

**STATUS OF
BROWN BEARS AND
OTHER NATURAL RESOURCES IN THE
McNEIL RIVER STATE GAME SANCTUARY AND REFUGE
IN 2006**

ANNUAL REPORT TO
THE ALASKA STATE LEGISLATURE

Submitted by: Denby S. Lloyd, Commissioner

Prepared by: Lands and Refuges Program
Division of Wildlife Conservation
Alaska Department of Fish and Game

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EXECUTIVE SUMMARY

The McNeil River State Game Sanctuary and State Game Refuge were created by the Alaska State Legislature in 1967 and 1991, respectively. The *sanctuary* was established primarily to provide permanent protection for brown bears and other fish and wildlife populations and their habitats and to maintain and enhance the unique bear-viewing opportunities within the sanctuary. The *refuge* was established for similar reasons and human use in the refuge is managed to maintain and enhance the bear-viewing opportunities within the adjoining sanctuary.

The sanctuary supports the largest gathering of brown bears in the world as they congregate to feed on migrating salmon. The Alaska Department of Fish and Game operates a world-renowned bear-viewing and photography program in the sanctuary at McNeil River and nearby Mikfik Creek. This report provides a summary of the status of brown bears and other fish and wildlife resources within the sanctuary and refuge, the effects of fishing and fishery enhancement activities on these resources, land status and management issues, and known public use.

As many as 144 individual bears have been observed along McNeil River during summer and as many as 72 bears have been seen at one time at McNeil River Falls, the primary bear gathering and viewing location. While the number of bears at McNeil River has increased over the past two years, it had declined significantly since 1998 and remains well below the level identified by sanctuary managers necessary to maintain the quality of the bear-viewing program.

One factor likely contributing to the decline is the long-term trend of low chum salmon returns to McNeil River. Chum salmon escapement in 2006 achieved the established range for the second consecutive season but only the fifth time in the past 17 seasons. Compounding the low salmon escapement in McNeil River, nearby systems have experienced relatively good returns of chum and sockeye salmon over the past seven seasons, which potentially drew bears away from the McNeil River system in search of a more abundant food source; however, these relationships are not well understood. Also not well understood are the effects of the brown bear harvest outside the sanctuary on bear use at McNeil River. Harvest levels have increased above historic levels since the 1999 regulatory year.

The bear-viewing program at McNeil River again attracted people from around the world in 2006 and 783 people applied for the 185 regular permits and 57 standby permits selected by lottery. During 2006, 183 people participated in the sanctuary's bear-viewing program, which included lottery winners and Special Access Permit holders. The permit program generated \$67,450 in 2006 that was deposited into the state's Fish and Game Fund.

Land use permits were issued to several commercial sport-fishing guides for camps and boat storage on the Kamishak River, for a commercial bear viewing camp on Chenik Lake, for a Department sponsored archeological survey of the McNeil River camp area, and several other research and monitoring programs.

I. INTRODUCTION

McNeil River, located in southwestern Alaska (Figure 1) supports the world's largest concentration of brown bears. The Alaska State Legislature established the McNeil River State Game *Sanctuary* in 1967 to: (1) provide permanent protection for brown bears 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 permanent protection of brown bears and other purposes described in (1) and to maintain and enhance the unique bear-viewing opportunities within the sanctuary; and (3) provide opportunities that are compatible with (1) for wildlife viewing, fisheries enhancement, fishing, temporary safe anchorage, and other activities (AS 16.20.162(a)). Hunting, trapping and mineral entry are prohibited in the sanctuary.

The sanctuary was expanded and the adjoining McNeil River State Game *Refuge* was created in 1991; however, implementation of this legislation was delayed until January 1993 when the Commissioner of the Department of Fish and Game (the Department) certified the newly constructed Paint River fish ladder as operational. The refuge was created for purposes similar to those of the sanctuary; however, hunting and trapping were allowed to continue in the refuge at the discretion of the Alaska Board of Game (BOG) (AS 16.20.041). Additionally, human use in the refuge is managed to maintain and enhance the unique bear-viewing opportunities within the adjoining sanctuary and mineral entry in the refuge is permitted.

This report is submitted annually to the Alaska State Legislature by the Commissioner of the Department as required by the sanctuary and refuge enabling legislation (AS 16.20.041(f) and AS 16.20.162(f), respectively). This report provides a summary of the status of brown bears and other fish and wildlife resources within the sanctuary and refuge, the effects of fishing and fishery enhancement activities on these resources, land status and management issues, and known public use.

II. STATUS OF BROWN BEARS

Monitoring Bear Use

The number of bears at McNeil River Falls fluctuates daily and annually. Variability in bear use may be influenced by several factors including: food availability, the strength and timing of salmon runs in McNeil River and in surrounding systems, changes in the regional bear population, hunting and other human-caused mortalities. A public advisory committee assisted the Department with the development of the sanctuary and refuge operational management plans in 1993 and concluded that managers needed a consistent and reliable method for monitoring the fluctuations in the number of bears at McNeil River Falls. This information allows for the proper management of the sanctuary in accordance with its legislative purposes. There are three different methods used to monitor bear use at McNeil River: index counts (average highest counts at McNeil River Falls), individual counts (minimum number of different bears observed during the season), and bear use days (sum of individual bears and the number of days each was present).

Index Counts- This monitoring program detects large, short-term declines or gradual, long-term declines in the average number of independent bears (not including cubs) at McNeil River Falls and includes a “bear threshold criterion,” which represents a statistically significant lower level in the observed number of bears. A decline below this “criterion” may result in adverse impacts to the purposes for which the sanctuary was established and would initiate an assessment of the possible causes.

This monitoring program involves counting all bears in view once each hour at McNeil River Falls from early July through early August and during the viewing period of approximately 11:00 a.m. to 7:00 p.m. The number of hourly counts (data points) that occur from year to year is variable due to the changing and opportunistic nature of the daily bear viewing schedule. The annual medians of the seven highest daily counts of bears at the falls from 1983 to 1992 were averaged to establish a standard of 48.6 bears as the benchmark for maintaining bear numbers and the quality viewing opportunities in the sanctuary. The “bear threshold criterion” (40.8 bears) represents the lower limit of these medians.

The highest individual hourly count in 2005 was 24 bears on July 20. In comparison, there were counts in excess of 40 bears on 11 days in 1997 and 1998 when as many as 66 bears were observed at one time (Table 1). The mean of the seven highest hourly counts (the count index) was 19.4 bears in 2005, well below the “bear threshold criterion” of 40.8 bears. This represents the lowest count index in the 23 years of monitoring bears at McNeil River Falls and continues the steady decline in the number of bears observed starting in 1998. The highest count indices in past years were 61.0 bears in 1990, 58.0 bears in 1997 and 57.0 bears in 1985; however, these high indices include cubs (Figure 2). Data for the 2006 hourly counts were inadvertently left at McNeil River when the camp was closed for the season. Those data will be included in the Legislative report for the 2007 season.

Individual Counts- A second method of monitoring bear use of the sanctuary and the quality of the bear-viewing program is by tallying the number of individual bears (adults, sub-adults, & cubs) observed by sanctuary staff throughout the season. Using unique identifying marks such as scars, coat color, sex and behavior, each bear visiting the sanctuary has been documented nearly every year since 1976. While this monitoring method only records the presence of an individual bear and not the frequency or amount of time it spends at McNeil River Sanctuary, it provides an additional index in evaluating the overall bear use and the quality of the bear-viewing program.

While the number of individual bears at McNeil River has increased during the past two years (from a 21-year low of 78 in 2004, to 87 in 2005, and 92 in 2006), it continues to remain below the long-term average of 102.5 individuals observed since 1983 (Table 2). It also remains well below the peak number of individual bears (144) observed in 1997. The results of this method of monitoring bear activity mimics the trend observed in the index count method discussed above, and the bear use days monitoring method discussed below.

