

Special Areas Management Report

McNeil River State Game Sanctuary

Annual Management Report

2009

Douglas D. Hill and Edward W. Weiss



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March 2011

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Weights and measures (metric)		General		Mathematics, statistics	
centimeter	cm	<i>all commonly-accepted abbreviations;</i>		<i>all standard mathematical signs, symbols</i>	
deciliter	dL	<i>e.g., Mr., Mrs., AM, PM, etc.</i>		<i>and abbreviations</i>	
gram	g	<i>all commonly-accepted professional</i>		alternate hypothesis	H _A
hectare	ha	<i>titles; e.g., Dr., Ph.D., R.N., etc.</i>		approximately	~
kilogram	kg	Alaska Administrative Code	AAC	base of natural logarithm	<i>e</i>
kilometer	km	Alaska Department of		catch per unit effort	CPUE
liter	L	Fish and Game	ADF&G	coefficient of variation	CV
meter	m	at	@	common test statistics	(<i>F, t, χ², etc.</i>)
milliliter	mL	compass directions:		confidence interval	CI
millimeter	mm	east	E	correlation coefficient (multiple)	<i>R</i>
		north	N	correlation coefficient (simple)	<i>r</i>
		south	S	covariance	cov
		west	W	degree (angular)	°
Weights and measures (English)		copyright	©	degrees of freedom	df
cubic feet per second	ft ³ /s	corporate suffixes:		expected value	<i>E</i>
foot	ft	Company	Co.	greater than	>
gallon	gal	Corporation	Corp.	greater than or equal to	≥
inch	in	Incorporated	Inc.	harvest per unit effort	HPUE
mile	mi	Limited	Ltd.	less than	<
nautical mile	nmi	District of Columbia	D.C.	less than or equal to	≤
ounce	oz	<i>et alii</i> (and others)	et al.	logarithm (natural)	ln
pound	lb	<i>et cetera</i> (and so forth)	etc.	logarithm (base 10)	log
quart	qt	<i>exempli gratia</i> (for example)	e.g.	logarithm (specify base)	log ₂ , etc.
yard	yd	Federal Information Code	FIC	mean	\bar{x}
		<i>id est</i> (that is)	i.e.	minute (angular)	'
Time and temperature		latitude or longitude	lat. or long.	not significant	NS
day	d	monetary symbols (U.S.)	\$, ¢	null hypothesis	H ₀
degrees Celsius	°C	months (tables and figures):	first three	percent	%
degrees Fahrenheit	°F	letters (Jan.,...,Dec)		plus or minus	±
degrees kelvin	K	registered trademark	®	population size	<i>N</i>
hour	h	trademark	™	probability	<i>P</i>
minute	min	United States (adjective)	U.S.	sample size	<i>n</i>
second	s	United States of America (noun)	USA	second (angular)	"
		U.S.C.	United States Code	standard deviation	σ or <i>s</i>
Physics and chemistry		U.S. state	use two-letter abbreviations	standard error (of the mean)	<i>s</i> \bar{x}
<i>all atomic symbols</i>			(e.g., AK, WA)	type I error probability	<i>P_a</i>
alternating current	AC			type II error probability	<i>P_b</i>
ampere	A			variance	σ ² or <i>s</i> ²
calorie	cal				
direct current	DC				
hertz	Hz				
horsepower	hp				
hydrogen ion activity (negative log of) pH					
parts per million	ppm				
parts per thousand	ppt, ‰				
volts	V				
watts	W				

Cover Photo: Sub adult brown bear (*Ursus arctos*) resting below west side bluffs, Mikfik Creek, McRiver River State Game Sanctuary. Photo © 2009 ADF&G, by Doug Hill.

Special Areas Management Report

McNeil River State Game Sanctuary Annual Management Report 2009

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Executive Summary

The McNeil River State Game Sanctuary (MRS GS) and McNeil River State Game Refuge (MRS GR) 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 one of the largest gatherings of brown bears in the world as they congregate to feed on migrating salmon. The Alaska Department of Fish and Game (ADF&G) 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 (1997) have been observed at MRS GS 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. Since 1997 the number of individual bears identified within the sanctuary dropped to 78 (lowest count since 1984) in 2004, increased to 93 in 2008 and dropped to 73 in 2009 (lowest count since 1983). The long term (1976-2009) average number of individual bears identified is 93.

