False Pass (both lucrative sockeye fisheries on the Alaska Peninsula) may earn upwards of $200,000 a year, while a lower Cook Inlet seiner typically nets about one-tenth that amount. Following three consecutive years of closures, run failures, and poor fish prices, a large portion of the seine fleet either went broke and sold out of the fishery or simply didn't fish because they couldn't afford to. Those fishers that remained pinned their hopes on the Paint River project.

Biologists from ADFG's commercial fish division have looked to the Paint River system as a potential salmon enhancement site since 1963 (Tom Walker, personal communication, July 1992). The Paint River is the first major drainage north of the McNeil River and spills into Akjemguiga Cove 3 miles from the McNeil River Falls. Encompassing approximately 200 square miles, the Paint River watershed is the largest freshwater system in lower Cook Inlet that is barren of anadromous fish runs (US Army Corps of Engineers 1992, 2) (figure 4). The only native fish residing in the system are arctic grayling (*Thymallus arcticus*), round whitefish (*Prosopium cylindraceum*), lake trout (*Salvelinus namaycush*), rainbow trout (*Oncorhynchus gairdneri*), and Dolly Varden trout (*Salvelinus malma*), all of which occur in small populations (Quimby and Dudiak 1984). Currently, salmon are unable to access the mainstem river due to a 37-foot vertical waterfall where the river enters tidewater in Akjemguiga Cove (plate 9). A 15-foot falls located at the outlet of Lower Paint Lake serves as a second migrational barrier to lake-spawning fish. It is believed that the Paint River system has been devoid of anadromous fish since at least prehistoric times, when a geological event likely created the impassable falls. Due to the absence of salmon, the Paint River is not utilized by brown bears except as a travel corridor to move from one food source to another.

Preliminary feasibility studies by Quimby and Dudiak (1985) concluded the Paint River and its tributaries would provide at least 25 miles of prime spawning gravels for pink and chum salmon, as well as over 400 acres of lake habitat that could be
Figure 4. Paint River watershed, with mainstem and Lake Fork Falls identified.
used by sockeye salmon for rearing and spawning. Former area fish biologist Tom Schroeder estimated that the spawning and rearing habitat throughout the Paint River system could ultimately support upwards of 225,000 sockeye, 600,000 chum, 900,000 pink, and 7,500 each of coho and chinook salmon, effectively doubling the size of the lower Cook Inlet salmon fishery and creating unlimited sport fishing opportunities (ADFG 1990, 11). Once the Paint River and a host of other sockeye enhancement projects came on line, Schroeder told commercial fishers in the late 1980's, the lower Cook Inlet salmon fishery would be well on its way to becoming another Chignik (Wes Bucher, personal communication, 2 September 1992). He was so optimistic, in fact, that he told fishers the state would probably have to issue another 25-30 limited entry permits for the fishery.

Sold on the idea of a river of hope, commercial fishers borrowed hundreds of thousands of dollars in order to buy new boats (a new seine vessel, jitney, and skiff costs an average of $370,000), and the price of limited entry permits quadrupled from $50,000 to nearly $200,000. Dave Blossom, for whom I had been fishing, went nearly a quarter of a million dollars in debt in anticipation of the Paint River salmon enhancement project.

In 1988, the Cook Inlet Aquaculture Association (CIAA), a non-profit organization of commercial fishers seeking to protect and enhance regional salmon stocks, announced their intention to build a $2.8 million vertical-slot fish ladder that would allow runs of more than 1.7 million migrating salmon to return to the Paint River system by the year 2002. The entire enhancement project, which would consist of building two fish ladders (around the mainstem and Lake Fork falls), stocking the Paint River system with three species of salmon (sockeye, chum, and pink) for a period of up to five years, and fertilizing the Paint River Lakes to stimulate zooplankton production, would end up costing an estimated $4,227,397 and was projected to contribute $4 million a year to the struggling lower Cook Inlet seine fleet (ADFG and CIAA 1985, i). If everything goes as planned, the Paint River salmon fishery is predicted to generate $220 million (US Army
Corps of Engineers 1992, 11) for the State of Alaska over a 30-year period and provide 267 new fishing-related jobs (Tom Walker, fax to Steve Meyers, 27 January 1992). Funding for the mainstem fish ladder project came from a $1 million grant from the US Department of Commerce, Economic Development Administration (EDA); $1.6 million in legislative grants from the state of Alaska; and $235,000 from CIAA-sponsored cost-recovery harvests* (Cook Inlet Aquaculture Association 1991, 17).

Although it would have been considerably cheaper to simply blast and regrade the Paint River falls, thus eliminating the danger of killing outgoing smolts, CIAA settled on a fish ladder designed to prevent bears from fishing at the falls and getting into conflicts with fishers. To build the ladder, an existing rock crevice adjacent to the falls would have to be enlarged, then a series of switchbacks composed of ascending resting pools would be installed to allow salmon to climb the river (plates 11-12). A similar fish ladder was built around a falls near Frazer Lake on Kodiak Island in 1962, resulting in a successful introduction of 400,000 sockeye salmon to a previously-barren watershed (Blackett 1987, 72). Plans called for the entire 420-foot length of the ladder to be enclosed by steel grating in order to keep bears away from salmon and to prevent them from falling into the structure and becoming trapped. Additionally, the entire 4.68-acre construction site would be fenced off to keep bears out, the food storage area at the camp would be bear-proofed, facilities would be provided for daily incineration of garbage, and construction workers would be required to attend an ADFG-run bear school (Alaska Contractor 1992, 6).

In accordance with the 55-year land lease between CIAA and the Alaska Department of Natural Resources, CIAA would cooperate with the Alaska Department of Fish and Game to develop a management plan for the Paint River project that would

* In a cost-recovery harvest, salmon are caught by a collective of commercial fishers in a special harvest area. The proceeds from the catch are used to pay off enhancement project expenses.
address; 1) anticipated levels of salmon production; 2) potential conflicts between commercial fishers and bears in Akjemguiga Cove; and 3) potential conflicts between bears and recreational users throughout the Paint River watershed. The plan would also propose mitigative measures to offset any adverse effects that might result from human-bear interactions. The lease further stated that, "In the event that unacceptable levels of bear/human conflicts occur," and they cannot be resolved by either management or mitigation, the lease could be terminated (Alaska Department of Natural Resources 1991, Attachment A).

Even if the Paint River fish ladder works as envisioned, some fish biologists worry that the nature of the riverine ecosystem might prohibit the long-term viability of salmon runs there (Wes Bucher, personal communication, 2 September 1992). For one thing, the Paint River Lakes and Elusivak Lake might be unable to support a large sockeye population due to their high elevations and glacial origins. Limnological studies have demonstrated that the Paint River lakes are not very productive compared to most salmon-bearing lakes in Alaska (including nearby Chenik Lake) based upon their conductivity, total alkalinity, and plankton populations (Quimby and Dudiak 1985). At the very least, they would have to be fertilized in order to provide enough food for juvenile sockeyes, who typically spend their first year feeding in the lake in which they were born. Despite the seemingly unfavorable feeding conditions that exist in the Paint River system, it is believed that they closely resemble conditions that exist in other nearby streams (McNeil, Mikfik, and Bruin Bay) that have occasionally been known to support large salmon runs.

Some biologists also remain unconvinced that outmigrating salmon smolts can survive the trip over the Paint River Falls on their way out to the ocean (Wes Bucher, personal communication, 2 September 1992). From 1980-83, ADFG commercial fish biologists conducted a series of experiments to determine if stocked pink salmon fry
would survive the trip over the falls and imprint on the Paint River. As a result of this research, biologists discovered that only 0.0-0.9 percent of the fry returned to the Paint River as adults; below the 1.0 percent threshold that is considered to be acceptable for direct hatchery releases (Quimby and Dudiak 1985). Because any fish going over the falls are forced into a 50-foot deep plunge pool, it is believed many embolize (i.e. their air bladders burst) as they are rapidly brought back to the surface. Due to the fact that outmigrating sockeye smolt appear to have survived a 40-foot falls where Kirschner Lake drains into Kamishak Bay further to the north, ADFG fish biologists believe that improper transport and fish stocking methods may have made a significant contribution to the high mortality figures of pink salmon (Wes Bucher, personal communication, 2 September 1992).

Beginning in 1986, the Alaska Department of Fish and Game, in conjunction with CIAA, has annually stocked the Paint River Lakes system with 800,000-2,000,000 Tustemena Lake sockeye fry in order to determine if a sockeye enhancement program would be successful there, but as of 1992 only about 300 returning adults out of an expected 5,000 were observed at the entrance of the fish ladder (Bucher and Hammarstrom 1993, 40). Area commercial fish biologist Wes Bucher attributes this small-scale run failure to interception by either the upper Cook Inlet gillnet fleet or seiners targetting the Chenik and Kirschner Lake runs. It is possible, however, that the sockeye smolt either did not survive the trip over the falls, or they perished during their first winter in the lakes. Since there have never been any tagging studies that could provide answers, no one knows for sure whether sockeye salmon can survive in the Paint River system without modifying the ladder to allow outmigrating fish to bypass the falls.

Nonetheless, in August 1988 the US Army Corps of Engineers (COE) granted CIAA the fish ladder construction permits required under section 404 (b) of the federal Clean Water Act (33 USC 1344) and section 10 of the Rivers and Harbors Act (33
In compliance with the National Environmental Policy Act (NEPA), both the Corps and the EDA (which provided federal money for the project) conducted environmental assessments (EA's) to determine if the fish ladder project constituted a major federal action that would have significant adverse impacts on the area's resident fish and wildlife populations. Although the Corps acknowledged that the creation of a new salmon fishery 20 times larger than the one that exists in the McNeil Cove would inevitably draw bears out of the sanctuary and onto unprotected lands, they concluded that the ladder and future salmon fishery would not affect bears adversely enough to merit a full-fledged environmental impact statement (US Army Corps of Engineers 1992, 53).

In their finding of no significant impact (FONSI), the Corps explained: "Given the lack of information with which to make an estimate, it appears there is only one way to determine the actual number of bears that would leave McNeil and the effect their departure would have on the McNeil viewing experience. The only way to accurately make such a determination is to allow salmon to enter the Paint River system (US Army Corps of Engineers 1992, 54)." To a certain extent, the Corps was justified in saying there was no way of predicting how many bears would shift to the Paint River. Because the McNeil Sanctuary is managed primarily for the purpose of bear-viewing and photography, ADFG prohibits biologists from tagging or radio-collaring bears since that would make them unsightly. Without good baseline data, any predictions on bear redistribution would be purely speculative. Nevertheless, the Corps' opinion appeared to be in clear violation of NEPA on at least two counts. First, NEPA states that any potentially destructive action should be evaluated prior to the action being taken, not after irreparable damages have been inflicted. Secondly, the Code of Federal Regulations (40 CFR 1508.27) states that an action is significant if any one of the following conditions is present:

1) The action takes place in an area close to Park lands or ecologically critical areas;
2) The effects of the action are highly controversial;
3) The effects of the action are highly uncertain or involve unique or unknown risks; or
4) The action establishes a precedent for future actions with significant effects.

In its environmental assessment, the EDA noted the Paint River fish ladder project's proximity to the McNeil River Sanctuary and Katmai NPP, and conceded, "the introduction of anadromous salmon in the Paint River system will likely alter the migration and hunting patterns of individual Alaskan brown and grizzly bears," but without any scientific analysis or in-depth discussion concluded, "no unique or unusual environmental conditions exist which would be adversely affected by the project." Both the EDA and the COE failed to: 1) address concerns that the McNeil bear-viewing program could be adversely affected; 2) propose any mitigative measures that could offset such impacts; or 3) offer a reasonable range of alternatives to the proposed project. In light of such a cursory environmental review, it was surprising that no one from either ADFG, the National Park Service, US Fish and Wildlife Service, National Marine Fisheries Service, Environmental Protection Agency, or environmental community raised any objections to the project when they were first made aware of it in 1988. Either the fish ladder project wasn't taken seriously until it was too late, no one realized where the Paint River was relative to McNeil and Katmai, or CIAA simply failed to notify those groups and agencies who might attempt to block the project. Most likely, the lack of input was due to a combination of the three.