Bear Use Days- The quality of the bear viewing is not just a matter of the number of bears that visit the area in a season, but also how many days the bears stay in the Sanctuary. This method of monitoring bear use at McNeil River is the annual summation of individual adult and sub-adult bears observed during each bear viewing day June 15 through August 25. One bear or

family group at McNeil River seen during a day is counted as one bear use day. This monitoring method may be less reliable than the *individual counts* and *index counts* discussed above. It represents the minimum bear use days due to count variability among sanctuary staff and variations in the total amount of daily effort. Because the actual amount of daily effort is not collected it is not possible to compare minor yearly variation. Bear Use Days is probably most useful in providing a general year to year comparison of the bear viewing experience relative to the number of bears observed. It is another method that can reflect trends in bear use and it generally correlates with the other methods discussed above (Figure 3). There were 795 bear-use days in 2006 (the third lowest recorded since this monitoring method was established in 1980). This is well below the annual peak of 1,863 use days in 1989 and it is also below the years 1983 through 2002 when bear-use days were well above 1000. The long-term average (since 1983) of bear-use days was 1,290 days.

Sex and Age Composition

Changes in the sex and age composition of a wildlife population can be indicative of other changes in the species' habitat and environment. The sex and age ratios of adult bears using McNeil River have changed in the last several years. While adult males have typically outnumbered adult females, this has become more pronounced in the past 6 years (Figure 4; Table 2). The percentage of adult male bears at the McNeil River increased from a five year (1986-1990) average of 54% to a 5 year (2001-2005) average of 67%. The percentage of adult males in 2006 was 63%.

The number of subadult bears observed in 2006 was 14. This was highest number of subadults recorded since 1988 and the fifth highest recorded since monitoring began in 1976 (Figure 5; Table 2). The highest subadult count was 17 in 1988 and 15 subadults were observed in 1981, 1982, and 1987. In contrast five subadults were observed in 2005 - approximately half of the long-term average of 10 subadults observed since monitoring began. The 2005 observation of five subadults was the second lowest count since observations began and continued a decline starting in 1999. The lowest number of subadults observed was 4 in 2003.

In 2006, there were 8 maternal females and 15 cubs counted at McNeil River (Figure 5; Table 2). While these figures are below the annual averages from the 30-year monitoring period (11.6 maternal females and 23.8 cubs), they are consistent with the decline in family group activity starting in the mid-1980s. The peak number of maternal females observed on the river was 20 in 1996 and the number of cubs on the river peaked at 43 in 1997.

Chenik Creek

While the Department has not conducted standardized surveys of bears in the refuge at Chenik Creek, a commercial bear-viewing company during the summer of 2006 counted a peak number of individual bears of approximately 15 during the July 5-10 period.

Hunting

The sanctuary is closed to hunting by Alaska state statute (AS 16.20.162(b)), and in October 1995, the Alaska Board of Game closed the refuge to brown bear hunting effective July 1996.

The areas south of the sanctuary including Katmai National Park and state-owned lands between the sanctuary and national park (including the Kamishak Special Use Area, managed by the Alaska Department of Natural Resources) are also currently closed to brown bear hunting, the national park by federal regulations and the state-owned lands by Board of Game action. The McNeil River sanctuary and refuge are currently within an area of approximately 5,585 square miles where bears are protected from hunting. However, in March 2005 the Board of Game removed the brown bear hunting closure on state owned lands in the Kamishak Special Use Area (and outside the sanctuary) starting July 1, 2007 (5AAC 92.510(9)(C)).

The harvest of bears marked at McNeil during early studies and observations by sanctuary staff have shown that some bears using McNeil River range throughout the region including areas open to hunting west and north of the sanctuary and refuge. Brown bear hunts on the Alaska Peninsula are currently open during alternate regulatory years with hunts open during the fall of odd-numbered years and the spring of even-numbered years. Historically, brown bear hunts were open every year; therefore, for purposes of this report, harvest for two consecutive regulatory years were combined to make the long term data more comparable. The reported bear harvests from areas surrounding McNeil Sanctuary and Refuge are presented in Figure 6.

Interpretation of data prior to the early 1980s is problematic and the harvest figures are not comparable to those afterwards (Figure 6). The Alaska Peninsula guided bear harvest was just getting started in the 1960s, and compliance related to mandatory sealing was low into the mid-1970s. The harvest database only includes reported harvests and is not indicative of the numbers of bears killed especially prior to the mid-70s. Tighter enforcement of laws around 1974 or 75 reduced unreported harvests and illegal take. The bear population had likely been over-harvested in large areas and greatly reduced by the late-70s. Regional bear populations began a slow recovery when a more conservative management regime was instituted.

The long term average harvest from areas surrounding McNeil River from the period 1980/81 thru 2004/05 is 73 brown bears. Average harvest by decade was 59 in the 1980s, 75 in the 1990s and 96 so far in the 2000s. Starting in 1998 the area saw a large increase in harvest. Two of the highest harvests in these areas were 120 during the combined 1998/99 regulatory years (July 1998 through June 2000) and 111 during the combined 2002/03 regulatory years (July 2002 – June 2004). The harvest during the combined 2004/2005 regulatory years (July 2004 through June 2006) was 88, closer to the long term average. There is no open season during the 2006 regulatory hunt year (July 2006 – June 2007).

Though brown bear harvests have increased since the early 80s, bear densities and hunter interest in the Alaska Peninsula bear population have also apparently increased. The lack of data on the bear population and hunting effort make it difficult to determine the rates at which the population has been harvested. The increase in harvest in recent years is likely due, in part, to the liberalized bear hunting seasons in Game Management Unit 9B (Iliamna Lake area) adopted by the Board of Game in an effort to bolster recruitment into the local moose population and to provide more opportunity for a sustained harvest of this resource.

Based on harvest levels, and the sex and age composition of harvested animals, it appears that legal hunting of bears outside the sanctuary is not significantly affecting the regional bear

population. But it is also unclear to what extent the increasing mortality in these areas may have affected the bear use of McNeil River.

Use Patterns

Although bear numbers were up somewhat in 2006, over the past eight years the brown bear monitoring programs at McNeil River indicate a significant decline in the number of bears and a shift in the sex composition, both of which have influenced the quality of the bear-viewing program at McNeil River. The reasons for these changes are not well understood but do not appear to be influenced by the sanctuary viewing program; sanctuary, refuge, or fisheries management actions; or land use activities in the region. Department staff conducted a preliminary assessment of historic bear-use at McNeil River including overall numbers and changes in sex and age composition, brown bear harvest from surrounding areas, and salmon escapement at McNeil River and surrounding systems. While results suggest some correlations may exist, more in-depth research is needed to better understand the effects that salmon escapement in McNeil River (and nearby drainages) have on McNeil River bears. Likewise, more information is needed to better understand the effects of legal hunting outside the sanctuary on bears at McNeil River.

As discussed in more detail in the *Fisheries* section below, McNeil River has experienced a long-term trend of low chum salmon returns that frequently fail to achieve escapement goals. Observations from the sanctuary indicate low salmon returns will result in a short-term increase in bear-use as they expend more effort and time catching enough fish to meet their nutritional requirements. However, long-term fish shortages will likely alter established use patterns as bears seek alternative sources for salmon or other sources of food. These long-term changes in use patterns appear to have started in 1998 and have continued to date. In addition to the size of the salmon run, the timing of the run also appears to influence the number of bears utilizing McNeil River. An evenly distributed run will generally attract more bears to the falls while a similarly sized run that arrives in a relatively short period will not afford a larger number of bears the opportunity to catch fish, thus they seek food elsewhere.

Observations at McNeil River also indicate that during periods of prolonged salmon shortages, the most dominant bears (generally larger males) occupy the most successful fishing spots and preclude use by less dominant bears. The least dominant bears (subadults and maternal females) typically fish in the less desirable locations downstream of the falls. In this area, they frequently consume partially eaten fish or fish scraps discarded by the more satiated bears upstream. During periods of diminished runs, overall fishing effort is less successful, particularly in the less desirable locations. Additionally, the dominant bears occupying the desired locations typically consume the entire fish, as they are not reaching satiation, leaving no opportunity for scavenging bears downstream. This is a potential reason for the unusually low number of subadults, maternal females and cubs in recent years.

Compounding the chronic low salmon escapements at McNeil River, comparatively strong chum salmon returns throughout Lower Cook Inlet during the past seven years (with the unique exception of the McNeil River system), and exceptionally large sockeye salmon returns to some nearby Bristol Bay drainages, may also be contributing to the decline in bear use by attracting bears away from McNeil River.