The 2009 season average of the seven high hourly counts of individual bears at McNeil Falls was 38. This is below the Bear Threshold Criterion (BTC) of 40.8 established by sanctuary managers to gauge the quality of bear viewing at McNeil River Falls. The 2009 seasonal average may have been affected by a mid-July high water event that resulted in a 50 percent and more decrease in the number bears observed at McNeil Falls during the high water event. From 1999 through 2007 the seasonal average of the seven high hourly counts of individual bears at McNeil River Falls was below the “threshold criterion” and in 2008 the average was above the threshold at 45.

One factor potentially contributing to the lower number of bears at McNeil Falls is the long-term trend of low chum salmon returns to McNeil River. The established chum salmon escapement range has only been achieved in nine of the past 20 seasons. The effect of this on bear numbers at McNeil River may also be exacerbated by the fact that nearby systems experienced relatively good returns of chum and sockeye salmon over the previous nine seasons (except for 2007). This may have drawn bears away from the McNeil River system in search of a more abundant food source during those years; however, these relationships are not well understood. Similar to the eight seasons prior to 2008, other Kamishak Bay District systems experienced relatively good runs of chum salmon in 2009. Additionally, the 2009 sockeye run to nearby Mikfik Lake was relatively strong, and the Chenik Lake sockeye run was considered excellent. While brown bear harvest levels outside the sanctuary have increased above historic levels since the 1999 regulatory year; based on the available information, legal hunting of bears outside the sanctuary is not a significant factor affecting the regional bear population. The effects of these harvests on bear use at McNeil River are unknown; however, at this time these harvests do not appear to affect the number of bears using the McNeil River.

The bear-viewing program at MRS GS again attracted people from around the world in 2009 and 725 people applied for the 185 regular permits and 57 standby permits selected by lottery.

During 2009, 181 people participated in the Sanctuary’s bear-viewing program (June 7 through August 25), which includes Guided and Standby lottery permit winners and Special Access Permit

holders. The permit program generated approximately \$61,325 in 2009 that was deposited into the state's Fish and Game Fund.

The MRSGS photo identification project (initiated in 2007) progressed in 2009. This collection and storage of digital images of individual bears and their defining characteristics is intended to be a long term project that will enhance and improve management of the bear viewing program and assist in monitoring life histories of individual bears. Volunteers from Friends of McNeil River, a nonprofit sanctuary support organization, and ADF&G staff utilized cataloged photos of individual bears to create a field book that was available to guests and staff.

Western Washington University graduate student Ian Gill and his assistant Larry Aumiller spent July and a few days in August researching the predator-prey dynamic between brown bears and the chum salmon at McNeil Falls in an effort to calculate the number of salmon harvested by bears and to understand the factors affecting the success of individual bears, how they learn, and how this interaction affects the health of both populations. The estimate of salmon harvested by bears at McNeil River Falls between July 1 and August 3 (12 hours/day) of 2009 is 12,774.

A facilities improvement CIP was obtained utilized for the razing of an old structure and construction of a new workshop/toolshed/guest quarters in 2009. During a preseason work party the third week of May a crew of 6 volunteers (including two Friends of McNeil River volunteers, 2 hired carpenters, and 1 ADF&G employee) dismantled the old rotting and leaking toolshed/guest quarters and framed a new 16'X16' toolshed/workshop/guest quarters prior to the onset of the bear viewing season. The interior of the building was completed when time allowed during the bear viewing season.

ADF&G special area permits were issued to: three commercial sport-fishing guide services for boat storage (7 boats) on the Kamishak River; one sportfishing guide services for a temporary guide camp on the Kamishak River; Ted Otis (ADF&G Division of Commercial Fisheries) for installation and operation of video escapement recorders at Chenik Lake and Mikfik Lake and maintenance of a cabin at Chenik Lake; ADF&G Division of Wildlife Conservation for field camp activities, facility improvements and new cabin construction; Ted Otis (ADF&G Division of Commercial Fisheries) and a graduate student for video camera installation at McNeil River Falls; a private non-profit organization for the installation and maintenance of GPS station on Chenik Mountain; a commercial bear-viewing guide for a temporary bear viewing camp at Chenik Lake; and to Cook Inlet Aquaculture Association (CIAA) for the installation and maintenance of fish counting weir (permit not used).