Confident that they had complied with all federal and state laws, and with permits in hand, CIAA began construction on the Paint River fish ladder on June 1, 1991 with a finishing date set for October. In the meantime, a grassroots organization of brown bear advocates and professional wildlife photographers calling themselves the Friends of McNeil River (FOMR) had formed in response to a barrage of policy initiatives and proposed development projects that were threatening the McNeil River ecosystem's brown
bears. Initially, FOMR was most concerned by the state's policy that allowed human-habituated brown bears to be trophy-hunted just outside sanctuary, as well as recent proposals to develop adjacent state lands for mineral extraction and recreational use. According to founding member Tony Dawson, it wasn't until ADFG conducted a public meeting in December of 1990 that FOMR first heard about the Paint River project. At the time, ADFG described the ladder as being a done deal (Tony Dawson, personal communication, 9 September 1992).

Four months later, on April 16, 1991, the Alaska Chapter of the Sierra Club, the Wilderness Society, the National Wildlife Federation, and the Alaska Wildlife Alliance joined FOMR in filing a lawsuit against the COE and the EDA, claiming the Paint River fish ladder constituted a major federal action that would result in adverse impacts to brown bears and other wildlife, and it was permitted without adequate public notice. They also charged the Corps and EDA with preparing grossly inadequate environmental assessments, noting that "an unbiased EA can only be completed if the physical site is considered to be in its natural state," which would be impossible if construction of the fish ladder were allowed to proceed (Tony Dawson, letter to Steve Meyers, 28 August 1991). The lawsuit marked the first time ever environmentalists had challenged a salmon enhancement project that was backed by the state's powerful commercial fishing industry (Medred 1991, 6[B]).

In their complaint for declaratory and injunctive relief, the plaintiffs stated:

This action pertains to the construction of a fish ladder and introduction of an enormous salmon run adjacent to the McNeil River State Game Sanctuary and its potential to substantially degrade the brown bear viewing and photographic opportunities which currently exist at McNeil. Several plaintiffs are professional photographers who derive a portion of their income from the sale of photographs taken at McNeil and who will economically be affected by degradation of photographic opportunities at McNeil. In particular, this project threatens to adversely impact plaintiffs' ability to safely observe, and photograph brown bears at close range if it proceeds without
identification, and mitigation, of the currently unaddressed potential impacts on the area as required by NEPA (Friends of McNeil River et al. v. US Army Corps of Engineers et al. 1991).

The plaintiffs listed the following potential impacts that the fish ladder project would have on both the behavior and concentration of McNeil's bears:

1) Lowering the concentration of bears at McNeil as they move out of the McNeil drainage to the newly created massive food source;

2) Degradation of the McNeil bears' people-neutral behavior through adverse behavior modification from increased human activity by commercial fishers fishing in the area of Paint River, and a resulting decline of opportunities to safely view and photograph bears in close quarters;

3) Degradation of the McNeil bears' people-neutral behavior through adverse behavior modification due to projected increased human activity by recreational users of the Paint River, and a resulting decline of recreational opportunities to safely view and photograph the bears in close quarters, and;

4) A decrease in human safety at McNeil due to an increase of unsupervised activity in the area.

"The number of fish escaping to spawn on the Paint will be 20 times the number which run at McNeil," said FOMR's Tony Dawson, "and there are more fishing sites on the Paint. Once the Paint River starts, the days of being able to sweep your eyes up and down McNeil River and see 65 bears will be over. It will be a bear magnet. It will suck bears out of McNeil River like a vacuum cleaner (Medred 1991, 6[B])."

Lower Cook Inlet seiners, who had frequently allied themselves with environmentalists since the two groups joined forces and blocked a proposed oil lease sale in Kachemak Bay in the early 1970's, reacted to the lawsuit with outrage and a sense of betrayal. Noting that nowhere in the lawsuit did the plaintiffs express a concern that bear populations would actually decline as a result of the fish ladder, CISA President Phil Brudie said, "If these guys (FOMR) had any real concern for the bears rather than their pocketbooks, they'd be embracing this project. This will add to the bears' habitat. It will
provide more food and area. We see no detrimental effects at all, unless you are a wildlife photographer (Loshbaugh, April 1991, 32)." "We've bent over backwards to mitigate problems with bears," claimed fisher Ken Castner, referring not only to the Paint River project, but also to the concessions that fishers had made to bears in the Mikfik and Chenik fisheries. "I keep hearing the word 'greedy.' Well, I couldn't even afford to fish this summer. I'd trade salaries with any one of those people who spent their four or five days at McNeil (Hulen 1991a, 10[A])." CIAA Executive Director Tom Mears denied the fish ladder project would have any adverse effects on wildlife, suggesting instead that sport fishers posed a greater threat to bears. "The groups are trying to seize the fish ladder project as a red-herring to promote the expansion of the McNeil sanctuary," said Mears. "It's not really the ladder, and it's not really the fish that threaten the bears, it's the sport fishers who might show up and shoot a bear in defense of life and property (Peninsula Clarion 1991, 6)."

On May 14, 1991, approximately one month after the preliminary injunction was filed, US District Court Judge Andrew J. Kleinfeld denied the plaintiff's motion, ruling that they had filed their affidavits too late, and had failed to prove that the ladder would cause immediate harm to bears or other wildlife (Anchorage Daily News 1991, 4[B]). In the court's opinion, the mere presence of the fish ladder would not have any significant impacts on the area's brown bears unless it was subsequently declared operational and salmon were allowed to colonize the Paint River system. Judge Kleinfeld did emphasize, however, that, "Based on the evidence submitted, there is no demonstration that the agencies have taken a hard look at the fish ladder's environmental consequences. There is no mention at all of McNeil's bears. Without the appropriate analysis and discussion, the EA appears insufficient (Sherwonit 1991b, 6[F])." Encouraged by the judge's comments, the plaintiffs appealed the decision to the US 9th Circuit Court of
Appeals seeking an emergency injunction to stop construction of the fish ladder, which was by this time well under way.

Meanwhile, in an attempt to strike a compromise that would accommodate commercial fishers and protect brown bears moving to the Paint River, Alaska State Representative Ben Grussendorf (D-Sitka) introduced House Bill 306 in May 1991 and it was signed into law a month later. In addition to expanding the existing McNeil River Sanctuary by over 29,000 acres to include the lower reaches of the Paint River where most salmon are expected to spawn, HB 306 created a new 131,840-acre refuge encompassing all of the remaining lands within the Paint River watershed, the Chenik Lake drainage, and previously unprotected tideland feeding habitat (figure 5). The stated purposes of the new McNeil River State Game Refuge (MRSGR) are to:

1) Provide permanent protection for brown bear and other fish and wildlife populations and their habitats, so that these resources may be preserved for scientific, aesthetic, and educational purposes;

2) Manage human use and activities in a way that is compatible with the purposes stated above, and to maintain and enhance the unique bear viewing opportunities within the sanctuary; and

3) Provide opportunities that are compatible with the above purposes for wildlife viewing, fisheries enhancement, and fishing, for temporary safe anchorage, and for other activities (Alaska Legislature 1991, 2-3).

Due to a controversial blackmail clause that was engineered by fishing interests while the bill was still in committee, enactment of HB 306 would only occur once the Paint River fish ladder was completed and officially declared operational. In other words, if there are no salmon runs in the Paint River, there will be no protection or added lands for bears.

At one point during the drafting of HB 306, mining industry lobbyists had asked that mineral extraction be listed as one of the primary purposes of the refuge, but that idea was rejected when legislators concluded that such a provision could make it
Figure 5. Land designations in the McNeil-Paint River Ecosystem following passage of HB 306. Sanctuary additions include lower stretches of the Paint River and land surrounding the mouths of the Kamishak and Little Kamishak Rivers.
difficult for the state to regulate any mines that might be developed in the future.

Instead, HB 306 legislatively closes all new mineral entry on new and existing sanctuary lands (Prior to passage, the McNeil River Falls could have been legally staked as a mineral claim), and orders the ADNR to close by administrative action all refuge lands to mineral entry, except those areas which have already been staked. Both Cominco Alaska, Inc. and the American Copper and Nickel Company currently have gold and copper claims staked in the Paint River uplands approximately 15 miles from McNeil River Falls (McNeil River Advisory Group 1992b, 5).

Had it not been for a highly controversial pro-hunting clause, HB 306 might have provided enough safeguards for bears to persuade the plaintiffs in the lawsuit to drop their case against the Corps and EDA. Although HB 306 legislatively prohibits all hunting in the McNeil River Sanctuary (prior to passage, bear hunting in the sanctuary was closed by the Alaska Board of Game), it left bear hunting open in the new McNeil River Refuge on a biannual basis, pending approval by the Alaska Board of Game. The Board subsequently voted 6-1 to allow hunting in October 1991. Under a plan first proposed by ADFG, a total of 3 bears a year could be taken by either legal harvest, poaching, defense of life and property (DLP) shootings, or as a result of human development. Once that threshold is reached, the ADFG Division of Wildlife Conservation can close the area to hunting by emergency order. Hunting was banned in the refuge in the original version of HB 306, but it was later allowed after the Alaska Outdoor Council (a pro-hunting group) threatened to go to court to block the Paint River fish ladder (Akre 1991).

In addition to allowing limited hunting and mining in the new refuge, HB 306 left ADNR Commissioner Harold Heinz with the option to allow development of fly-in fishing and hunting lodges along the upper Paint River. Although the original intention of HB 306 was to protect bears drawn into the Paint River watershed by the new salmon runs, in effect it excluded no activities in the refuge and only closed bear hunting on less than
five percent of the lands that were set aside in the bill. The failure of HB 306 to secure safe habitat for bears prompted FOMR and other environmental groups throughout Alaska to claim that the new McNeil River Refuge did absolutely nothing to protect bears. According to FOMR's Tony Dawson, "Instead of being a protected area, it (the refuge) could become a death trap for bears. There could be a firing line within the refuge where people literally wait for bears to leave the sanctuary (Sherwonit 1991b, 6[F])." Mike DeNeut, who has over 20 years of bear guiding experience in the nearby Iliamna Lake drainage, said of the new refuge, "If you include it as part of McNeil, guides will stay away because they know the government will almost send them to the electric chair for hunting in the sanctuary. I know the mentality of a lot of guides, and they can't wait for the ladder to go in (Futch 1991, 5[B])." Despite the controversial hunting provision in HB 306, both ADFG and CISA went on record as saying that they supported the creation of a refuge, "that best protects the wildlife and habitat of Paint River lands, so long as it doesn't interfere with the creation of a new commercial salmon fishery (Sherwonit 1991a, 2[F])." The watered down version of Grussendorf's bill evidently met that condition.

Because HB 306 failed to provide adequate protection for brown bears along the Paint River, and due to public outcry over the fish ladder's potential effects on the McNeil Sanctuary's bear-viewing program, the Corps determined that a re-evaluation of the fish ladder permit they had granted CIAA in 1988 was warranted. On July 31, 1991 the Corps re-opened public comment on permit no. 2-880038 for a period of 30 days. Meanwhile, the 9th District Court of Appeals had rejected the plaintiffs' request for an emergency injunction, and the Paint River fish ladder was rapidly nearing completion. "Once the fish ladder is built," argued FOMR's Tony Dawson, "it's a dead issue. The momentum to produce a commercial fishery will be unstoppable. After all the money that's been spent, there's no way the federal government is going to come up with an EA that would shut the project down (Sherwonit 1991b, 6[F])."
Upon re-evaluating the fish ladder permit, the Corps was left with three options: 1) they could revoke the permit, killing the Paint River project and forcing CIAA to pay for the the removal of the fish ladder; 2) they could leave the permit as is, allowing the fish ladder to remain; or 3) they could modify the conditions of the permit in order to mitigate any adverse effects that the ladder might have on bear populations or the McNeil bear-viewing program. In response to the permit re-evaluation, the Corps received 263 comments on the Paint River EA. Only 30 of those comments expressed support for the fish ladder project, and virtually all of those came from Alaskans. The overwhelming majority came from commercial and sport fishers, hunting guides, and politicians who had worked to secure funding for the project. Of the remaining 233 commenters who opposed the project, 51 requested the Corps complete a full-blown environmental impact statement (US Army Corps of Engineers 1992).