Based on the Department's review of fisheries escapements at McNeil River, and considering that commercial harvest of chum salmon in the McNeil River Subdistrict has been negligible for the past 13 years (and has been closed for the duration of the chum salmon return during every season since 1997), staff determined that changes in commercial fisheries activities were not warranted. Management actions such as artificial enhancement of the chum salmon population were also considered. However, sanctuary managers felt that these actions would have minimal or no affect on the McNeil River bear population or, in the case of fisheries enhancement, would not be feasible nor would it be consistent with management goals of the sanctuary. Managers did feel that further study of the McNeil River chum salmon spawning habitat and other parameters would assist in the future management of these resources and the sanctuary. This study was initiated in 2003 with a spawning habitat assessment. A chum salmon life history study was initiated in 2005 and was completed in 2006 (see *Fisheries* section below).

III. WILDLIFE OBSERVATIONS

One new mammal species was observed at McNeil River Sanctuary in 2006. A red squirrel was observed on the head between Akjemguiga Cove and McNeil Cove. Caspian Terns which were first observed in the sanctuary in 2005 were often observed in the vicinity of McNeil Spit and lower McNeil River.

A male cub of the year was found dead below the bluff on the west side of the Mikfik sedge flats on July 14, 2006. The cub had several injuries. The injuries included: a broken neck, severed spinal column, a punctured cranium, a broken and dislocated right femur, and a tear wound through the stomach cavity that pierced the kidney and bowel. It also had several contusions and breaks in the skin. The cub was observed with its' mother and siblings the previous evening.

IV. FISHERIES

Commercial Fisheries

The cumulative Mikfik Creek sockeye salmon escapement index for 2006 was 17,700 fish while the McNeil River chum salmon escapement was estimated at 28,176 fish (Table 3). Minimal commercial fishing effort targeting sockeyes in the McNeil River Subdistrict this season resulted in the harvest of 1,300 fish, while the subdistrict was closed for the duration of the chum return. Consequently, nearly all of the Mikfik Creek sockeye run, and the entire McNeil River chum return, entered their respective drainages to spawn. The 2006 Mikfik Creek estimated escapement of almost 18,000 sockeyes was about 45% (or 5,500 fish) greater than the upper end of the sustainable escapement goal (SEG) range of 6,300 - 12,150 sockeyes.

This season was the eighteenth consecutive year the McNeil River chum salmon run failed to produce a significant harvestable surplus. However, chum salmon escapement achieved the established SEG range of 14,000 – 26,000 chums for the second consecutive season but only the fifth time in the past 17 seasons (Figure 7). In a continuing recent trend, chum returns to the nearby Big and Little Kamishak Rivers and Bruin Bay River were relatively strong, while chum

returns to more northerly Kamishak Bay systems between Ursus Cove and the northern limits of the district were also once again quite strong in 2006. In addition, for the seventh successive season, commercial fishing effort directed at chum salmon occurred in the Kamishak Bay District, primarily in the northern portion of the district at Cottonwood/Iliamna Subdistrict, resulting in a district-wide harvest of nearly 57,000 fish, the fifth highest total for the district since 1988.

The number of spawning chum salmon documented upstream of McNeil River Falls in 2006 was similar to the previous two seasons and represents a considerable improvement over the preceding 11 years. Fish were consistently seen above the falls during aerial observations this season, beginning with the third survey on June 27. A peak daily count of just under 1,500 fish upstream of McNeil River Falls occurred on July 17.

Post-season evaluation indicated that run timing was conspicuously late for the Mikfik sockeye salmon run, while that of McNeil River chums seemed close to normal in arrival but peaked later than usual. The three different methods used to derive the total McNeil River chum escapement index yielded mixed results: 1) the historic mean run timing curve, used to extrapolate the "tail" of the run after the last (August 8) survey, produced a cumulative total of 23,500 fish; 2) the preferred method (calculates area under the curve assuming a 17.5-day stream life factor), now used to estimate escapements for most pink and chum streams in Lower Cook Inlet, resulted in a cumulative estimate of 28,176 chums; and 3) simple accumulation of daily counts, made after the first observed peak on July 10, resulted in an estimate of 30,300 chums. The second method has been adopted as the standard methodology for generating escapement indices in Lower Cook Inlet. Another method for estimating escapements, using a video camera attached to a digital video recorder to record the video images (see below), was used at Mikfik Creek/Lake again this season.

Mikfik Creek Video Research

A remote video escapement recorder (RVER) was installed at the outlet of Mikfik Lake for the eighth consecutive season. This project has already proven invaluable to both in season and post-season fisheries management and research in Lower Cook Inlet, demonstrating that remote video and time-lapse recording technology has the capability to largely supplant aerial surveys as a means for collecting escapement data on small clear streams that do not warrant the expense of weirs or sonar.

When originally configured eight years ago, the Mikfik video system consisted of a single remote video camera and a time-lapse videocassette recorder (VCR) logging one frame per second onto analog VHS tapes. While this system produced images of sufficient quality to facilitate reliable fish counts, it had shortcomings. Weekly flights were necessary to refresh videotapes, the analog tapes were fragile and cumbersome to review, and tracking individual fish was difficult at one frame per second. The next evolution of the Mikfik system, used from 2002 through 2005, recorded up to five digital frames per second and stored the images on a computer hard drive. However, relatively high power consumption by the computer resulted in recording downtime and has led to the development of alternative equipment. The new setup, implemented at Mikfik Creek in 2006, uses a time-lapse digital video recorder (DVR) in place of the personal computer. The new configuration completely overcomes the power issues affecting the

computer-based version. Additionally, in order to facilitate near real-time escapement monitoring and eventually reduce the number of flights necessary to maintain the system, transmission of recorded images via satellite back to Homer on a daily basis has also been tested with mixed success in recent years. The Department believes these problems can be successfully resolved and plans to continue the development of this promising technology, ultimately incorporating it into the Mikfik remote recording system.

In 2006, the video system at Mikfik Creek/Lake was powered up on June 17 and shut down on July 10. The system operated continuously during daylight hours (~ 20 hrs/d) and successfully recorded images 100% of the time that it was programmed to operate. Digital images were recorded locally onto a hot-swappable hard drive able to record about 28 days of video.

As was the case in 2001 and 2003 - 2005, a single camera mounted on the original (north bank) light pole, was used to collect all video images of fish passage in 2006. After experimenting with several configurations, recordings were made using a compression rate of five frames per second. The resulting image quality was excellent. Fish were very easy to see, and the new DVR facilitated efficient and convenient video review to estimate escapement. Upon preliminary review of the images collected at Mikfik Creek, 14,983 sockeye salmon were counted, representing approximately 2,717 fewer fish than were estimated by aerial surveys. The video-based estimate should be considered conservative, because the system is not designed to count fish during hours of darkness. To remain consistent with the historical Mikfik Creek database, aerial survey data was once again chosen to generate the 2006 spawning escapement index.

One advantage of using a remote video counting tower to count salmon escapement at Mikfik Creek is the opportunity to incidentally monitor other wildlife in the area. Video reviewers documented 12 instances where brown bears transited the field of view of the camera, with a peak of four bears recorded on July 2. Other wildlife observed included moose, beavers and river otters.

Sport Fishing

Limited sport fishing occurs in McNeil Lagoon and Chenik Creek and is incidental to bear-viewing activities. The only area in the sanctuary that attracts significant sport fishing interest is on the Kamishak River and, to a lesser extent, the Little Kamishak River and its tributary, Strike Creek. Due to the small number of anglers that fish in the Kamishak River relative to more accessible locations in Alaska, the annual survey of sport anglers conducted by the Division of Sport Fish does not accurately portray angler effort, catch or harvest in this area. Seven Bristol Bay area lodges operated in the area during summer and, as a condition of their sanctuary access permits, are required to report their sport fishing activities. Their reports are thought to better reflect the level of angler activity in the area (Table 5).

These lodges brought a minimum of 292 visitors to the sanctuary who sport fished; however, wildlife viewing, primarily brown bears, was a significant part of their activities. These anglers reported catching 6,343 fish, of which 45% were Dolly Varden and 38% were coho salmon. Nearly all Dolly Varden were released as were most pink and chum salmon. Eighty-seven percent of coho salmon were also released.

Fisheries Research

The Department hired a graduate student intern in 2005 to begin conducting a two year radio telemetry project on McNeil River chum salmon to estimate freshwater streamlife, document spawning distribution and estimate predation by bears. Because the number of pre-spawning chum salmon killed by brown bears is much greater at McNeil River than other streams, the Department wants to determine the average freshwater residency of chum salmon at McNeil River in order to improve the accuracy of total escapement indices derived by aerial survey. This project will likely result in the development of a new sustainable escapement goal (SEG) for McNeil River chum salmon that more accurately reflects the high rate of in-river predation that occurs there.