In 2009 seven Commercial Transporter Permits were issued. Five permits were issued to guide services that primarily transport anglers to the Kamishak River (three of these flight services occasionally fly bear viewing permittees to McNeil River camp), one permit was issued to a bear viewing guide, and one permit was issued to a flight service that transports the bulk of bear viewing permittees to MRSGS.

One MRSGS Commercial Guide Access Permit was issued to a commercial bear viewing business from Homer.

CIAA informed the Division of Wildlife Conservation in 2008 that they received grant monies to conduct maintenance on the Paint River Fish ladder. CIAA intends to make repairs, cover open cells, and perform other maintenance as required in order to get the ladder into operating condition. Although a Paint River Salmon Enhancement Project Operational Plan was drafted in 1993, it was never approved, but CIAA anticipates eventual completion of this plan. Currently no specific plans to stock the Paint River system have been identified. CIAA notified ADF&G that they had no activity in the MRSGS or MRSGR in 2008 or 2009. In November 2009 ADF&G received a Special Area permit application from CIAA to access the Paint River Fish Ladder to assess repair needs to be completed in 2010.

Sea otter carcass surveys were conducted in the sanctuary and refuge to assist the United States Fish and Wildlife Service in determining the cause of declining sea otter population in Southwest Alaska. Beach walks occurred from the north end of Amakdedori Beach to Horshoe Cove and spot checks of beaches on Augustine Island were made via helicopter.

Governor Sarah Palin visited MRS GS in July 2009. The Governor's party included Todd Palin, Chuck and Sally Heath (mother and father), and ADF& G Commissioner Denby Lloyd. The Governor and her husband spent one day at McNeil River Falls.

I. Introduction

McNeil River, located in southwestern Alaska (Figure 1) seasonally supports one of the world's largest congregations of brown bears as they feed on returning chum salmon. 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. Wildlife

Brown Bear Monitoring Program

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 MRSGS: index counts (average of the seven highest hourly counts each season 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 at McNeil River Falls and includes a Bear Threshold Criterion (BTC), 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 from the viewing pad at McNeil River Falls once each hour from early July 15 through August 5 and during the viewing period of approximately 11:00 a.m. to 7:00 p.m. (Figure 2; Table 1). The mean of the seven highest hourly counts is calculated and used as an index that is weighted against the BTC. 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 BTC (40.8 bears) represents the lower limit of these medians.

In 2009 the mean of the seven highest hourly counts was 38 bears, which is below the BTC of 40.8 bears. In 2009 there was only one count (41 bears) above the BTC. There were two days with high counts of 40. The highest individual hourly count was 48 bears at 2100 hours on July 19th - this observation was obtained outside the standard count hours (1100 hrs to 2000 hrs) and obtained from the graduate project. The 2009 seasonal average may have been affected by mid and late July high water event that resulted in a 50 percent and more decrease in the number bears observed at McNeil Falls.

Between 1993 and 2009 the highest and lowest means of the seven highest hourly counts were 55 (1997) and 22 (2005) respectively. From 1998 to 2005, there was a relatively steady decline in the mean of the seven highest hourly counts. The mean has remained at 32 and above since 2006 with a peak of 45 in 2008.

Individual Counts

A second method of monitoring bear use of the MRS GS and the quality of the bear-viewing program is by tallying the number of individually identifiable bears (adults, sub-adults, & cubs) observed by sanctuary staff throughout the season (Table 2). 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 (34 years). Only individual bears that are recorded a minimum of three times are included in this count. Hence, this method provides an intrinsically conservative estimate. While this monitoring method only records the presence of an individual bear and not the frequency or amount of time it spends at MRS GS, it provides an additional index in evaluating the overall bear use and the quality of the bear-viewing program.