Surprisingly, some of the strongest comments in opposition to the Paint River fish ladder came from the Department of the Interior. Although both the National Park Service and US Fish and Wildlife Service had failed to voice any objections to the fish ladder project when they were given the opportunity to comment on it in 1988, this time around they expressed five major concerns and recommended that the Corps prepare a new and more comprehensive EA. Among their concerns were:

1) The creation of a major new salmon fishery would draw bears out of the McNeil River State Game Sanctuary National Natural Landmark (part of the National Park system) and onto unprotected lands along the Paint River;

2) The new salmon fishery would potentially alter the migratory behavior of brown bears which range within Katmai National Park and Preserve;

3) The new salmon fishery would potentially affect the species diversity, relative composition, and genetic integrity of native, naturally regulated salmon stocks attempting to migrate into the Douglas and Kamishak River drainages (both within Katmai NPP);
4) The new salmon fishery would potentially lead to overfishing of existing wild stocks in the Douglas and Kamishak Rivers, affecting brown bears, Steller sea lions, and other marine mammals; and

5) The new salmon fishery would lead to an increase in the number of commercial fishers in Kamishak Bay, potentially affecting Steller sea lion and other marine mammal populations (McGillivary 1991).

Although ADFG came out in strong support of the fish ladder project, both Larry Aumiller (the manager of the McNeil River Sanctuary) and Derek Stonorov (a sanctuary biologist who has studied brown bears on the Alaska Peninsula for over 20 years) risked their jobs by harshly condemning the project. Among their concerns were:

1) The new salmon fishery would lead to overfishing and genetic dilution of existing wild stocks in McNeil Cove, thus depriving sanctuary bears of a reliable food source;

2) Introducing salmon into the Paint River system would alter one of the basic reasons why bears concentrate along the McNeil River, i.e., the absence of comparable fishing opportunities nearby;

3) Increased human use in the new McNeil Refuge would potentially lead to direct mortality of bears as well as behavior modification of bears that is at odds with current management;

4) Salmon concentrating above and below the fish ladder will attract bears, which could potentially lead to bears being swept over the falls and bears getting into trouble with commercial fishers in the intertidal areas of Akjemguiga Cove;

5) The wilderness experience at McNeil Sanctuary will be degraded due to increased use of McNeil Lagoon by commercial fishers and the despoliation of land associated with construction of the fish ladder; and

6) If bears are drawn out of the McNeil River Sanctuary, the greatest natural laboratory for brown bear research in the world will be severely compromised (US Army Corps of Engineers 1992, 35-37).

According to Larry Aumiller, if the ladder is allowed to go in, and the Paint River fish ladder proves to be as successful as aquaculture planners predict, the McNeil River Sanctuary could lose up anywhere from 20-80 percent of its brown bear population. The exact number of bears that would leave the sanctuary would depend upon
how well the fish ladder works (how many salmon will be available), how easy the salmon are to catch, the availability of salmon at McNeil Falls, and other factors relating to human use in both areas. "The Paint River project," says the man who has lived among McNeil's bears since 1976, "could very easily change the McNeil River viewing situation from what is legitimately recognized as the world's largest concentration of brown bears to just another Alaskan stream with 15-20 bears using it. The McNeil River is a world treasure and I'm appalled and disappointed to see this project approved after such a cursory environmental assessment (Larry Aumiller, letter to the Corps, 16 August 1991)."

In the end, construction of the Paint River fish ladder was allowed to proceed, and in September 1991 the project was completed. In a 73-page combined decision document released on January 10, 1992, Col. John W. Pierce of the Corps of Engineers wrote:

Although the actual number of bears that would be drawn away (from McNeil) is uncertain, such a migration could diminish the viewing opportunity currently existing at the McNeil Falls. If salmon became as or more readily available in the Paint River, the McNeil experience would probably never be the same because the exceptional circumstances which created it would have changed to some degree.

...I believe, however, that the overall public interest requires me to provide the State of Alaska and the permittee an opportunity to demonstrate that they have the wherewithal to identify threshold levels of impacts, actual mitigative measures to prevent these impacts and the means to implement them (US Army Corps of Engineers 1992, 70).

The Corps made only one minor modification to the fish ladder permit. In short, it said that the Cook Inlet Aquaculture Association must meet with representatives from the Alaska Department of Fish and Game, the Alaska Department of Natural Resources, the US Fish and Wildlife Service, and the National Park Service on an annual or emergency basis to determine the levels of impact from salmon entering the Paint River on brown bear concentrations or behavior at the McNeil River State Game

On January 1, 1993, ADFG Commissioner Don Collinsworth officially declared the Paint River fish ladder operational, triggering the expansion of the sanctuary and the creation of the new McNeil River Refuge, and on April 23, 1993, following two years of acrimonious public debate and several court battles, the lawsuit over the construction of the Paint River fish ladder ended with all parties agreeing to a stipulation of dismissal. The river of hope had finally become reality.
Plate 1. (top) A large boar and sow with cubs fish for late-running coho salmon (*O. kisutch*) at the McNeil River falls.

Plate 2. (bottom) A brown bear sow and her three cubs search for spawning salmon along the north shore of the McNeil River. Note well-defined bear trails on grassy hillside at left.
Plate 3. (top) Looking south towards Mt. Douglas (far left) from Nordyke Island. Note presence of nesting glaucous-winged gulls (L. glaucens).

Plate 4. (bottom) A jitney crew prowls McNeil Cove looking for Mikfik sockeye salmon (O. nerka) in early June. The snow-covered Chigmit Mountains rise in the background.
Plate 5. (top) A seine boat and jitney anchor in the calm waters of McNeil Cove, with 4,000-foot Augustine Volcano (center) and Nordyke Island (left) in the distance.

Plate 6. (bottom) The F/V Miss Molly (right center) and other fishing boats seek anchorage off Nordyke Island, with mountains of Lake Clark National Park rising in background.
Plate 7. (top) The F/V *Kay Suzanne* gone dry on a reef off Amakdedori Beach.

Plate 8. (bottom) Photographers wait for bears to congregate at the McNeil River falls.
Plate 9. (top) The 37-foot mainstem falls of the Paint River prevent salmon from utilizing over 25 miles of prime spawning gravels. The fish ladder was chiselled into the conglomerate rock wall at lower right.

Plate 10. (bottom) Outlet of Paint River in Akjemguiga Cove, where brown bears and commercial fishers will likely compete for salmon.
Plate 11. (top) Commercial fishers inspect the Paint River fish ladder construction site in June, 1991. The ladder was inserted in the rock crevice in left foreground.

Plate 12. (bottom) The $2.8 million Paint River fish ladder, with upstream outlet at upper left.
4  BLIND SET

With the exception of holding hook* along beaches and near stream mouths, seine fishers ordinarily set their nets only after either seeing a jumping salmon or after their spotter pilot has guided them over a school of fish. When fishing is poor, however, a fisher may choose to make a set without any visible signs of fish in the area, and with little knowledge as to what lies beneath the water's surface. Seiners call this a blind set. While occasionally blind sets result in handsome payoffs, most times they yield no fish at all, and often they end with seines getting torn apart on submerged reefs, rock piles or other sunken debris. By nature, blind sets tend to have unexpected and disastrous consequences.

The Paint River project can be compared to a blind set. Instead of resulting in a tattered seine, however, it has the potential to unravel an entire ecosystem. Considering that a major new salmon run is being introduced into a river system only three miles from the largest concentration of brown bears in the world, amazingly little is known about brown bear and salmon ecology in the McNeil-Paint River ecosystem. Radio-collar studies that could yield valuable information on home ranges of McNeil River brown bears haven't been done since the early 1970's, and no fish-tagging studies that could reveal information on salmon migration routes in Kamishak Bay have ever been done.

* Holding hook refers to when fishers make a U-shaped set and keep the seine open for periods of up to half an hour.
reveal information on salmon migration routes in Kamishak Bay have ever been done. Additionally, fisheries biologists are only now beginning to realize the long-term negative effects that hatcheries have had on wild salmon stocks in lower Cook Inlet. Indeed, only once before in Alaska has a salmon run of the Paint River's magnitude been introduced into a previously-barren watershed. More than twenty years after a major run of sockeye salmon was introduced into Frazer Lake on Kodiak Island, researchers attempting to determine the project's latent effects on bears concluded, "It is unknown whether or not the establishment of a sockeye run in the Frazer Lake system increased bear density in that watershed, but it clearly influenced the seasonal distribution of bears (Barnes 1990, 305)." In short, due to a lack of adequate baseline data, biologists can only speculate what the long-term, cumulative effects of the Paint River project will be.

One of the most compelling arguments commercial fishers used to support construction of the fish ladder was that the 1.7 million salmon that would run up the Paint River would provide bears with a reliable new food source, thus causing their numbers to increase. Because brown bears are a K-selected species (i.e., they have low reproductive rates and respond slowly and minimally to changes in the carrying capacity of their environment), that is unlikely to happen. According to ADFG biologists, the availability of food may be a limiting factor to population growth in low-density bear populations such as those found in the interior, but in high-density populations such as the one at McNeil, population growth is much more likely to be limited by the availability of food in areas of low social stress (Johnson 1991, 3). Social stress among brown bears occurs primarily as a result of overcrowding and fierce competition at feeding areas. The most obvious example of social stress at McNeil River Falls is intra-specific predation (i.e., when one bear kills and eats another bear), which pushes mortality rates among subadult bears to 40 percent (Bunnell and Tait 1985). Even if the McNeil chum run increased by ten times,
bear numbers at the falls would probably remain unchanged because the social carrying capacity has already been reached.

Virtually all biologists who have been involved with the Paint River project agree that a significant percentage of brown bears will leave the McNeil River Falls following a successful introduction of salmon into the Paint River system. If Larry Aumiller's predictions prove accurate, between 20-80 percent of the McNeil bear population, or 24-120 bears, will end up leaving the sanctuary for the Paint River (Larry Aumiller, personal communication, 18 August 1991). To arrive at those figures, he looked at both a best-case scenario (i.e., strong salmon runs at McNeil and Mikfik, weak runs at Paint River, and highly restricted human use in the new sanctuary and refuge lands) and a worst-case scenario (i.e., run failures at McNeil and Mikfik, strong runs at Paint River, and uncontrolled human use in the new sanctuary and refuge lands). He then went through the list of bears that currently fish at McNeil, and based upon each bear's life history, predicted which bears would stay and which would leave. According to Aumiller, subdominant young bears and socially/human intolerant older male bears would likely be the first bears to move to the Paint River. Also, any bears travelling to the McNeil River Falls from the north will likely be short-stopped at the Paint River provided that good fishing opportunities exist there. Bears migrating to the McNeil River Falls from the south or west (Katmai National Park and Preserve) will likely be the last bears to learn about new fish runs in the Paint River, and consequently would be the last to leave the falls. The ADFG Division of Wildlife Conservation (DWC) has tentatively proposed capturing, immobilizing, and radio-collaring 30 bears that are known to use the sanctuary in order to gauge bear movements into the Paint River drainage and obtain information on bear numbers, den sites, travel corridors, and areas where bears go after leaving the McNeil River Falls (McNeil River Advisory Group 1992b, 6).
bears, availability of alternative fishing spots, and levels and types of human activities (ADFG 1991b, 3). Based upon sheer numbers of salmon that will be available to bears, some McNeil River bears are certain to move to the Paint River system. Between 1972-92, the average salmon escapements in the McNeil River and Mikfik Creek were 20,300 fish and 9,900 fish, respectively (Bucher and Hammarstrom 1993, 118-119). Beginning in 1996, salmon escapements in the Paint River system are expected to surpass the combined escapements of McNeil and Mikfik, and by 2002 the Paint River escapement will be approximately 15 times larger (443,000 fish) than the escapements in McNeil Cove (Walker, 27 August 1991, i). In terms of total run size (escapement plus fish that are caught by commercial fishers), the Paint River runs are expected to be 30 times larger than the combined McNeil and Mikfik runs by the time they reach their peak in 2002 (Appendix 11). Since brown bears generally prefer higher fat/oil content fish (such as sockeyes, kings, and cohos) over lower ones (such as chums and pinks), some McNeil River bears are expected to shift to the Paint River in late July when close to 20,000 sockeyes will be concentrated below the Lake Fork falls (ADFG 1991b, 4).