Two remote data logging stations were installed in June 2006, one at the tip of McNeil spit and one approximately 300 m above McNeil Falls. Approximately 70 radio tags were deployed between June 24 and July 28. Each tag was outfitted with a mortality sensor to indicate when fish died. Tags that were recovered from dead fish were redeployed in season, resulting in a total of 95 chum salmon being tagged. The movements and lifespan of tagged chum salmon were monitored by a combination of the remote data logging stations, radio telemetry flights, and daily manual tracking between the spit and McNeil Falls. The graduate intern successfully concluded the field portion of this project in August 2006 and has begun working up the telemetry data. More detailed results from this study will be forthcoming with the completion of the student's Master's Thesis in spring 2007.

Fisheries Enhancement

Fisheries enhancement continues to play a major role in Lower Cook Inlet salmon production and commercial harvests. The results of enhancement and rehabilitation of the Kamishak Bay District sockeye stocks have, at times in the past, made significant contributions to commercial salmon harvests. In 2006, no sockeye salmon were documented via aerial observation near the mouth of the Paint River, located approximately two miles north of McNeil River. The Paint River Lakes were first stocked with sockeye salmon fry in 1986 in an effort to develop a new sockeye salmon return to this salmon-barren drainage, which is blocked to upstream fish migration by a steep waterfall at tidewater. From 1991 to 1996, approximately 600,000-750,000 sockeye salmon fry were stocked annually in the Paint River Lakes. Although construction of the Paint River fish ladder was completed in October 1991, the number of returning adult sockeye salmon has only ranged from 30 (in 2000) to 2,000 (in 2005). Consequently, the structure has never been opened to allow fish passage upstream through the ladder.

Although the Paint River sockeye stocking project was formally suspended after the 1996 season, the Cook Inlet Aquaculture Association (CIAA) experimentally stocked Upper Paint Lake in early October 2002 with 536,000 sockeye fry/pre-smolts. An amendment to the 2002 Trail Lakes Hatchery Annual Management Plan granted the aquaculture association authorization for a one-time release of juveniles that were surplus to the 2002 Annual Management Plan stocking schedule.

V. LAND STATUS/USE

Land Use Permitting

Kamishak River- Seven lodges in the Bristol Bay region operated sport fishing and wildlife viewing operations on the Kamishak River within the sanctuary and adjacent Katmai National Park in 2006. The lodges stored riverboats on the lower reaches of the river and three of the lodges operated a guide camp at this location. These activities are managed through Special Area Permits and Access Permits issued by the Department, and Land Use Permits issued by the Department of Natural Resources. This area is also part of the Kamishak Special Use Area, which is managed by the Department of Natural Resources. Concerns about conflicting permit and management requirements on the Kamishak River between the Department, the Alaska Department of Natural Resources and the National Park Service have been mostly alleviated by coordinating permit requirements and by jointly addressing management concerns and conducting joint field visits.

The area will continue to be monitored for permit compliance and identification of possible impacts to the sanctuary. The primary management concern is the food-conditioning of Kamishak River bears, which also visit Mikfik Creek and McNeil River. Food-conditioning of bears would not be consistent with the purposes for which the sanctuary was established and would jeopardize the bear-viewing program at McNeil River. Additionally, concerns have been expressed about overcrowding, boating safety and impacts to the fisheries, bears and other resources on the Kamishak River. Several operators and guides have suggested that visitor limitations be placed on this area.

Chenik Creek- One commercial bear viewing operator obtained a Special Area Permit for a camp near the outlet of Chenik Lake for the purpose of bear viewing along Chenik Creek. The camp was occupied from July 5-10.

Archeological Survey- As part of a cooperative archeological survey of the McNeil River area, a National Park Service archeologist collected "charcoal" samples from pre-historic house pit sites for carbon dating. Samples were collected from sites on the bluff above the McNeil River/Mikfik Creek confluence, from the beach berm just east of the McNeil River camp, and from the McNeil River campground.

Other Land Uses- Several ongoing land use permits were in effect during 2006 and included: camp facilities at McNeil River, remote Internet camera placement at McNeil River Falls, fisheries remote video camera at Mikfik Creek/Lake, fisheries research cabin at Chenik Lake, and a GPS recording station in the refuge.

Air charter services periodically land on Chenik Lake, Paint River Lakes, Mikfik Lake, and other water bodies with the sanctuary and refuge when waiting on weather and scheduling issues.

Chenik Lodge- The facilities that formerly comprised the *Chenik Wilderness Lodge* located near Chenik Head in the refuge came under state ownership in October 2003 when 6,871 acres of federally owned land were conveyed from the Bureau of Land Management to the State of Alaska and incorporated into the refuge. With this land transfer, the state assumed ownership of

the unauthorized facility as the former owner had relinquished all interest in this site. In January 2005, the Department removed the facilities including the main lodge, three guest cabins and other support buildings and structures.

In May 2006, the Department conducted additional “mop-up” operations at the lodge site and removed tons of metal roofing, PVC pipe, wood pilings, and a variety of garbage. The debris was hauled by ship to Homer. One tent platform remains at the site and other debris still remain, however.

VI. SANCTUARY MANAGEMENT

Staff

Sanctuary Manager Doug Hill, previously the manager of Redoubt Bay Critical Habitat Area logged his first season at McNeil River. Tom Griffin (assistant Sanctuary Manager) returned for his seventh season; Polly Hessing (Wildlife Technician) who worked for the sanctuary in 1984-1987, 1995-1998, and 2005 returned for her tenth season. Josh Peirce (Graduate Intern) and Kelly Peirce (Volunteer) conducted their second year of research on McNeil River chum salmon.

VII. PUBLIC USE

McNeil River Falls/Mikfik Creek

Public use and access to the sanctuary, with the exception of the McNeil Cove spit and beach, requires an access permit from the Department (5 AAC 92.065). Since 1973, bear-viewing at established sites on McNeil River and nearby Mikfik Creek has been limited to ten people daily between June 7 and August 25, and Viewing Access Permits for this period are issued by lottery. Currently, 185 regular permits (Guided Viewing Access Permits) and 57 standby permits (Camp-Standby Viewing Access Permits) are issued in the lottery. An additional 15 regular permits are issued as Special Access Permits at the Commissioner’s discretion for scientific, educational, media and other purposes. Ten regular and three standby permits are issued for each of the established four-day permit periods, a total of 257 permits issued for the season

In 2006, 183 permittees (Guided Viewing, Camp Standby, and Special Access) visited the sanctuary (Table 4). The previous 10-year period annual visitation average was 202. During the same ten year period, the lowest annual number of visitors occurred in 2002 when 175 people visited the sanctuary. The maximum number of people able to visit the sanctuary under the existing permit program is 257 people.

The average number of permits used each day at the sanctuary in 2006 was 7.5 (out of a maximum of 10.0), which is slightly higher than the low of 6.6 in 2002. These annual fluctuations were likely attributable to several factors including the streamlining of the permit system, limits placed on campground capacity, limits placed on the number of nights each individual is allowed to stay in the sanctuary, lottery winners either not purchasing or not utilizing their permits and more recently, the reduction in the number of standby permits issued.

The utilization of permits has improved since 2002 partly as a result of selling unclaimed permits to the next applicant on the draw list. In 2006 eleven "resale" permits were issued and utilized.

There were 783 Guided Viewing and Camp Standby applications received in 2006 for the 185 regular and 57 standby permits issued through the permit lottery. This is a decrease from the previous year (960 applicants) and is considerably lower than the annual average for the previous 10 years (1,058). The peak number of applicants received was 2,150 in 1993. While the number of applicants fluctuates annually, there was a general decline starting in 1993 when the Board of Game started requiring a 4-year waiting period for successful applicants to reapply. This general decline stopped in 1999 when the Board of Game reduced the waiting period to one year and then applicant numbers increased for the next three years. Since 2002, applicant numbers have generally declined. A contributing factor to these annual fluctuations and perhaps the reason for the recent decline in applicants is the availability of commercially guided bear viewing operators in the region.