The number of individual bears identified at MRS GS in 2009 was 73. This is the lowest count since 1983 when the count was 70. Since 1976 the lowest count was 58 (1976) and the highest count was 144 (1997). After 1997 this number dropped to a 20 year low of 78 in 2004 and rose to 93 in 2007. The long term average of individually identifiable bears from 1984 to 2009 is 93. 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.

The total number of adults observed in 2009 was 61. The 34 year average is 61 and the 10 year average is 65. The 34 year high is 93 (1997) and the 33 year low is 31 (1976). The total number of adult males observed in 2009 was 40. The 34 year average is 37 adult males and the 10 year average is 44.

The 34 year high was 55 adult males in 1997 and the 33 year low was 16 adult males in 1976. There were 21 adult females observed in 2009; 16 were single adult females and 5 were females with cubs. The 34 year average is 13 single adult females and 11 females with cubs and the 10 year average is 12 single adult females and 8 females with cubs. The 33 year high was 20 single adult females in 1996 and the 33 year low was 5 in 2001. The peak number of females with cubs was 19 in 1992, 1993, 1997, and 1998. The 34 year low was 5 females with cubs in 1976 and 2009.

The number of sub-adult bears observed in 2009 was 4. This, along with 2003, was a 34 year low. This is down from the 14 observed in 2006 and 2007 (which were the highest numbers of sub-adults recorded since 1988 and among the third highest recorded since monitoring began in 1976). The highest sub adult count was 17 in 1988 and 15 sub-adults were observed in 1981, 1982, and 1987. There were 14 sub-adults recorded in 1983, 1986, and 2006. In contrast five sub-adults were recorded in 2005 - half of the long-term (1976-2008) average of 10 sub-adults recorded since monitoring began. The 2005 observation of five sub-adults was the second lowest count since observations began and continued a decline that started after 1988. The lowest number of sub-adults recorded was 4 in 2003.

There were 8 cubs observed in 2009. This was a 34 year low. The previous low was 12 (1980). The 34 year average is 22 and the 10 year average is 16. The 34 year high was 43 (1997).

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 MRS GS is the annual summation of individual adult and sub-adult bears observed at McNeil River Falls during each bear viewing day June 15 through August 25 (Figure 3). One bear or family group at McNeil River Falls 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. This data has been recorded since 1980, but no data was recorded in 1999, 2000, or 2001.

There were 971 bear use days at McNeil River Falls in 2009 (the eleventh lowest recorded since this monitoring method was established in 1980), which is up from the low of 781 in 2006. This is well below the highest count of 1,863 bear use days in 1989 and below the years 1984 through 2002 when bear use days were well above 1000. The lowest count was 709 in 1980, which was the first year of bear use days recording. The long-term average (since 1980) of bear-use days is 1,199 days and the 10 year average is 1015.

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 and Mikfik Creek have changed in the last several years (Figure 4 & 5; Table 2). Since 1984 there has been a general trend towards a great proportion of adult males relative to adult females. In 1984 the percentage of adult males was 47% and in 2009 the percentage of adult males was 66% (Figure 4). Comparison of multi-year averages exhibits the same trend (figure 5). The 1984-1988 (5 year) average was 53% and the 2006-2009 (4 year average) was 68%. The percentage of adult males was highest in 2001 (76%).

The number of subadult bears observed in 2009 was 4. The 2009 count and the 2003 count of 4 represent the lowest number of subadults observed since monitoring began in 1976. The long term (1976 – 2009) average is 10. The highest subadult count was 17 in 1988. There were 15 subadults were observed in 1981, 1982, and 1987. There were 14 subadults observed in 1983, 1986, 2006, and 2007. There were 5 subadults observed in 1979, 2004, and 2005.

There were 5 maternal females and 8 cubs observed in 2009 (Table 2). The 2009 count and the 2001 count of 5 represent the lowest number of maternal females observed since monitoring began in 1976. The 2008 count of 8 cubs is the lowest count observed since monitoring began. The long term (1976-2009) average is 11 maternal females and 22 cubs. The peak number of maternal females observed was 20 in 1996 and the number of cubs peaked at 43 in 1997.