Currently, bears concentrate at the McNeil River Falls because large numbers of spawning chum salmon are concentrated in a relatively small area where it is easy for them to catch fish. Unlike the McNeil, where close to 90 percent of the chum salmon spawn in the lower one mile of the river, the salmon that will be stocked in the Paint River system are expected to scatter over a much larger area, providing numerous fishing spots for bears. After floating the entire length of the Paint River in June 1991, ADFG biologists concluded that there were at least 20 sites on the Paint River and several more on Dunuletak and Sulukpuk Creeks where bears would easily be able to catch migrating salmon at normal summer water levels (Johnson 1991, 1). The most likely areas where bears will concentrate are the shallow channel between Upper and Lower Paint
migrating salmon at normal summer water levels (Johnson 1991, 1). The most likely areas
where bears will concentrate are the shallow channel between Upper and Lower Paint
Lakes, the Lake Fork falls, the tidal flats of Akjemguiga Cove, and the upstream outlet of
the mainstem fish ladder (Larry Aumiller, personal communication, 18 August 1992).

If bears concentrate in either the tidal flats of Akjemguiga Cove or at the
outlet of the mainstem fish ladder, a number of problems would likely arise. First, if the
Paint River is managed as a terminal fishery, between 20-40 boats could be fishing in
Akjemguiga Cove at the same time bears are feeding on the tidal flats (plate 10). Should
this occur, we can expect a repetition of the same conflicts that erupted between fishers
and bears in McNeil and Chenik Lagoons (i.e., bears getting into fish-filled nets and
climbing aboard boats, fishers feeding bears and shooting at charging bears, etc.). Not
only would bears be displaced from their feeding areas by noisy fishing boats, but they
would also be stressed by increased spotter plane activity in the area. Secondly,
Akjemguiga Cove is one of three sites that are likely to be used by the seine fleet for
anchorage. The others are McNeil Lagoon and Nordyke Island (plates 5-6). Because the
Paint River fish runs will probably draw at least another 10-20 boats to Kamishak Bay (in
addition to the 20 already there), neither McNeil Lagoon nor the lee side of Nordyke
Island could accommodate the entire Kamishak Bay seine fleet. McNeil Lagoon has room
for about 5 boats, while Nordyke has space for about 10. Although it would greatly
increase the potential for conflicts between fishers and bears, ADFG has stated its
preference for an anchorage in Akjemguiga Cove because, "It would be easier and less
expensive to bulldoze, blast, fill, and protect a sandy area big enough to anchor several
boats than to build a breakwater or provide deep water anchorage off Nordyke Island
(Aumiller 1989, 8)."

If bears end up concentrating at the upstream outlet of the fish ladder, it is
likely that some of them, especially sows with cubs, will be swept over the falls and
drown. The shallow pool into which the fish ladder empties lies just upstream from a set of rapids, and less than 100 feet from the brink of the falls (plate 12). Since this pool is only 0.5-6.5 feet deep, and pink salmon in particular have a tendency to school up and rest at the top of fish ladders, the outlet of the ladder will probably be an ideal place for bears to catch fish (Larry Aumiller, personal communication, 18 August 1992). On the Frazer River on Kodiak Island, a fish ladder had to be modified after bears quickly learned to catch salmon by blocking the entrance to the ladder (ADFG 1991b, 11). During the construction of the Paint River fish ladder, bears were frequently observed swimming across the river near the top of the ladder, and one bear was found dead at the bottom of the falls after the fish ladder was completed (Larry Aumiller, personal communication, 18 August 1992). To prevent bears from concentrating at the top of the falls, the fish ladder could be modified in one of two ways. First, the outlet of the ladder could be extended at least another 100 yards upstream. Although this would be quite expensive, it would probably be the best long-term solution to the problem of bears being swept over the falls. Secondly, the exit pool could be dredged to make it harder for bears to catch fish. In the absence of a food reward, bears would not be drawn to the fish ladder outlet in the first place.

Perhaps the greatest single threat the Paint River project poses to both brown bears and the greater Kamishak Bay ecosystem is its potential to decimate naturally-occurring wild salmon stocks in the area. With few exceptions, most of the wild salmon runs in Kamishak Bay are small and susceptible to wild fluctuations. As an example, wild chum runs in the McNeil River have historically been as high as 153,000 fish (1988), but they averaged only 18,000 in the past four years (Bucher and Hammarstrom 1993, 118). Since the escapement* goal for chum salmon in the McNeil River

* Escapement is the amount of fish that must make it into a river system to spawn in order to ensure future generations.
years. Meanwhile, if aquaculture planners are right, roughly 40 fishing boats will be vying for over 1.7 million fish bound for the Paint River by 2002. If Paint River fish end up schooling with McNeil River fish in run failure years on the latter, it is highly likely that the McNeil chum run will be severely overfished. The potential also exists to overfish stocks on the Kamishak, Little Kamishak, and Douglas Rivers, and Mikfik, Chenik and Amakdedori Creeks, all of which are less than ten miles from Akjemguiga Cove.

Without healthy runs of salmon in these systems, bears would inevitably leave the sanctuary and refuge in search of alternative food sources.

Overfishing of wild stocks can be minimized in two ways. First, the Paint River can be managed as a terminal fishery. In a terminal fishery, commercial fishing is only allowed upstream of the point where the targeted salmon stock has separated from adjacent wild salmon stocks. Based upon returns of sockeyes that were planted in the Paint River Lakes in 1986, it is believed that salmon returning to the Paint River come from the north, where they mix with Kirschner Lake and Chenik Lake fish (Wes Bucher, personal communication, 2 September 1992). Likewise, commercial fishing experience indicates McNeil River and Mikfik Creek fish enter McNeil Cove from the south. If the Paint River is managed as a terminal fishery, the only place where commercial fishing will be allowed would be in Akjemguiga Cove (Appendix 12). Although spatial separation of salmon stocks would decrease the chances for overfishing of adjacent wild stocks, it would increase the chances for conflict between fishers and bears in the tidal flats at the outlet of Paint River. It would also mean that fishers would be paid less for their fish, since salmon quality generally deteriorates the closer the stock gets to its natal stream.

Incidental overfishing also can be curtailed by temporal separation of Paint River stocks from adjacent wild stocks. If Paint River fish had a later run timing than McNeil and Mikfik fish, two major problems could be avoided. First, bears travelling to the McNeil River from the north would not be short-stopped at the Paint River,
than McNeil and Mikfik fish, two major problems could be avoided. First, bears travelling
to the McNeil River from the north would not be short-stopped at the Paint River,
consequently bear numbers at the McNeil River Sanctuary would probably be less affected.
This was the greatest concern expressed by the plaintiffs in the lawsuit over the fish
ladder. Secondly, if Paint River stocks are not fished until adjacent wild stocks have
already entered their natal streams, the risk of overfishing wild runs would be greatly
diminished. Temporal separation of fish stocks has one major problem that may prove
irresolvable. Since sockeyes enter Mikfik Creek in June, and chums and sockeyes enter
McNeil and Chenik, respectively, in July, that leaves only May and/or August to get three
runs of salmon (sockeye, chum, and pink) into the Paint River.

Ideally, lower Cook Inlet seiners would like to see an early (May) run of
sockeyes introduced into the Paint River, since the first fish to hit the market generally
command a much higher price than later runs. Copper River sockeyes would fit this
description because they return to Prince William Sound in May, and they are relatively
large fish. Unfortunately, an early run of Paint River sockeyes would likely intercept
bears travelling to the McNeil River Sanctuary from the north, thus impacting bear-
viewing opportunities along Mikfik Creek in early June. The seiners' second preference is
a sockeye stock that returns later than the Chenik sockeye run in order to separate the two
fisheries, but not as late as August because that is when fall storms usually begin
pounding Kamishak Bay. Crescent River (west side of Cook Inlet) sockeyes would meet
both of those criteria. In addition to returning to the Paint River after the peak of the
McNeil chum run and Chenik sockeye run in mid-July, they would also be genetically
adapted to the relatively harsh environmental conditions which exist in the Paint River
system. Because Crescent River sockeyes would be entering the Paint River while there
are still chums in the McNeil, some bears are likely to move from the McNeil River Falls to
the Lake Fork in late July, especially during run failure years on the former (McNeil River Advisory Group 1992b, 2).

Aquaculture planners are looking to either Cottonwood Creek or Bruin Bay for chum and pink salmon stocks because they have a 7/22-8/15 run timing and they are genetically equipped to survive in the Paint River system (McNeil River Advisory Group 1992b, 2). Bruin Bay chums also have a stronger urge to move upstream than other Kamishak Bay stocks, which would help them move up the fish ladder and disperse throughout the upper reaches of the Paint River system. If coho salmon are introduced into the Paint River system at a later date, which appears likely, they would be selected for an early August run timing, thus avoiding the problem of late-running (Sept.-Nov.) salmon attracting brown bears to the McNeil River Refuge during the fall bear-hunting season. This early run timing for cohos may or may not end up protecting bears. Research in other enhanced systems has shown that cohos tend to extend their run timing into October and November regardless of stock selection (McNeil River Advisory Group 1992b, 3). Even if the coho run has completed spawning by September, bears could return to the Paint River in October (hunting season) to feed on dead or dying salmon. On the Brooks River in Katmai NPP, more bears return to feed on spawned-out salmon carcasses in the fall than any other time of the year (Squibb 1992, 1). Consequently, the only sure way of protecting brown bears feeding on late-run silvers is to permanently close the fall bear-hunting season.

The primary concern with all three species of salmon entering the Paint River within three weeks of each other is that sockeye salmon require a high water velocity in order to attract them to the entrance of fish ladders, while pink salmon often mortally exhaust themselves while ascending fish ladders at the same water levels (Blackett 1987, 75). If multiple runs of salmon return to Akjemguiga Cove at roughly the same time, it will be impossible to alter flow rates for each species. Biologists also worry
that spawning habitat in the Paint River could be overutilized by the sheer numbers of fish that are expected to return to the Paint River (Wes Bucher, personal communication, 2 September 1992). If this occurs, the last salmon to enter the Paint River will dig their redds where earlier-running fish had already laid their eggs, thus destroying them. Additionally, with up to 1.7 million salmon returning to the Paint River in one brief period, large numbers of predators such as seals, sea lions, orcas, Beluga whales, and bald eagles will likely concentrate to feed in Akjemguiga Cove. For these reasons, the Paint River may not be able to support as many salmon as originally thought. It would therefore be wise for CIAA to consider introducing only one species of salmon at a time (preferrably sockeyes first) into the Paint River. If irresolvable problems arise after a five-year probationary period, the entrance to the fish ladder could be closed and the salmon run could easily be terminated. It should be noted that even if aquaculture planners and ADFG fish biologists make all the right decisions in selecting Paint River stocks, some McNeil River bears will inevitably be drawn to the Paint, some adjacent wild runs will be overfished in run failure years, and potentially lethal conflicts between commercial fishers and bears will occur within the confines of Akjemguiga Cove.