There were 19 applications received for sanctuary Special Access Permits and included projects under the Department's criteria for scientific, educational, media or other projects. Twelve of these applicants and 5 additional visitors were issued access permits which included representatives of federal agencies involved in the management of bear-viewing programs, ADF&G hunter and wildlife education personnel, CBS news, Kenai Peninsula School District, ConocoPhillips, National Geographic Society, Rasmuson Foundation, one Alaskan writer, and the Pratt Museum of Homer.

In 2006, \$67,450 was generated from the McNeil River sanctuary permit program and all revenues were deposited in the Fish and Game Fund.

Kamishak River

Seven Bristol Bay area lodges operated on the Kamishak River in 2005 and brought a minimum of 292 visitors to the sanctuary and adjacent Katmai National Park (Table 5). Their primary activity was sport fishing; however, they also engaged in wildlife viewing activities, primarily of brown bears.

Bear-Human Conflicts

There were no known adverse interactions between bears and people in the sanctuary or refuge during the 2006 season.

VIII. ACKNOWLEDGEMENTS

Sanctuary Manager Doug Hill and staff, Tom Griffin, Polly Hessing, and Josh Peirce gathered data on bear use and visitor activities. Aaron Christ provided information on the bear-monitoring program; Doug Hill, John Hechtel, and Joe Meehan prepared this report and Lee Hammarstrom and Ted Otis prepared the narrative on fishing activities; Liz Solomon prepared the GIS map; Marian Snively provided technical advice, and Lem Butler provided bear harvest data and reviewed a draft of this report.

Figure 1. Map showing location of the McNeil River State Game Sanctuary and Refuge in southwestern Alaska.

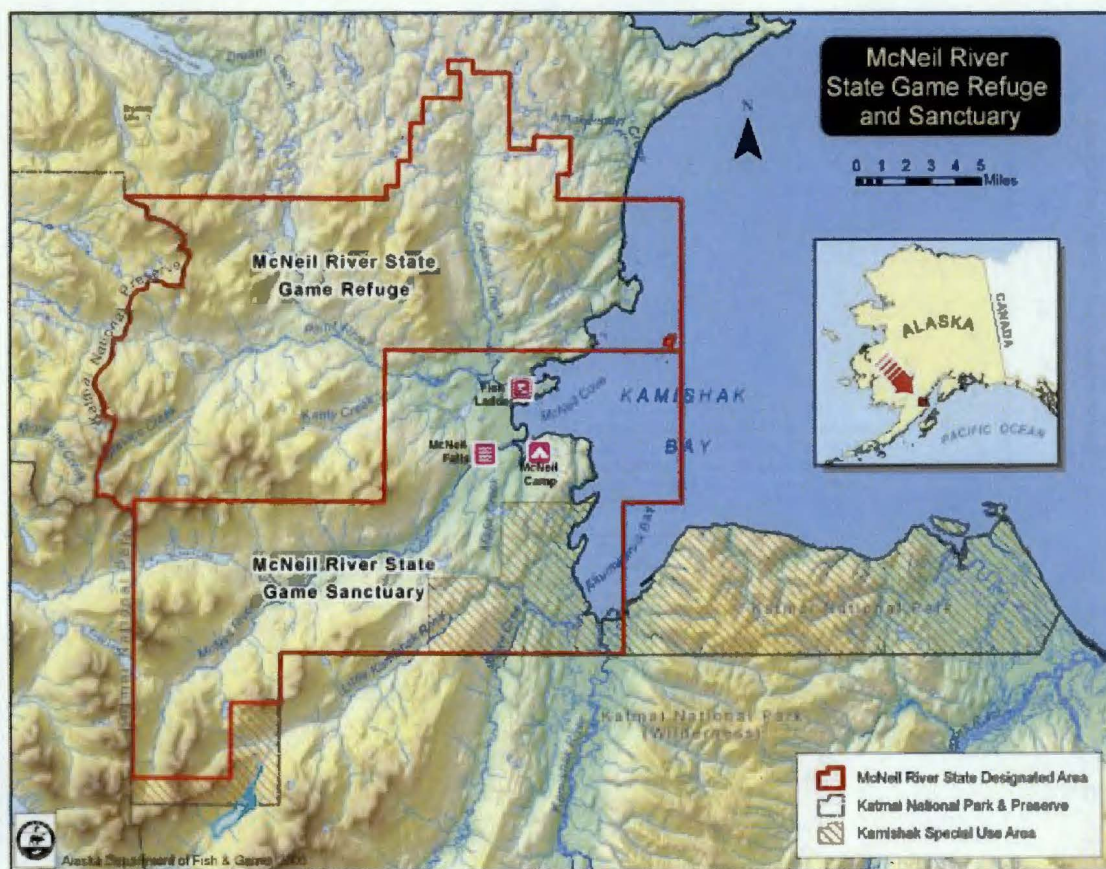


Figure 2. One-sided Shewhart control chart for the seven highest daily and hourly bear counts at McNeil River Falls, McNeil River State Sanctuary, Alaska, 1983 - 2005 ($\alpha = 0.01$).

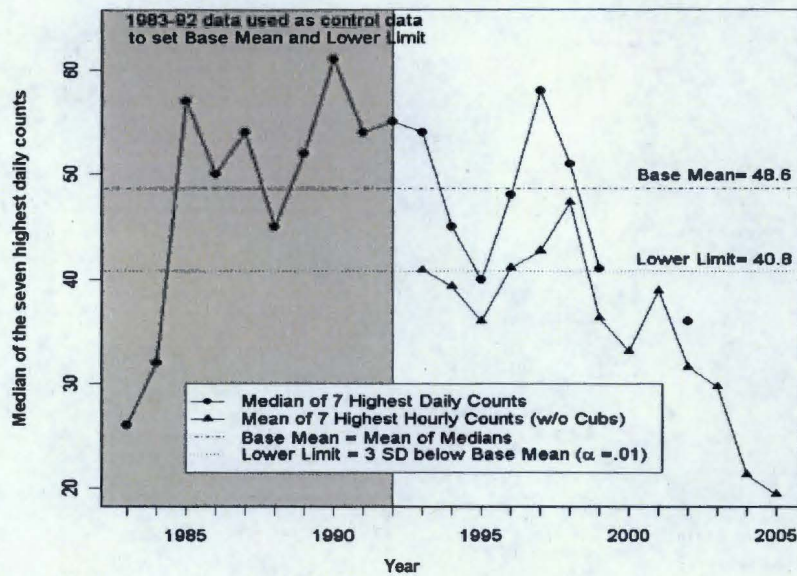


Figure 3. Bear use days at McNeil River Falls, McNeil River State Game Sanctuary, Alaska, 1982-2006.

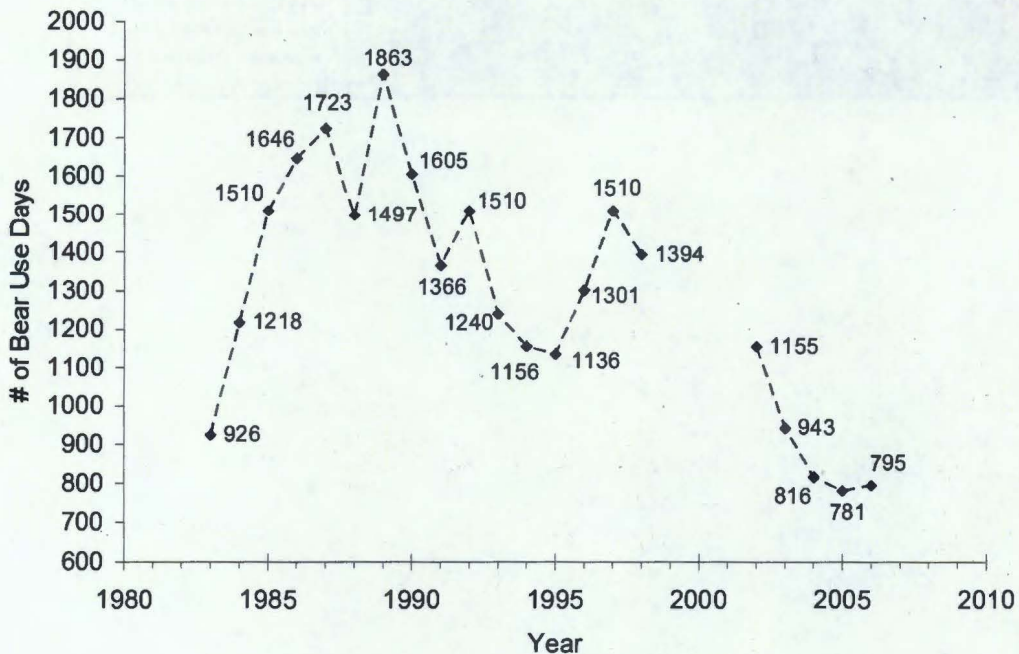


Figure 4. Average annual proportion of male and female bears observed at McNeil River Falls, McNeil River State Game Sanctuary, Alaska, 1986 – 2005 (in five year increments).