Multi year averages (Figure 6) exhibit an overall decline in maternal females from 1981-1985 to 2006-2009. The mean number of subadults declined steadily from 1981-1985 to 2001-2005 and then nearly double between 2001-2005 and 2006-2009.

Bear Photo Identification Project

The field portion of the photo identification project was initiated in 2007. As in 2008, Assistant Sanctuary Manager Tom Griffin continued the task of photo documenting identifiable bears observed at McNeil throughout the 2009 season. Digital images of individual bear and their defining characteristics were collected using a Canon 30D SLR camera with a Canon 100-400mm zoom lens. The collection and cataloging of bear photo is intended to be a long term project that will assist McNeil staff in the following ways: expedite and enhance the process of bear identification; improve communication between staff members; enhance the process of tabulating the number of individual bears; enhance the process of tracking the history of individual bears; assist in sharing information and tracking the movements of individuals; assist in the identification of male and female characteristics; provide basic life history information; etc.

In 2006 FOMR and McNeil River staff had the idea to utilize future cataloged photos of individual bears to create a fieldbook that would augment visitor experience. Utilizing photos from 2007 and 2008, the first edition was printed in June 2009 on 5.5” x 8.5” “Rite-In-Rain” paper and titled “McNeil River Bears – 2009 Photo ID Fieldbook”. FOMR staff, current and former ADF&G Sanctuary staff, and past Sanctuary visitors/photographers participated in the project. The book contains information about MRS GS and MRS GR, maps (regional, Sanctuary trails, and camp), bear safety, plant, mammals, birds, descriptions and identifying photos of 30 brown bears, as well as space for keeping notes.

Other Areas

Kamishak River Drainage

The lower stretches of the Kamishak River, Little Kamishak River, and Strike Creek are within the McNeil River State Game Sanctuary. Bears fish these water bodies, graze sedge in the Kamishak sedge flats, and dig clams in the Kamishak River mud flats. The Department does not conduct bear surveys in these drainages. However, commercial sportfishing guide services operate in the area from approximately early July to mid September and brown bears are typically observed on a daily basis. In 2009 one guide reported observing 29 bears on the Kamishak River in one day. The average number of bears reported (by two guide services) per day on the Kamishak River from 7/5/09 through 9/11/09) was 10.

Chenik Creek

The Department does not conduct bear surveys in the McNeil River State Game Refuge. Brown bears are most frequently observed at the falls where Chenik Creek empties into the Kamishak Bay. A long time bear viewing guide from Homer that provides overnight trips was at the site from 7/8/09 through 7/19/09. The guide reported a minimum of 19 individual bears (1 female and 2 cubs of the year (COY), 1 female and 2 yearlings, 1 female and 1 yearling, 2 mature females, 4 subadults, 3 young males, 2 mature males). Another long time Homer guide service that provides day trips was at the site on the following dates (7/2, 7/3, 7/4, 7/5, 7/6, 7/24, and 9/12). This guide service reported observing at least 17 bears at one time. A private party from Homer camped at Chenik Head from July 11 through July 14 and counted at least 15 individual bears (mostly sows with cubs – one female had 3 COY and another had 2 COY) at Chenik Creek. One member of the group worked as a bear guide in the area in the past.

Historic Brown Bear Use Patterns

The number of individual bears observed at McNeil River increased slightly from a 24 year low of 78 bears in 2004 until 2007 when 93 individual bears were identified. In 2008 the number of individual bears observed was 89. The brown bear monitoring program at McNeil River indicates 1) a significant decrease in the number of bears since the numbers of individuals counted peaked in 1997 (144 bears) and 2) 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 sanctuary staff indicate low salmon returns may 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 may 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 (sub-adults 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.

Compounding the chronic low salmon escapements at McNeil River, comparatively strong chum salmon returns throughout Lower Cook Inlet during eight of the past nine 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.