If and when brown bears move from the McNeil River falls to the upper Paint River system, they face their most formidable threat from big game hunters who are expected to increase in number once salmon have entered the Paint River. In 1991 the Alaska Board of Game voted 6-1 to allow trophy brown bear hunting to continue in the Paint River uplands on a biannual basis. Under the new guidelines, 3 brown bears can be legally harvested in the McNeil River Refuge every other year, but hunting could be closed by emergency order if other human-caused bear mortality throughout the refuge reaches unacceptable levels. Despite ADFG’s assurance that this level of bear hunting is sustainable and won’t affect brown bear populations in the McNeil-Paint River ecosystem, the plan remains controversial for a number of reasons.
years), small average litter size (~2), and long interval between litters (>3 years) (US Fish and Wildlife Service 1990, 11). Consequently, brown bear populations cannot sustain harvest levels in excess of 2-5% of the population, depending on levels of human activity in the area (ADFG 1991a, 8). In uniform coding unit (UCU) 301, which encompasses the new McNeil River Refuge and the Amakdedori Creek drainage, spring brown bear densities are thought to be 4 sq. miles/bear, meaning that UCU 301 contains approximately 62 bears (ADFG 1991a, 8). If UCU 301 were to be managed at a conservative harvest rate (2%), only 1.2 bears could be harvested in any given year. That number rises to 1.9 bears/year at a harvest rate of 3%, 2.5 bears/year at 4%, and 3.1 bears/year at 5%. Since the new McNeil River Refuge comprises only two-thirds of the land area of UCU 301, harvest levels in the refuge would be 0.8 bears/year at a 2% harvest rate, 1.2 bears/year at 3%, 1.6 bears/year at 4%, and 2.0 bears/year at 5%. Even if bears in the McNeil River Refuge were allowed to be hunted at a maximum-level harvest rate (5%), the current harvest level (3 bears/year) is 50% higher than what is considered to be sustainable. Evidence also demonstrates that brown bears using refuge lands have been severely overharvested during the past decade. Between 1980-90, harvest levels in the Paint River and Chenik Creek drainages averaged 3.6 bears/year (9% harvest rate), and between 1988-90 they averaged 5.0 bears/year (12.5% harvest rate) (ADFG 1991a, 8) (Appendix 13).

Even if brown bears were harvested at sustainable levels in the refuge, bear-viewing opportunities at the McNeil River Falls could suffer in several ways. Traditionally, trophy hunters have targeted three segments of the brown bear population; large males, bears with desirable physical features (i.e., bears with light blonde fur), and bears that have little fear of humans. The most likely candidates for hunters are also some of the most popular bears with bear-viewers in the sanctuary. If a bear like "Melody" (a large, blonde female who is extremely tolerant of humans) were killed by hunters, the "McNeil experience" would be greatly diminished for sanctuary visitors.
"Melody" (a large, blonde female who is extremely tolerant of humans) were killed by hunters, the "McNeil experience" would be greatly diminished for sanctuary visitors. Melody is perhaps McNeil's most photographed bear and has frequently been observed nursing her cubs within 20 feet of awe-struck viewers. The only ways of protecting individual McNeil River bears that wander into the Paint River uplands are to either ban brown bear hunting in the refuge outright, or mark McNeil River bears with clearly visible ear tags so hunters know they are off limits. Should the latter option be choosen, bears would be exposed to the risk of tranquilizer drug overdoses, become fearful or aggressive around humans as a result of being drugged and tagged, and photographic opportunities at the McNeil River falls would inherently be degraded.

Recreational development in the new McNeil River Refuge poses another serious threat to regional brown bear populations. If ADNR allows development of sportfishing and big game (moose and caribou) hunting opportunities in the Paint River drainage, which is all but certain, brown bears could be adversely affected in several ways. The only places along the Paint River system that are even remotely accessible to float planes carrying sport fishermen and hunters are the Paint River Lakes and Akjemguiga Cove; the same areas where bears are expected to concentrate to fish. As habituated McNeil River bears come into close contact with people in these areas, many will feel threatened and either shoot the bears because they are not used to bears approaching to within 10-20 feet, or they will attempt to scare them away, giving bears the opposite message they are given in the sanctuary. In 1979, ADFG closed the McNeil River to sport fishing when increasing numbers of sport fishermen began fishing for late-running silvers in September, after sanctuary staff had left for the season. Their primary concern was that fishers unaccustomed to human-habituated bears would shoot them in defense of life and property (Sinnott 1992, 3).
Also, any facilities such as fishing lodges or hunting camps would likely generate significant amounts of garbage and attract bears with food odors. ADFG has already documented several cases on the Kamishak and Douglas Rivers where sport fishers have left fish scraps and other food for scavenging bears. Once bears associate humans with food, they will be a threat not only to sport fishers and hunters, but to sanctuary visitors as well. As a result, bear mortality from DLP kills is likely to increase sharply. If the new McNeil River Refuge is managed anything like the Brooks Camp in Katmai NPP, brown bears are in for trouble. Brooks Camp attracts roughly 10,000 visitors a year, most of whom are sport fishers. Despite the existence of a comprehensive and restrictive brown bear management plan for the area, the National Park Service reported 497 cases of visitors breaking the park rule that prohibits approaching to within 50 feet of bears in 1991 alone (Squibb 1992, 5). Most of these cases involved fishers who had refused to retreat when bears approached them in the river in search of a free meal. In the past 25 years, at least 20 bears have been shot and killed in DLP at Brooks Camp, and 4 visitors have been mauled by bears (McNeil River Advisory Group 1992a, 3). In the Kodiak Archipelago, at least 93 brown bears were shot in DLP from 1974-86, and 7 people were killed by bears (Smith, Barnes, and Van Daele 1989). Statewide, DLP killings account for between 5-10% of all reported bear mortalities, but the actual number is probably more than twice that high due to unreported kills. The overwhelming majority of DLP killings and maulings have one thing in common; improperly stored food.

In order to minimize conflicts between recreational users and brown bears, avert DLP killings, and treat brown bears in a manner that is consistent with the habituation program at the McNeil Sanctuary, ADFG should include the following provisions in the management plan for the Paint River drainage:

1) Commercial fishing in the sill area of Akjemguiga Cove should only be allowed during high tide periods in order to avoid confrontations with fishing bears.
2) Fishing vessels should be prohibited from going dry in Akjemguiga Cove in order to avoid attracting bears to fish-filled nets. The safest, least impactive anchorage site for the seine fleet would be on the lee side of Nordyke Island.

3) During the peak of the salmon runs sport fishing and big game hunting should be prohibited in areas where bears concentrate to feed (i.e., Akjemguiga Cove, the top of the fish ladder, and Lake Fork Falls).

4) Sport fishers and big game hunters should be required to attend an ADFG-run bear school that would teach proper behavior around human-habituated bears.

5) Sport fishers should be required to cut their lines when bears attempt to catch fish that have been hooked. This would discourage bears from associating humans with food.

6) Refuge visitors should be prohibited from approaching to within 50 feet of bears.

7) Fly-in fishing and hunting lodges should be limited in number and restricted to low bear-use areas, and should be required to be equipped with appropriate bear-proof facilities (i.e., secure food caches, garbage incinerators, proper waste disposal facilities, etc).

8) Float-planes and boats should be prohibited in areas where bears concentrate to feed. Spotter planes used to locate schools of fish are not necessary to harvest salmon in a terminal fishery such as Akjemguiga Cove and should be prohibited.

9) A permit system should be instituted to limit recreational use in the refuge. Parties should be limited to ten people or less to lessen local impacts, maintain a wilderness atmosphere, and minimize disturbance of bears.

10) Camping should be allowed only in designated areas that are made off-limits to bears through the use of fences.

11) All food preparation and storage should be confined to specific areas that are equipped with bear-proof facilities.

12) All leftover food and trash should be removed or burned on-site.

13) All fish scraps should be disposed of below the low tide line.

14) Pets should be banned.

15) All mining, including development of existing claims, should be prohibited.

16) The mainstem Paint River should be considered for status as a wild river under the 1968 Wild and Scenic Rivers Act in order to protect it from degradation associated with mining and other proposed development.
In addition to threats posed by bear-hunting and recreational development, brown bears face one other very real danger in the Paint River drainage. As noted in chapter 3, both Cominco, Inc. and the American Copper and Nickel Company (ACNC) have legitimate mining claims staked in the Paint River uplands. Surveys conducted in 1989 showed that the area just east of Upper Paint Lake was highly prospective for gold and copper deposits, and could also contain reserves of molybdenum, silver, iron, and titanium (Selkregg 1974). These claims are less than 2 miles from the Lake Fork falls, where bears are expected to concentrate to feed on migrating sockeye salmon. In 1990 and 1991, test-drilling along Canyon Creek confirmed a deposit that is estimated to contain 1 million tons of marginal-grade ore, about one-tenth the amount of ore that is required to make a large-scale mining operation economically viable. In the event that other significant mineral deposits are discovered in the area, a mine could be developed and ACNC would have the option of building a road either north to Iliamna Lake or east to Amakdedori Beach (McNeil River Advisory Group 1992b, 5).

Mining activity could have at least three major adverse impacts on brown bears that move into the refuge. First, intensive mining activity in the area of existing claims would in all probability dump increased sediment loads containing toxic heavy metals into the Paint River Lakes where sockeye salmon are expected to spawn. If the Paint River Lakes are polluted with mine tailings, sockeye salmon populations would inevitably decline, and toxic runoff would eventually take its toll on downstream chum and pink salmon populations. In the absence of healthy salmon populations, brown bears would eventually leave the Paint River drainage and search for food elsewhere. Secondly, if a mine is developed and a road is built, all the noise associated with heavy equipment, trucks, barges, and planes would likely disturb bears to the point where they would no longer feed in their preferred areas, and they would eventually become highly intolerant
of humans. Finally, all the adverse effects associated with recreational development (i.e., bears associating food with humans, DLP kills, etc.) would also be expected in a backcountry mining camp.

Brown bears are not the only animals that are threatened by salmon enhancement in the McNeil-Paint River ecosystem. Native populations of freshwater fishes, marine mammals, and seabirds are all likely to suffer increased mortality due to increased negative interactions with commercial fishers and inter-specific competition. The introduction of 1.7 million salmon into the Paint River system will undoubtedly have a profound effect on resident arctic grayling, round whitefish, lake trout, rainbow trout, and Dolly Varden populations. Since salmon and trout will compete for scarce resources such as food (zooplankton), cover, spawning habitat, and resting pools, it is safe to assume that the latter will experience significant population declines once salmon enter the Paint River. Also, the possibility exists that hatchery-bred salmon could transmit potentially deadly diseases such as BKD (bacterial kidney disease), IHN (infectious hematopoietic necrosis), and cold water disease to resident freshwater fish populations during the spawning season.

Marine mammal populations in Kamishak Bay will be affected by the Paint River project in at least three ways. Initially, harbor seal, Steller sea lion, Beluga whale, orca, and sea otter populations will likely increase as the result of a major new source of food (salmon) being introduced into the Kamishak Bay ecosystem. As marine mammals learn to obtain salmon from commercial fishers' nets, however, it is highly likely that large numbers of them will be shot. As noted in chapter 1, it is common practice for some lower Cook Inlet commercial fishers to shoot and kill harbor seals, endangered Steller sea lions, and other marine mammals during the Mikfik and Chenik sockeye fisheries. Biologists studying mortality of Steller sea lions in nearby Shelikof Strait have determined that direct and indirect interactions with commercial fisheries is the greatest
single cause of human-caused mortality of sea lions (Loughlin and Nelson 1986). Indirect interactions usually involve seals and sea lions becoming entangled in trawl web or ingesting plastic debris, both of which are potentially lethal.

In addition to freshwater fishes and marine mammals, resident seabirds such as double-crested cormorants (Phalacrocorax auritus), common murres (Uria aalge), pigeon guillemots (Cepphus columba), horned and tufted puffins (Fratercula corniculata and Fratercula cirrhata, respectively), black oystercatchers (Haematopus bachmani), glaucous-winged gulls, bald eagles, and others are likely to be adversely impacted by salmon enhancement in the Paint River. Similar to marine mammals, seabird numbers will probably increase in response to the new salmon runs initially, then suffer excessive mortality at the hands of commercial fishing crews who will inevitably disturb nesting sites and shoot birds for target practice on nearby Nordyke Island. Due to a projected doubling in size of the seine fleet in Kamishak Bay, a rise in the number of seabird deaths from getting caught in seine web and ingesting floating debris should also be expected.

Interestingly, the corps' environmental assessment for the Paint River salmon enhancement project concluded that there would be virtually no short or long-term negative effects on resident freshwater fish or marine mammal populations despite the evidence that has been cited. Additionally, the Corps of Engineers stated that, "no known endangered or threatened species or their critical habitat will be affected by the proposed work (US Army Corps of Engineers 1992, 7)," even though threatened Steller sea lions are known to occupy Kamishak Bay and the area of McNeil Cove. The environmental assessment failed to even mention threats that the Paint River project poses to seabirds.