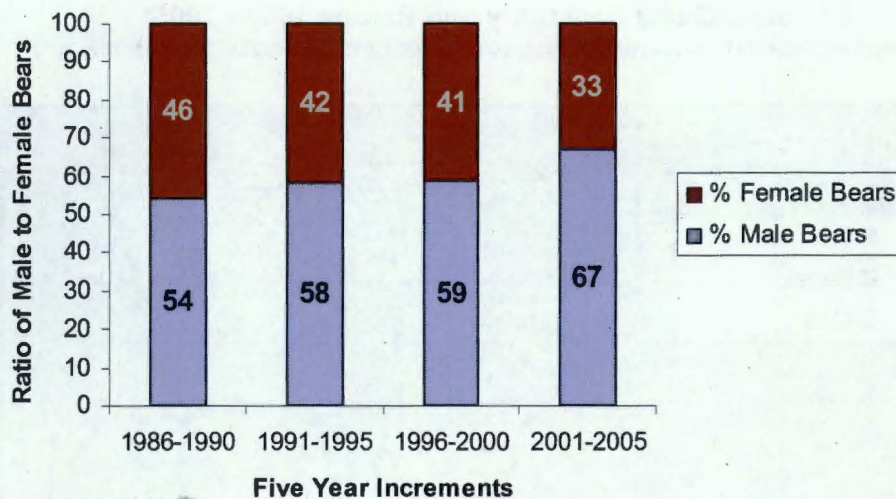


Figure 5. Average annual number of maternal females and sub-adult (both sexes) observed at McNeil River Falls, McNeil River State Game Sanctuary, Alaska, 1976-2005 (in five year increments).

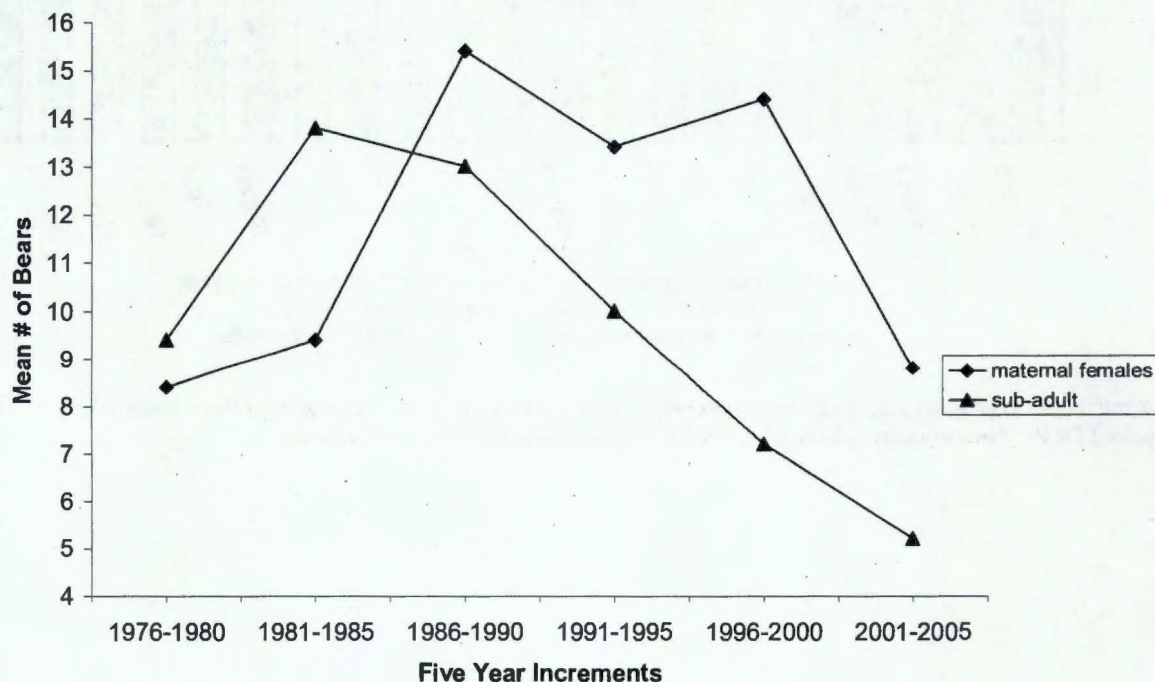
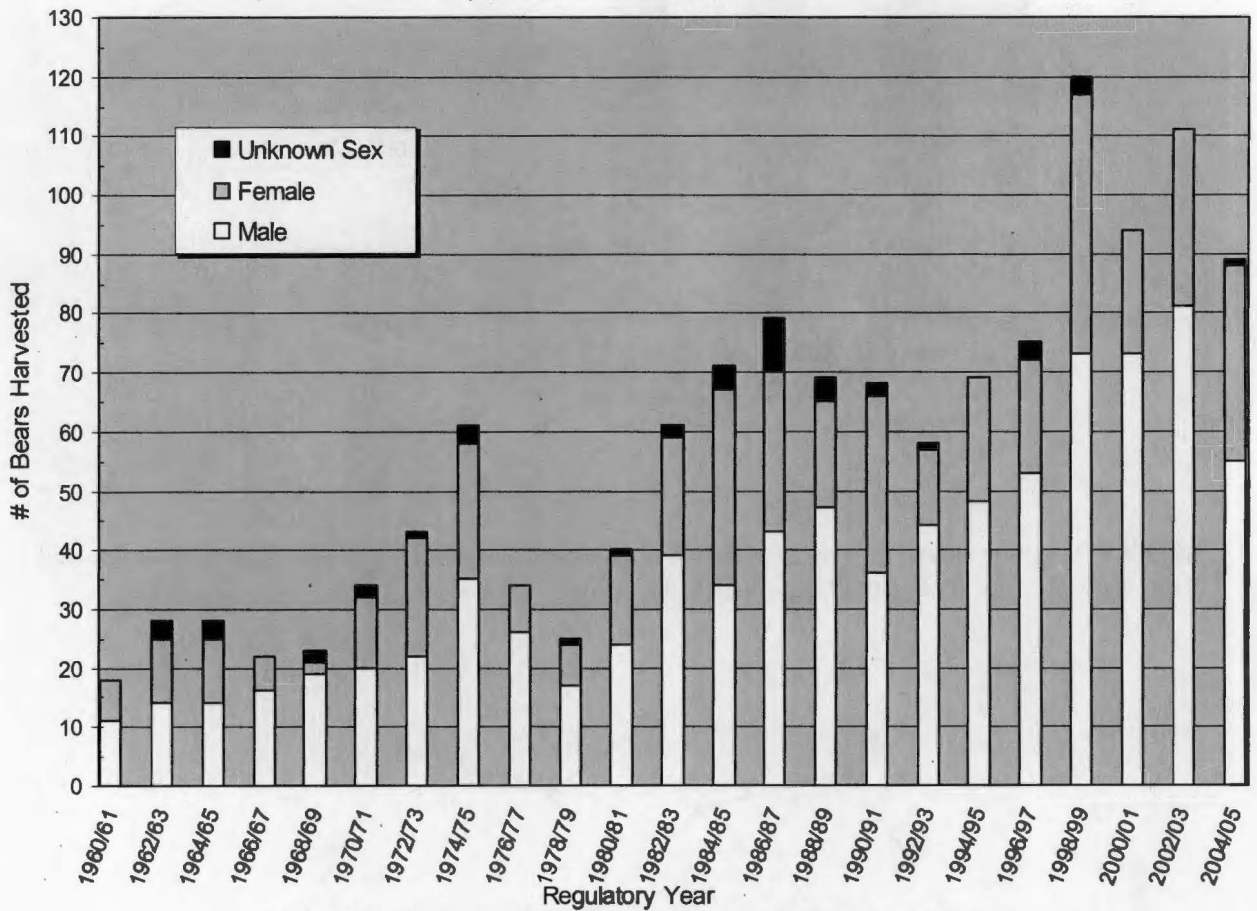


Figure 6. Brown bear harvest from areas surrounding the McNeil River State Game Sanctuary and Refuge, Alaska, 1960-2005 (harvest from GMU/UCUs: 9A/201, 301, 401, 501; 9B/301; and 9C/201,301, 601, 702, and 703). Two consecutive regulatory years* are lumped.

Figure 2
Brown Bear Harvest From Areas Surrounding the McNeil River
State Game Sanctuary and Refuge 1960 - 2005*

(Harvest from GMU/UCUs: 9A/201, 301, 401, 501; 9B/301; and 9C/201, 301, 601, 702, 703)



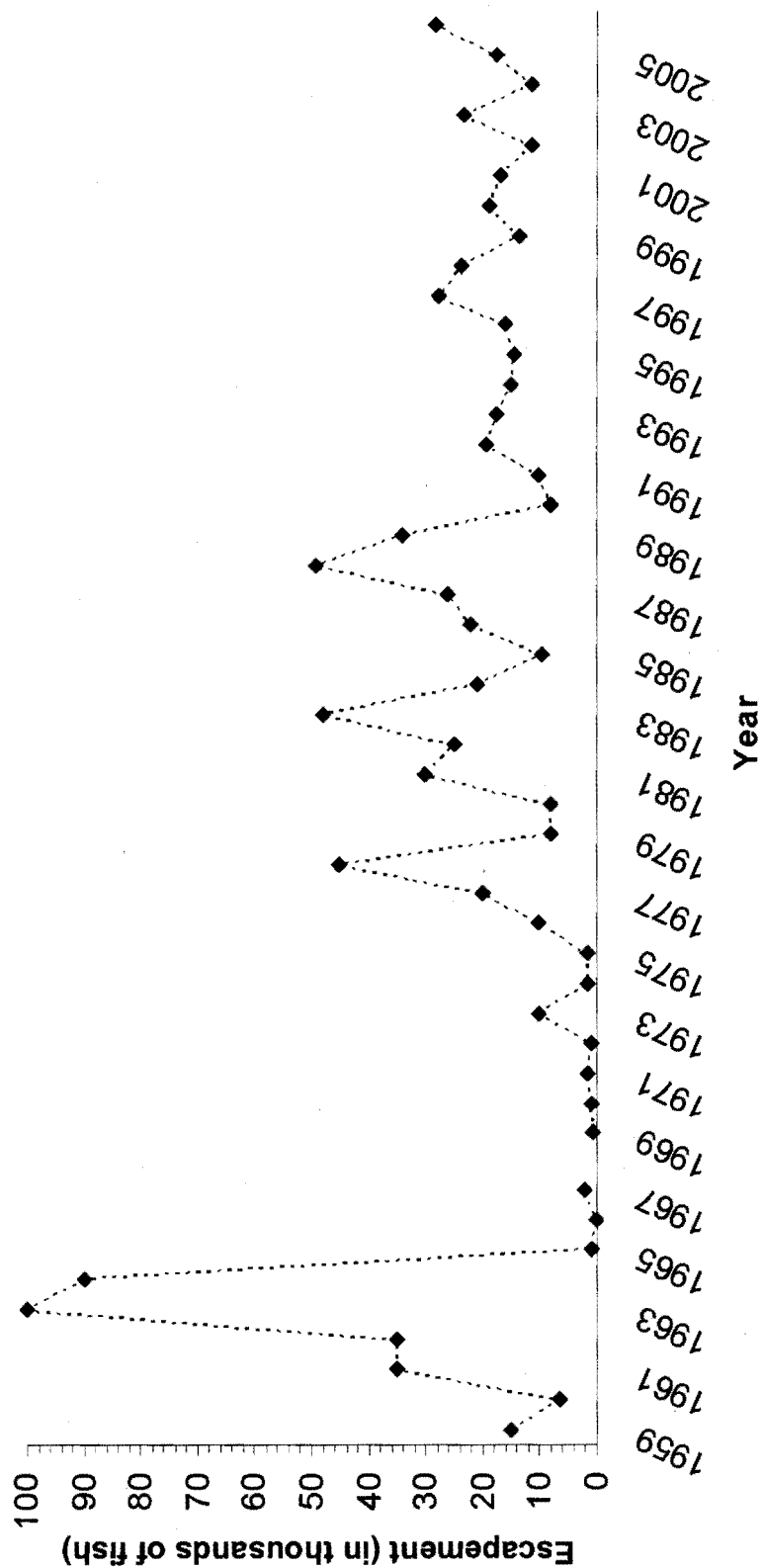
* Notes: A regulatory year starts July 1 and ends June 30 of the following year.

Harvest includes those bears taken as reported DLPs.

Hunts occurred annually through 1975 and every other year thereafter.

* A regulatory year starts July 1 and ends June 30 of the following year. Harvest includes those bears taken as reported DLPs. Hunts occurred annually through 1975 and every other year thereafter.

Figure 7. McNeil River chum salmon escapement, McNeil River State Game Sanctuary, Alaska, 1959-2006.



* Note: The Sustainable Escapement Goal (SEG) was established at 14,000 - 26,000 fish beginning with the 2002 season.

Table 1. Peak hourly counts of brown bears (not including cubs) at McNeil River Falls, McNeil River State Game Sanctuary, Alaska, 1993-2005.

Date	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Average
July 15	-	-	-	38	40	<u>47</u>	28	<u>37</u>	25	30	<u>42</u>	<u>24</u>	<u>23</u>	33
16	-	-	-	<u>46</u>	32	42	28	31	<u>39</u>	26	<u>31</u>	<u>31</u>	<u>22</u>	33
17	-	-	-	29	47	46	35	31	<u>41</u>	32	<u>36</u>	<u>22</u>	<u>23</u>	<u>34</u>
18	<u>37</u>	30	29	<u>44</u>	43	<u>47</u>	26	<u>32</u>	<u>40</u>	<u>33</u>	<u>40</u>	<u>23</u>	<u>21</u>	<u>34</u>
19	<u>58</u>	<u>50</u>	<u>33</u>	<u>54</u>	<u>56</u>	<u>57</u>	36	<u>36</u>	<u>36</u>	<u>36</u>	<u>40</u>	<u>28</u>	<u>20</u>	<u>42</u>
20	<u>55</u>	<u>37</u>	<u>40</u>	<u>40</u>	<u>52</u>	32	<u>37</u>	23	<u>37</u>	<u>26</u>	<u>38</u>	<u>27</u>	<u>24</u>	<u>36</u>
21	<u>46</u>	<u>43</u>	28	<u>47</u>	<u>50</u>	10	35	28	<u>40</u>	<u>40</u>	30	21	13	33
22	<u>54</u>	26	<u>48</u>	<u>49</u>	44	18	38	<u>37</u>	32	25	<u>37</u>	<u>22</u>	16	<u>34</u>
23	<u>49</u>	<u>43</u>	29	<u>47</u>	<u>53</u>	35	<u>42</u>	<u>36</u>	30	<u>41</u>	27	17	<u>18</u>	<u>37</u>
24	30	<u>52</u>	31	<u>33</u>	<u>52</u>	43	32	<u>36</u>	<u>42</u>	32	20	20	13	<u>34</u>
25	18	18	<u>39</u>	<u>40</u>	<u>51</u>	46	29	<u>36</u>	33	30	25	11	2	29
26	28	<u>37</u>	30	31	<u>54</u>	<u>53</u>	35	<u>32</u>	24	30	21	7	8	31
27	<u>34</u>	<u>44</u>	<u>39</u>	37	49	<u>50</u>	31	23	29	22	24	6	7	30
28	24	33	28	33	27	<u>51</u>	<u>37</u>	23	23	<u>34</u>	17	12	8	27
29	28	32	12	21	30	<u>48</u>	36	24	20	<u>36</u>	14	9	6	24
30	21	25	<u>32</u>	29	27	39	<u>41</u>	28	15	31	16	10	8	25
31	19	20	<u>35</u>	26	15	34	<u>42</u>	19	11	<u>33</u>	-	14	7	23
August 1	13	16	23	22	17	35	<u>42</u>	15	7	25	-	9	-	20
2	7	16	16	18	24	31	29	20	5	21	-	12	-	18
3	-	-	-	18	21	23	27	25	3	19	-	10	-	18
4	-	-	-	11	11	12	16	14	3	11	-	4	-	10
5	-	-	-	10	-	18	23	4	1	9	-	7	-	10
Average of 7 high days	<u>48</u>	<u>44</u>	<u>38</u>	<u>47</u>	<u>55</u>	<u>52</u>	<u>40</u>	<u>36</u>	<u>39</u>	<u>36</u>	<u>38</u>	<u>25</u>	<u>22</u>	<u>40</u>

Notes: Highest hourly count is the single highest count of the day taken on the hour.