The Council on Environmental Quality (CEQ) defines cumulative impacts as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions (US Army
Corps of Engineers 1992, 12)." Based upon this definition, it is clear that the Paint River project could and probably will have major adverse impacts on brown bears and other wildlife within the McNeil-Paint River ecosystem. Even if brown bear hunting were banned in the refuge and ADFG put together a highly restrictive management plan for the Paint River drainage, the problems associated with overfishing adjacent wild salmon runs, bears being swept over the Paint River Falls, bears and commercial fishers getting into lethal conflicts in Akjemguiga Cove, habituated bears being shot in defense of life and property, bears being displaced by mining development, and marine mammals and seabirds suffering at the hands of commercial fishers remain either inadequately mitigated or irresolvable. The potential threats that have been detailed here, in combination with a history of conflict between commercial fishers and brown bears in Kamishak Bay, should dispel the notion that the Paint River enhancement project promotes both fisheries development and environmental conservation. Ultimately, it may prove to do neither.
As noted earlier, the Paint River conflict marked the first time Alaskans had ever mounted a serious challenge to a fisheries enhancement project backed by the politically powerful commercial fishing industry. Even though environmentalists lost the battle over the Paint River, they may have won an even greater victory by challenging a number of assumptions commercial fishers had been operating under for nearly a century. Foremost among them were the assumptions that commercial fishing is the highest and best use of the salmon resource; fishers should be able to enhance any and all lake or river systems regardless of costs to wildlife; and enhancement projects are good for the long-term health of salmon fisheries. It is the third assumption that will be the focus of this chapter.

Following nearly three decades of poor salmon returns as a result of overfishing and progressive habitat degradation, commercial fishers in the Cook Inlet region banded together and formed the Cook Inlet Aquaculture Association in 1976. CIAA’s mission was four-fold: 1) protect self-perpetuating salmon stocks and the habitat upon which they depend; 2) rehabilitate self-perpetuating salmon stocks; 3) rehabilitate salmon habitat, and 4) maximize the value of the Cook Inlet common property salmon resource by using hatchery science (Cook Inlet Aquaculture Association 1992a, 3). In
1982 CIAA undertook its first major enhancement project with the construction of the Eklutna chum salmon hatchery, and by 1991 CIAA had stocked and fertilized scores of lower Cook Inlet lake systems, opened up hundreds of miles of new spawning habitat, and taken over operation of the Tutka Bay pink salmon hatchery in Kachemak Bay (figure 6). Virtually all of CIAA's funding came from a 2% salmon enhancement tax that fishers had imposed upon themselves in 1980 (Cook Inlet Aquaculture Association 1991, 5).

Ever since the Tutka Bay hatchery started pumping out record numbers of pink salmon in 1978, lower Cook Inlet fishers have been addicted to salmon enhancement as a means of improving their fishery. In the first two years of adult returns to the hatchery, the pink salmon harvest in Tutka Bay increased by over 1900% and the ex-vessel value of the LCI commercial salmon harvest nearly tripled (Bucher and Hammarstrom 1993, 115-116) (Appendix 8). Convinced that hatcheries could resurrect the lower Cook Inlet salmon fishery and bring prosperity to the seine fleet, ADFG and CIAA embarked on an ambitious path that would ultimately transform lower Cook Inlet from a "mom and pop" hand-purse fishery entirely dependent on wild salmon into one of the most hatchery-dependent salmon fisheries in Alaska. By 1992, FRED and CIAA-sponsored enhancement projects in Kamishak and Kachemak Bays accounted for 82% of the LCI sockeye harvest, 78% of the LCI pink salmon harvest, and 76% of the total LCI salmon harvest (Bucher and Hammarstrom 1993, 32). Based upon average fish weights and prices per pound, approximately 75% of the total value of the 1992 LCI salmon harvest was directly attributable to FRED/CIAA-sponsored enhancement projects (Bucher and Hammarstrom 1993, 32). Were it not for these enhancement projects, lower Cook Inlet would not have had a commercial salmon fishery in 1992.

While commercial fishers have touted salmon enhancement as a boon to lower Cook Inlet (Appendix 14), area commercial fish biologist Wes Bucher warns that such a high degree of dependence on hatchery-bred salmon stocks presents a danger to the
Figure 6. Lower Cook Inlet commercial salmon fishery with selected enhancement projects identified.
long-term health of the fishery, and to wild stocks in particular (Wes Bucher, personal communication, 2 September 1992). First, hatchery-bred salmon compete with wild salmon for food and habitat microsites such as spawning beds, protected nursery areas, and feeding spots in eddies and pools, forcing native salmon to utilize marginal habitat (Bosse 1991, 21). Additionally, hatchery-bred salmon have been known to prey voraciously upon wild salmon fry and eggs (Hilborn 1992, 6). Following an enhancement project that involved creating new spawning habitat for sockeye salmon in Babine Lake, British Columbia, biologists discovered that as more sockeye smolts left Babine Lake and swam down the Skeena River, a smaller proportion of them survived during their years spent in the ocean (McDonald and Hume 1984) (Appendix 15). Presumably, this occurred because of intense competition for food and space in both fresh water and in the ocean. The end result of the Babine Lake enhancement project was that wild runs throughout the Skeena River system decreased by nearly 50%. Similar trends were observed along the Fraser River in southwestern British Columbia, where the Canadian government built an extensive network of chinook salmon (O. tshawytscha ) hatcheries to mitigate habitat losses from hydroelectric development. As a result of this hatchery work, ten times more chinook smolt were released during the 1980's than in the 1970's, yet commercial chinook harvests actually declined, presummably because of competition from hatchery fish (Hilborn 1992, 6). Research conducted by University of Washington fish biologist Ray Hilborn demonstrates that this pattern of declining survival of hatchery-reared fish is found in nearly every hatchery program in North America. Lower Cook Inlet is no exception. Despite a five-fold increase in hatchery fry releases between 1976-92, pink salmon returns to Tutka Bay have declined to the point where virtually all of the returning adults are now either used for brood stock collection or cost-recovered to pay for the operation of the hatchery. CIAA's response has been to pump out even more pink salmon fry.
The most ruinous effects of salmon enhancement occur when hatchery-bred salmon interbreed with wild salmon. Interbreeding produces genetically-diluted offspring that lack the traits necessary to thrive in highly specialized stream or lake environments and survive cataclysmic natural events such as volcanic eruptions, glacial advances, geomagnetic reversals, and El Nino currents (Brown 1982, 63). Because each run of wild salmon is believed to be genetically distinct from all others, once they are watered down by the infusion of hatchery-bred genes, they can never be replicated, either through hatchery production or the lengthy process of natural selection. In some cases, entire wild salmon runs have been wiped out as a result of genetic dilution. On the northern Japanese island of Hokkaido, wild salmon runs containing all six species of Pacific salmon were decimated when the Japanese government built a network of chum salmon hatcheries to offset extensive habitat degradation, industrial pollution, and hydroelectric development. Consequently, the hatchery-bred chum runs that now return to Japanese rivers and streams are only a fraction of the multispecies wild runs that formerly existed there (Hilborn 1992, 8). In the Pacific Northwest, noted fish biologist Loyd Royal's 1973 report entitled, "An Examination of the Anadromous Trout Program of the Washington Department of Game" showed the State's hatchery program had led to precipitous declines in wild winter and summer steelhead populations due to "genetic pollution, competition for food and space, and egg-robbing." The report concluded by saying, "most hatchery operations have been an economic failure and have failed to substantially increase the runs," and that in the end, "artificial propagation of salmon will kill the wild runs (Brown 1982, 192)."

Research has consistently shown that offspring of wild x hatchery matings are far inferior to wild x wild matings in terms of reproductive efficiency, weathering environmental changes, surviving disease epidemics, capturing prey, returning to natal streams, and locating optimal spawning gravels (Bosse 1991, 21). A study conducted by
the National Marine Fisheries Service on Washington's Kalama River showed that wild steelhead trout (O. mykiss) were more than nine times more effective at producing offspring compared to hatchery-bred fish (Koberstein 1991, 27). Biologists believe wild salmon breed more efficiently than their hatchery-bred counterparts because they are genetically programmed to know exactly when to leave their natal streams for the ocean, when to return, where to find mates, how to recognize and avoid predators, and what their prey looks like. Conversely, hatchery fish are raised in plastic trays, live for up to a year in concrete pools, and subsist on a diet of human-made pellets. Hence, releasing hatchery-bred fish into the wild can be compared to releasing a domestic dog into the wilderness and expecting it to live like a wolf.

The common practice of taking smolts from one hatchery stock and planting them throughout a wide area can also endanger wild salmon runs by destroying genetic diversity and promoting homogeneity. This problem is compounded when fish biologists attempt to enhance already existing wild runs by collecting wild broodstock during one short period of a run and then fertilizing the eggs of many females with one male's sperm. Research has clearly shown that the vitality of wild salmon is dependent upon a wide genetic mix within each individual run (Hilborn 1992, 7). Homogeneous salmon stocks become particularly vulnerable to diseases such as BKD (bacterial kidney disease), IHN (infectious hematopoietic necrosis), and cold water disease, which can be passed from hatchery stocks to the offspring of wild stocks during spawning (Mulcahy and Pascho 1986, 2515). There is also considerable evidence that BKD is transmitted in the water and feed that are given to smolts while they are raised in hatcheries (Brown 1982, 116). Due to the marked homogeneity of hatchery stocks, it is not uncommon for entire generations of smolts to be wiped out by a single epidemic. A recent study showed that 100% of the hatchery-bred salmon in the Columbia River system above the Bonneville Dam are infected with BKD (Koberstein 1991, 27). In lower Cook Inlet, nearly 90% of the hatchery-bred
sockeye smolts that were stocked in Chenik Lake in 1991 died as a result of an IHN epidemic that likely originated in the Crooked Creek hatchery (Bucher and Hammarstrom 1993, 37).

Hatchery production also threatens wild salmon runs by encouraging fisheries managers to set excessively high harvest rates in mixed-stock fisheries (i.e., fisheries containing both wild and hatchery stocks). While harvest rates in wild salmon fisheries are set according to how many salmon are needed to meet escapement goals, harvest rates on hatchery runs are often set according to the maximum potential productivity of hatchery stocks. In certain parts of Washington's Puget Sound that have been declared "hatchery management areas," harvest rates are now so high that few wild salmon are allowed to spawn, and in adjacent Canadian waters off Vancouver Island harvest rates on hatchery-bred coho have been as high as 95% (Hilborn 1992, 7). Consequently, when hatchery runs are poor, both hatchery salmon and wild salmon are severely overfished. To make matters worse, when hatchery runs fail, biologists often must capture the few wild fish that return to use as brood stock. There have been documented cases where wild runs have almost been totally eliminated by egg takes for hatcheries (Hilborn 1992, 24). Problems associated with overharvesting of wild stocks are particularly applicable to Alaska's Paint River due to the presence of several nearby streams containing tenuous runs of wild sockeye, chum, and coho salmon.

One major problem associated with hatchery production has already surfaced in several areas of lower Cook Inlet: predator buildup. Even when the first salmon hatcheries were built along the Columbia River over a hundred years ago, hatchery managers recognized predator buildup as a serious problem. According to pioneering cannery owner R.D. Hume, "The turning out of large numbers of fry in a small stream attracts their enemies of all kinds, besides giving the fish an insufficient supply of food, from which lack many perish from starvation (Brown 1982, 147)." Lower Cook Inlet area
commercial fish biologist Wes Bucher believes that predator buildup primarily in the form of increasing numbers of juvenile tomcod and pollock may be one of the principal causes of recent salmon declines in both lower Cook Inlet and adjacent Prince William Sound, where tens of millions of pink salmon fry are simultaneously released every spring (Wes Bucher, personal communication, 2 September 1992). Although the obvious answer to this problem is to increase the amounts of tomcod and pollock that can be caught in commercial fishing openings, that would not help in this case because the fish are so small (usually around six inches long) that there is no market demand for them. Predator buildups have also been noted by commercial fishers in Kamishak Bay, where increasing numbers of marine mammals and brown bears have been observed since the Chenik Lake system was enhanced in 1986.