High daily count is a one time count of the highest number of bears taken when the most bears are present.

(*) = Observations are generally made between 11:00am and 7:00 PM and average 6.5 hours a day.

(-) = Counts were not made.

Bold Numbers = 7 high daily counts for the season or 10 year average of 7 high daily counts

Table 2. Sex and age composition of brown bears at McNeil River State Game Sanctuary, Alaska, 1976-2006.

Year:	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06
Females w/cubs	9	10	8	9	6	8	7	7	9	16	14	14	14	19	16	15	16	11	11	14	20	19	15	11	7	5	10	12	7	10	8
Single Adult Females	5	8	6	8	8	10	9	15	16	12	11	13	13	14	16	12	19	19	15	12	14	19	19	14	14	12	8	16	12	13	15
Single Adult Males	16	18	18	19	23	26	20	22	22	27	31	34	34	42	37	41	39	48	45	49	46	55	54	48	48	53	45	45	39	41	40
Adult Sex Unknown	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Adults	31	36	32	36	38	44	36	44	47	55	56	61	61	75	69	68	74	78	71	75	80	93	88	73	69	70	63	73	58	64	63
Sub-Adult Females	4	3	4	2	6	9	11	9	8	2	7	7	9	4	5	6	6	8	9	3	6	5	6	4	4	4	4	2	4	2	6
Sub-Adult Males	0	5	4	0	0	1	1	4	5	10	7	8	8	5	5	4	2	4	3	5	1	3	3	2	2	2	2	2	1	3	8
Sub-Adult Sex Unknown	3	4	5	3	4	5	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Sub-Adults (1)	7	12	13	5	10	15	15	14	13	12	14	15	17	9	10	10	8	12	12	8	7	8	9	6	6	6	6	4	5	5	14
Total Adults & Sub-Adults (2)	38	48	45	41	48	59	51	58	60	67	70	76	78	84	79	78	82	90	83	83	87	101	97	79	75	76	69	77	63	69	77
Total Cubs	20	21	20	17	12	14	16	12	17	28	26	30	31	42	34	30	31	24	22	25	35	43	31	20	15	11	21	26	15	18	15
Total Bears	58	69	65	58	60	73	67	70	77	95	96	106	109	126	113	108	113	114	105	108	122	144	128	99	90	87	90	103	78	87	92

Notes: (1) Defined as 5.5 years old and younger from 1977 through the present.

(2) Only the bears that are recognizable as individuals and given names are included. In addition any bear that is recognizable but is seen less than three times and is not a regular user of Lower Mikfik, McNeil Falls or McNeil Cove are not included. Hence these figures represent minimum number of bears present at the sanctuary.

Underlined Bold Numbers represent average of data four years prior and after. (No data was actually recorded in 1999 & 2000)

Notes: (1) Defined as 5.5 years old and younger from 1977 through the present.

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Underlined Bold Numbers represent average of data four years prior and after. (No data was actually recorded in 1999 & 2000)

Table 3. Aerial escapement estimates of sockeye and chum salmon in the Mikfik Creek and McNeil River drainages, McNeil River State Game Sanctuary, Alaska, 2005.

Survey Date	Mikfik Sockeyes (Daily) ^a	Estimated Cumulative	McNeil Chums (Daily) ^a	Estimated Cumulative ^b
5/31	0	0		
6/2	0	0		
6/13	0	0		
6/20	25	25	0	0
6/23	250	250	2	2
6/27	17,700	17,700	2,075	2,075
6/30	8,900	17,700	3,270	3,270
7/3	2,030	17,700	1,740	3,270
7/10	3,900	17,700	4,900	4,900
7/17			4,475	4,900
8/1			7,500	10,400
8/8			13,390	17,400
CUMULATIVE TOTAL		17,700		28,176 ^c

^a All individual daily estimates are unexpanded live counts and considered to be conservative.

^b The cumulative estimate is not the sum of daily counts, but is adjusted for fish schooled in the lagoon that may or may not have been observed in previous surveys.

^c The cumulative total was derived by estimating area under the curve with 17.5-day stream life factor applied and compares favorably with the historical mean run timing curve for McNeil River chum salmon.

Table 4. Number of applicants, visitors, user days and permit days at McNeil River State Game Sanctuary, Alaska, 1984-2006.

Year	Footnotes	# of Applicants	# of Visitors*	Total User days in Sanctuary**	Total Permit Days July/Aug (560 possible)***	Comments on Season Length
1984	A, F	992	159	574	377	6/5 - 8/27
1985	A	832	216	816	449	6/10 - 8/25
1986	A	806	255	967	430	6/9 - 8/25
1987	A, G	1,757	252	1,054	473	6/9 - 8/23
1988	A	1,094	304	1,328	498	6/1 - 8/29
1989	A	1,306	264	1,183	488	5/22 - 8/26
1990	A	1,481	299	1,435	524	6/8 - 8/25
1991	B, E	1,818	249	1,415	526	6/1 - 8/27
1992	C, E, H	1,672	245	1,210	478	6/1 - 8/25
1993	D	2,150	225	1,128	516	6/7 - 8/25
1994	D, I	1,766	228	1,086	484	6/7 - 8/25
1995	D, I	1,486	212	1,074	475	6/7 - 8/25
1996	D, I	1,502	219	1,158	494	6/7 - 8/25
1997	D, I	1,474	228	1,197	489	6/7 - 8/25
1998	D, I	1,159	219	1,096	504	6/7 - 8/25
1999	D, I, J	1,223	208	1,122	398	6/7 - 8/25
2000	D, J, K, L, M	1,322	198	1,051	424	6/7 - 8/25
2001	D, J, K, L, M, N	1,329	186	1,012	437	6/7 - 8/25
2002	D, J, K, L, M, N	1,434	175	930	351	6/7 - 8/25
2003	D, J, K, L, M, N, O, P	1,314	188	995	451	6/7 - 8/25
2004	D, J, K, L, M, O, P	860	201	1,034	462	6/7 - 8/25
2005	D, K, L, M, O, P	960	195	983	431	6/7 - 8/25
2006	D, K, L, M, O, P	783	183	970	420	6/7 - 8/25

Footnotes Table:

A = No limit on standby or camp numbers.
B = 1st come, 1st served for standby with no camp limit.
C = 1st come, 1st served for standby with camp limit of 15.
D = All permits (regular & standby) by lottery including June.
E = Unlimited permits prior to June 15 then 10 a day.
F = \$5 application fee instituted in 1993.
G = \$10 application fee and \$40 user fee instituted.
H = \$20 application fee and new user fees (\$100 Resident/\$250 Non-resident) instituted.
I = Visitors to the sanctuary must wait four years to re-apply.
J = Lower staffing levels prevented late arriving or early departing visitors from joining the group.
K = \$25 application fee and new user fees (\$150 Resident/\$350 Non-resident) instituted.
L = Number of Standby permits drop from 5 to 3 per period (95 to 57 annually).
M = Visitors to the sanctuary must wait one year to re-apply.
N = A major air taxi operator retires, leaving only one primary carrier to serve MRS GS.
O = Includes Resale permits (Unissued permits were reissued and used).
P = Includes "fill in" permits.
* = Season (6/7-8/25) total of Guided, Standby, & Special Use permittees (actual bear-viewing permittee visitation).
** = Summation of all visitors (permitted bear-viewers and all other visitors) each day of viewing season (6/7-8/25).
*** = Summation of all Guided, Standby, & Special Use permittees each day from 7/1-8/25 (Relates to use of McNeil Falls area).

Table 5. Minimum visitor use and fish harvest reported at Kamishak River, McNeil River State Game Sanctuary, Alaska, 2006.

# of Anglers	# of Non-Anglers	# Days Guided	COHO SALMON		CHUM SALMON		PINK SALMON		DOLLY VARDEN	
			Kept	Released	Kept	Released	Kept	Released	Kept	Released
292	0	85	324	2113	0	387	0	665	62	2792