From a purely economic standpoint, salmon enhancement in lower Cook Inlet may ultimately prove to be a losing cause in at least two ways. First, hatcheries cost hundreds of thousands of dollars a year to maintain, while wild runs are for the most part cost-free. In 1992, over 15% ($227,800) of the total ex-vessel value ($1,105,200) of the LCI salmon fishery was used for hatchery cost recovery purposes, and another 2% was collected from fishers in the form of a salmon enhancement tax (Bucher and Hammarstrom 1993, 33). Once a lake system has been enhanced with non-native sockeye salmon, that fishery is then forever dependent on the availability of surplus fry and smolt from hatchery production, and wavering state stocking budgets. Secondly, salmon enhancement projects such as the Paint River project cause limited-entry permits to become artificially inflated and encourage commercial fishers to overcapitalize by buying expensive new boats and hiring spotter planes to locate fish for them. Since salmon enhancement in lower Cook Inlet began in earnest in the early 1980's, permit prices have increased by over 500% and a large portion of the seine fleet traded in their $50-100,000 boats for bigger, higher-tech vessels worth in excess of $200,000, yet the total ex-vessel value of
the salmon harvest has actually declined. In effect, salmon enhancement in lower Cook Inlet has set commercial fishers up for a fall. Part of that fall can be attributed to a glut of hatchery-produced salmon that have caused fish prices to plummet by up to 80% (in the case of pink salmon) since 1988. In 1991 the Alaskan pink salmon harvest was so high that processors refused to buy surplus fish and upwards of 2.3 million adult pink salmon were literally dumped into Prince William Sound while another 1 million fish were canned and shipped to Russia as a humanitarian gesture (Cook Inlet Aquaculture Association 1992b, 3).

Perhaps the most tragic effect hatcheries have had on wild salmon fisheries is that they have provided a mechanism to defuse conflict over habitat destruction and poor fisheries management. Commercial fishers in lower Cook Inlet and throughout most of coastal Alaska are fortunate in that salmon habitat in their fisheries remains relatively intact, but that is rapidly changing. In the last five years alone, critical salmon habitat in lower Cook Inlet has been destroyed or degraded by intensive clearcut logging on the outer coast of the Kenai Peninsula near Windy Bay, two major oil spills (from the Exxon Valdez and Glacier Bay), and the construction of a major dam on the Bradley River near the head of Kachemak Bay. Had it not been for the Kachemak Bay State Park timber buyback in 1993, over 6,000 acres of old-growth forest surrounding Halibut Cove, China Poot and Hazel Lakes, and Tutka Bay would have fallen to saws, leaving some of the fishery's most productive lakes and streams vulnerable to sedimentation. Across Cook Inlet, Kamishak Bay faces imminent threats from mining development in the area of the Paint River Lakes and offshore oil development as a result of oil lease sales that were finalized in 1992. The bottom line is that salmon need pristine aquatic systems in order to survive, and no amount of hatcheries can reliably and sustainably produce enough fish to offset the disastrous impacts associated with habitat destruction.
Despite the lessons that should have been learned in the Pacific Northwest over the past hundred years, new hatcheries are still being built in parts of Alaska and British Columbia even as catches from wild salmon runs are now at or above all-time highs. Nowhere is this more evident than in Prince William Sound. According to University of Washington fish biologist Ray Hilborn, "There is no mitigative excuse for these facilities; they are the result of technology being sold by fisheries scientists to unwary fishers motivated by short-term greed (Hilborn 1992, 8)." The most recent technological fixes being hawked by fisheries scientists are supplementation (when eggs are incubated in hatcheries and then spread throughout a watershed to rear naturally) and the creation of "artificial" salmon habitat to provide developers with an excuse to destroy existing natural wetlands. In his book, Mountain in the Clouds, Bruce Brown compares the destruction of wild salmon runs on the Olympic Peninsula and their subsequent replacement by hatchery fish to the decimation of Atlantic salmon (Salmo salar) in England during the Industrial Revolution:

There is a suggestion in the English experience, and the subsequent imperialism of newly industrialized Europe, of a basic mechanism of modern hegemony. It is that the destruction of common food resources is not a sad byproduct of modern industrialism, but rather a necessary prerequisite for its success: that industrial society extends and consolidates its control by creating scarcities that can only be met by entering the money economy (Brown 1982, 234).

If there is one thing to be learned from this chapter, it is that the dangers associated with salmon enhancement alone should be enough to stop construction of projects such as the Paint River fish ladder and demand that full environmental impact statements be prepared. While it is true that the Paint River project is likely to severely affect brown bear populations in the McNeil-Paint River ecosystem, the overall practice of salmon enhancement in lower Cook Inlet and throughout coastal Alaska could potentially obliterate something even larger and more significant: North America's last great runs of
wild salmon. Without the salmon, there would be no brown bears and there would be no
fish for fishers to catch.

Does this mean commercial fishers should stop building new hatcheries,
stocking lakes, and trying to create runs of salmon where they have never run before? Yes.
Although the cessation of salmon enhancement in the form of hatchery production might
initially wreak economic havoc in lower Cook Inlet, it would certainly be the wisest path
to take if the ultimate goal of commercial fishers is to protect wild salmon stocks for
future generations. Studies have shown that, given time, wild salmon stocks can recover
and rebuild lost years if hatchery-bred fish are no longer mixed with wild fish, and if
vital habitat is protected. As an example, wild trout populations in Montana's Madison
River increased by 180% after hatchery releases were discontinued (Brown 1982, 121).
As a first step, lower Cook Inlet fishers should consider declaring a moratorium on all
new salmon enhancement projects that involve stocking non-native salmon in watersheds
containing existing wild runs. The next step fishers should take is to shift money from
the 2% salmon enhancement tax they now pay into a fund dedicated to securing important
salmon habitat. Additionally, commercial fishers would be wise to actively pursue
habitat acquisitions via the Exxon Valdez Oil Spill (EVOS) Trustee Council, which was set
up to protect and restore habitat and resources that were damaged by the nation's worst-
ever environmental disaster. The Council has recently purchased large chunks of critical
salmon habitat in Kachemak Bay and Seal Bay (on Afognak Island), and is now considering
purchasing coastal habitat near Cordova on Prince William Sound (Alaska Center for the
Environment 1993).

Lower Cook Inlet fishers should realize that there is more than one way to
boost per capita incomes in the seine fleet. Instead of trying to produce more and more
fish by means of costly salmon enhancement, commercial fishers could take a smaller-is-
better approach and reduce the number of permit-holders in the fishery through a state-
funded permit buyback program. Currently, there are 82 permit-holders in the lower
Cook Inlet seine fleet. That number should be reduced to about 50, the same number that
existed when limited-entry first went into effect in 1975 (Bucher and Hammarstrom 1993, 97).
This action alone would probably eliminate the need for the Paint River enhancement
project. A similar buyback program was recently implemented in the Canadian Province
of Newfoundland in an effort to save dwindling Atlantic salmon stocks (Poole 1993, 24).
To date, over 60% of the commercial salmon fishers in Labrador and 96% of the fishers on
the island of Newfoundland have accepted the government's offer of $50,000 to hang up
their nets.

There are still other means of boosting incomes among lower Cook Inlet
salmon fishers. One of the greatest problems that lower Cook Inlet fishers have always
faced is the lack of competitive bidding due to the presence of only one major fish buyer
(Icicle Seafoods) in Homer. Instead of having every fisher in the seine fleet competing for
a small number of salmon, as is the present situation, fishers could form cooperatives
where only a portion of the fleet harvests salmon while others are freed up to develop
value-added products such as smoked salmon (which sells for up to 30 times the price of
whole fresh salmon) and find specialized markets for them. Another promising
alternative for commercial fishers is to convert their seine vessels to charter boats. A
growing number of charter boat captains operating out of Homer make upwards of $1,000 a
day taking tourists on wildlife tours in Kachemak Bay and halibut fishing in the Gulf of
Alaska. In the final analysis, lower Cook Inlet commercial fishers' livelihoods will change
in the coming years regardless of whether salmon enhancement is allowed to continue at
the current pace. These changes will come not from efforts to restore wild salmon runs to
their former levels, but because salmon production from aquaculture has boomed off the
coasts of countries where wild runs no longer flourish, providing consumers with
hatchery-bred fish that are less expensive, more uniformly-sized, and of higher quality
than native stocks due to their year-round availability. Sadly but inevitably, the surging tide of modern industrialism has swept up the small-time Alaskan salmon fisher just as it has the grizzly bear and the wild salmon, and brought them all one step closer to the verge of extinction.
Before I started writing this paper, when in my heart I was still more a commercial fisher than someone trying to see through grizzlies' eyes, I sincerely wanted to believe that salmon enhancement on the Paint River could be compatible with protecting bears along the McNeil. Like most commercial fishers, I was convinced to think that more salmon runs would mean more bears, and more bears would make for a healthier ecosystem. Back then, I never stopped to think that there might be more to a good fishery than lots of fish. The seine fleet was struggling just to keep from going under, and it made no difference to me whether a salmon was wild or hatchery-bred so long as it ended up in a fisher's net, preferably ours. For the fishing families I had become a part of, an entire way of life hung in the balance. In the end, I had to leave Alaska and return to my home in western Montana to realize what was at stake along the Paint River.

At the time of the Lewis and Clark expedition in the early 1800's, perhaps 100,000 grizzlies roamed throughout the western United States (US Fish and Wildlife Service 1982, 9). Their range stretched from the Great Plains west to the Pacific coast, and from the Arctic circle south into Mexico's Sierra Madres (US Fish and Wildlife Service 1990, 4). Today, grizzly bears are considered a threatened species in every state but Alaska, and occupy a mere 2% of their former range. The only two places left in the lower
48 states that support viable populations of grizzly bears are the Northern Continental Divide and Greater Yellowstone Ecosystems. Between those places an estimated 600-700 bears remain (Craighead 1979, 4), but that number is ever-shrinking due to the combined effects of poaching, accidental kills, livestock depredation control, clearcut-logging, roadbuilding, mining, oil drilling, and other development. In late October 1993, big-game hunters in western Montana twice shot and killed grizzly bears in defense of life and property. One of the bears, who was gunned down in the Gallatin Canyon just north of Yellowstone, had four two year-old cubs with her (Missoulian 1993a, 2[B]). Two days later, a radio-collared adult female grizzly bear was found dead in the Swan Mountains south of Glacier National Park (Missoulian 1993b, 1[B]). Hence, potentially 1% of the lower 48 grizzly population was lost in a single week.

Meanwhile, wild salmon populations in the Pacific Northwest states have plummeted by 98% since the turn of the century due to overfishing, dam-building, old-growth logging, agricultural development, overgrazing of rangelands, mining, and urban expansion (Nehlsen et al. 1991). Of the 16 million salmon and steelhead that once ran the rivers of the Columbia system, possibly 2.5 million remain, and only about 300,000 of those are wild fish. The rest are raised and bred in hatcheries. Sockeye and chinook runs that once numbered in the hundreds of thousands in Idaho's Snake River system are now so small biologists count salmon returns on a single hand. For all intents and purposes, both grizzly bears and wild salmon have vanished from the American West. Alaska is where they will make their last stand.

Many Alaskans resent outsiders like myself who come north telling them what they should and should not do with the land and natural resources they consider theirs. And their feelings are understandable. After all, we in the lower 48 states have tamed or destroyed nearly all of the wild country here in less than three human lifetimes, yet somehow we feel qualified to tell Alaskans how to save their state from themselves. By
and large, we have failed miserably in our efforts to develop economically while maintaining intact ecosystems and healthy wildlife populations. Hence, we now have a situation where there are ten times more grizzly bears and wild salmon on the Alaska Peninsula alone than in the entire lower 48 states. On the other hand, there exists amongst many Alaskans an extreme degree of denial when it comes to the ill-effects of large-scale development. Such an attitude leads many Alaskans to think that they have limitless natural resources that exist in a boundless wilderness full of inexhaustible wildlife. It is this denial that blinds many Alaskans into thinking that endeavors like the Paint River project can occur without causing irretrievable losses. As shown by this paper, they cannot.

There are those in the scientific and environmental communities who believe that wildlife-viewing programs such as McNeil's are the key to saving animals that are fast disappearing from our even faster-disappearing wildlands. According to McNeil Sanctuary manager Larry Aumiller:

Alaska is no different than anywhere else; we're just in a different stage of evolution. Growth is real, no matter the rate at which it occurs. Given enough time, the effects of growth reach some level that has irreversible impact. Those areas that are earmarked for certain use, like McNeil, have the highest potential to remain until the last. But eventually they could go. They can't exist as islands (Walker and Aumiller 1993, 147).

To a certain extent, wildlife viewing areas like McNeil do indeed serve a valuable purpose. While few members of the general public are willing to rescue a "man-eating beast" from the slide towards extinction, many are eager to preserve an intelligent and beautiful animal that embodies the American wilderness. And that is what McNeil does so well. It changes peoples' perceptions about bears. In the twenty years since the permit system was instituted in 1973, nearly 4000 visitors have journeyed to the McNeil River to see the annual gathering of bears. Most, say Larry Aumiller, have said it was the
most rewarding wildlife-viewing experience in their life. Some have said it was the most
moving and rewarding experience of any kind in their life (Larry Aumiller, letter to Corps
of Engineers, August 1991, 8). If nothing else, McNeil has bought precious time for bears
while our society has evolved ever so slowly towards a more biocentric perspective.

Many people, myself included, remain unconvinced that any place where
there are humans can be good for the bears that live there, and question whether McNeil is
a sanctuary in the truest sense of the word. According to Canadian bear biologist Stephen
Herrero:

In learning to co-exist with black and grizzly bears, we will need to
develop not only more efficient resource and people management, but we shall also
have to change some of our attitudes and expectations. Wild bears should not be
regarded as our friends. They are too dangerous and too powerful to semi-tame.
They exist in a world of their own where biological evolution has left them adapted
to survive the vicissitudes of nature but not some of the ways of man... Mutual
avoidance, which in human terms means mutual respect, is a desirable end state
(Herrero 1985, 260).

Following a lifetime researching brown bears on southeast Alaska's Admiralty Island,
biologist Frank Dufresne lamented the grizzly bear's only sin "is that it has not learned to
be afraid of us, like other animals (Dufresne 1991, 232)." Indeed, in almost every
instance where bears have lost their fear of humans, be it in Kodiak, Katmai, Yellowstone,
or Glacier; those bears have eventually died from hunters' or park rangers' bullets
(Herrero 1985).

When envisioning the ideal sanctuary for bears, I think of a place high in
the Mission Mountain Tribal Wilderness of western Montana. Every summer, grizzly bears
from miles around congregate on the summit of 9820-foot McDonald Peak to feed on masses
of protein-rich ladybugs and army cutworm moths. It is the highest point in the Mission
Mountains, and on a clear day you can see deep into the bear-infested mountains of
Alberta and British Columbia and imagine the Arctic coast a thousand miles beyond. Out
of reverence for the "great bear", the Flathead Indian tribe closes McDonald Peak to hikers from June-October. Not only can you not climb to the peak during those months, you cannot even set foot on the entire mountain. The McDonald Peak closure is an example of the type of selfless wildlife conservation that has the best chance of saving vanishing species. It is a tribute to human self-restraint. What I am saying is that if it is bears we are really concerned about at McNeil, the best single thing we could do to help them is to leave them alone.

Nonetheless, it would be foolish to think that wildlife-viewing programs or island sanctuaries alone can save bears and other vanishing creatures. As noted earlier, habitat degradation in the forms of massive clearcut logging, oil and gas development, mining, ocean pollution, overfishing by factory trawlers and foreign driftnetters, and tourist development threaten bears far more than do small-time salmon fishers or trophy hunters. Now that the Prudhoe Bay oil fields have begun to dry up, the Hickel Administration and other pro-development forces in Alaska have made it their mission to find new ways to keep money flowing into state and corporate coffers. Since he was elected into office in 1990, Governor Hickel has proposed to drill for oil in the Arctic National Wildlife Refuge, construct an 800-mile natural gas pipeline across the Alaskan interior, punch a new highway through the vast wilderness between Anchorage and Bristol Bay, and divert fresh water from the Yukon River south to California via a giant underwater pipeline. Meanwhile, multinational and Native corporations continue to level the old-growth forests of Afognak Island, the outer Kenai Peninsula, Prince William Sound, and much of southeast Alaska at an astonishing rate. It is not premature to say that if current trends continue, there will soon be no more places even in Alaska for grizzlies or salmon to hide.

The Paint River conflict should teach Alaskans and others several paradigm-shifting lessons. 1) It is impossible to alter one component of an ecosystem
without also affecting all the others. Contrary to the Corps' findings, brown bears, marine mammals, seabirds, native freshwater fishes, and adjacent wild salmon runs will all suffer direct or indirect effects if major salmon runs develop in the Paint River system.

Endeavors like the Paint River project must be assessed not only for their direct effects, but for their indirect, cumulative, and long-term impacts as well. 2) Multiple-use is not always possible in some areas. Most of the clashes that have occurred in the McNeil Sanctuary during the past two decades have arisen because different state agencies in Alaska have promoted conflicting uses in the region. In short, wildlife preservation, trophy hunting, and the development of a major new commercial salmon fishery are not compatible goals in the area of the McNeil River. Brown bears, for whom the area is primarily managed, simply cannot tolerate high levels of human activity. 3) There are limits to what humans can do to improve the productivity of natural systems. Contrary to what commercial fishers have been told, large-scale fisheries enhancement will not result in healthier salmon fisheries. In fact, most studies have shown that in the long run, enhancement ends up hurting fisheries by destroying self-sustaining wild runs and replacing them with more costly and less productive hatchery fish. Rejecting the Paint River project should not be construed to mean commercial fishers have no place in Kamishak Bay. It simply means they should play with the cards nature dealt them. 4) When it comes to sustainable economic development, more is not always better. Despite a significant increase in enhancement activity in lower Cook Inlet during the past decade, net per-capita incomes in the seine fleet have not risen. In fact, they have declined due to a combination of poor salmon returns, falling fish prices, and overcapitalization. 5) Finally, conflicts involving environmentalists and those who earn a living off natural resources should not cause the parties involved to lose sight of underlying and even greater problems that give them a powerful common interest. In this particular case, it is the rapid disappearance of wildlands habitat. If Alaska is to be saved from the same
forces that plundered the lower 48 states, environmentalists and commercial fishers must quickly put aside past differences and join forces. In the final analysis, if the Paint River project and projects like it are allowed to proceed, both wildlife and humans will end up paying an unbearable price.

Dusk, McNeil Camp, August 1992. Gale warning. Sixty-knot winds and horizontal rain buffet the surrounding hillsides as the first major storm of the fall season strikes Kamishak Bay with a vengeance. Looking out past Nordyke Island there is nothing but a sea of grey and an endless procession of exploding whitecaps. I think back to last spring when I was here fishing for Mikfik sockeyes. The images of still-frozen mountains, midnight sun, and early morning seawater numbing my fingers flood my mind as the advancing army of waves pounds volcanic rock into fine sand and sea mist. For now, I am trapped in the cookshack drinking hot tea as the wooden walls around me creak and groan and bend.

Rather than staying in the warmth of the cabin all day I left camp just before low tide this morning and hiked along the narrow strip of beach bordering McNeil Head. As I worked my way around piles of driftwood strewn with trawl net and neon pink fishing buoys, I wondered what role, if any, humans have in desolate places like this one. Have commercial fishers and wildlife photographers earned the rights of citizenship in this ecosystem or are they simply mercenaries who come here to mine the river for its salmon and bears? I pondered the questions hard, and concluded that if each group cared as deeply about the resource as Dave Blossom and Larry Aumiller do, they would indeed have a place here. But for many, long-held beliefs are too hard to abandon. And in the end I decide that this piece of earth should be set aside primarily as the domain of bears and wild salmon.

I harbor no illusions that we can ever return to a life in the wilderness. The frontier we once viewed as endless closed a long time ago, even in Alaska. With the
coming of high-tech fishing boats, spotter planes, geodesic dome tents, and gore-tex parkas we have even further detached ourselves from wild nature. So the question that remains is, can humans even visit magnificent places like this one without tearing away at the integrity of the ecosystem? Can we learn to harvest only that which nature can itself replenish, or must we continue in our futile efforts to play God here? In his visionary essay, The Land Ethic, Aldo Leopold writes, "A land ethic changes the role of Homo sapiens from conquerer of the land community to plain member and citizen of it. It implies respect for his fellow members, and also respect for the community as such." If bears and humans are to have a chance here, we must strive to maintain an environment that can support both species.

Looking out onto the steel-grey water I feel sorry for any seiners who might be left scrap-fishing for late-run chums and silvers, yet I feel sorrier still knowing that there are so few fish returning this year. It will be a hard winter for both commercial fishers and their families and bears. Only now do I fully realize how the salmon binds the fates of the two. The sea is now a windswept froth, with waves blowing up into the swirling cobalt clouds above before they have a chance to break and release their energy. A cold wind blowing down from the Chigmit Mountains signals a changing of the seasons. It is time for humans to leave this place, time for the big bears to roam free again.
APPENDIX
### Appendix 1. Estimated densities of *Ursus arctos* in selected areas.

<table>
<thead>
<tr>
<th>Location</th>
<th>km²/bear</th>
<th>mi²/bear</th>
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<tr>
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<td>6.4</td>
<td>Ostroumov (1968) as cited in Kistchinskii 1972</td>
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<td>88.4</td>
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*Column added*

**Editor's Note:** Differences in densities between areas may actually result from differences in study methods, length and depth of study, seasonality, etc but they are indications of the productivity of the respective areas.
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source: Alaska Department of Fish and Game


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<th>Chum</th>
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*Average prices are determined only from fish ticket information and do not reflect any retroactive or postseason adjustments.

source: Alaska Department of Fish and Game
McNEIL SANCTUARY ESCAPEMENTS

GOAL - 30,000 CHUMS AND 6,000 REDS

source: Alaska Department of Fish and Game

PROJECTED PAINT R. SALMON ESCAPEMENTS

DATA PROVIDED BY CIAA

Appendix 12. Kamishak Bay special harvest areas with Paint River special harvest area identified.

<table>
<thead>
<tr>
<th>Year</th>
<th>&quot;McNeil&quot; Refuge</th>
<th>Amakdedori</th>
<th>Kamishak &amp; Douglas</th>
<th>Battle &amp; Kukaklek</th>
<th>Kulik &amp; Nonvianuk</th>
<th>East Iliamna</th>
<th>Total</th>
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* Preliminary
** Season Closed

Source: Alaska Department of Fish and Game

We spawn success – one fish at a time.

Cook Inlet Aquaculture Association produced a return of 790 thousand adult salmon in 1991. More than 500 thousand of those were harvested by Cook Inlet fishermen who made over $2.6 million from an investment of only $1.5 million. That's what we call success. And it's only going to get better.

An investment with a high return.

Cook Inlet Aquaculture Association is investing in the future by continuing to bring Cook Inlet hatchery projects to maturity -- projects like Coal Creek, Chelatna Lake and Eklutna. As a result, Cook Inlet fishermen will make in excess of $20 million over the next five years harvesting CIAA produced salmon. That's a return that benefits everyone.
Appendix 15. Survival trends of sockeye salmon (*O. nerka*) from Babine Lake, British Columbia. As enhancement increased the total number of smolts leaving Babine Lake, the survival of returning adults declined dramatically. Data from McDonald and Hume (1984).
LITERATURE CITED


Alaska Contractor. 1992. Paint River fish ladder: Can a good project go bad?


Bucher, Wesley, Alaska Department of Fish and Game, Lower Cook Inlet Area Commercial Fish Biologist. Interview by author. 2 September 1992.