The commercial seine fishery in waters of McNeil River Subdistrict has been closed for the duration of the chum salmon return during every season since 1997, thus virtually no commercial harvest of this stock has occurred since 1988. 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 effect on the McNeil River bear population or, in the case of fisheries enhancement, would be neither feasible nor consistent with management goals of the sanctuary. Managers did feel that further study of potential bottlenecks to the freshwater production of McNeil River chum salmon might provide insight into future management actions to benefit resources in the Sanctuary. In 2003, a survey was conducted to evaluate the availability of spawning habitat above and below McNeil Falls. The Department also conducted a chum salmon radio telemetry study during 2005-2006 to estimate the average streamlife of McNeil River chum salmon. Results from the telemetry study were used in a retrospective analysis of historical escapements above and below McNeil Falls. That analysis resulted in an increase in the escapement goal range for McNeil River chums in 2008 intended to stimulate greater utilization of underused spawning habitat upstream of the falls when the run recovers (see Fisheries section below).

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 MRS GS and MRS GR are currently within an area of approximately 5,585 square miles where bears are protected from hunting. In March 2005 the Board of Game removed the brown bear hunting closure on state owned lands in the Kamishak Special Use Area starting July 1, 2007 (5AAC 92.510(9)(C)). However, due to public opinion, in March 2006 the Board of Game voted to maintain the brown bear hunting closure on state owned lands in the Kamishak Special Use Area.

The harvest of bears marked at McNeil during early studies and observations by sanctuary staff and others 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. The area represented includes 2100 mi² currently open to hunting.

The long term average harvest from areas surrounding McNeil River from the period 1980/81 thru 2004/05 is 77 brown bears. Average harvest by decade was 62 in the 1980s, 77 in the 1990s and 101 so far in the 2000s. The harvest during the combined 2004/2005 regulatory years (July 2004 through June 2006) was 102. There was no season during the 2006 regulatory hunt year (July 2006 – June 2007), and harvest was 93 during the 2007 regulatory year hunt.

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 historic population

data and information about hunting effort make it difficult to compare rates at which the population has been harvested. However, current harvest rates are sustainable based on recent population surveys and harvest indices.

Based on all available information, legal hunting of bears outside the sanctuary does not appear to be a significant factor affecting the regional bear population or the number of bears using the McNeil River. Though minor changes in how bears use the falls have been theorized to occur (i.e. changes in social structure that may affect use of the falls by individual bears or family groups), it is impossible to distinguish changes due to human disturbance from those that would occur in the absence of human influence.

Other Wildlife

General Observations

Bear sign was observed on 5/21/09. The first brown bear courtship behavior was observed on 6/7/09. Bears were observed on 5/22/08 clamming just north of camp. The first cub of the year was observed on 7/19/08.

Sockeye salmon were first observed on 6/8/09 on the ocean side of the spit. On 6/11/09 5000-8000 sockeye were observed in the lagoon and lower Mikfik Creek. Sockeye were observed running at Mikfik Riffles on 7/27/09. Chum salmon were first observed on 6/24/08.

Bears were first observed fishing Mikfik Creek (riffles) on 6/9/09 and the last recorded observation of bears fishing Mikfik Creek (riffles) was on 7/27/09. A few fish were observed milling around lower Mikfik into August.

Bears (5 adult males and 1 adult female) were first observed at McNeil Falls on 6/30/08. The first full day McNeil Falls bear viewing occurred on 7/5/08 – 14 adult bears were observed. The last group viewing session at McNeil Falls was on 8/23/07 – 3 adult males and 1 adult female were observed. The last staff trip to McNeil Falls occurred on 8/24/08 – 2 young adult bears passed by the falls.

Clamming effort (amount of time spent clamming and the number of bears clamming) by bears seemed to more be less intense in 2009 than in 2008. Perhaps this was due to the seemingly storm run of sockeye and the lack of cubs of the year (COY). The most intensive clamming observed occurred off the beach to the north of camp.

Wolf tracks were observed were first observed in the sanctuary on 5/21/09. Wolf tracks were then observed periodically throughout the rest of the season.

Moose tracks were observed on the Mikfik Creek trail and on the McNeil Falls trail on 6/9/09.

Up to 300 Black Brandt were observed feeding and loafing in McNeil Lagoon from the end of May through the month of June. Three White-Fronted Geese were observed in sedge near camp on during the second two weeks of July. Flocks of up to 200 White Winged Scoters were observed flying over McNeil Cove periodically throughout July. Approximately 30 swans (Trumpeter?) were observed in lagoon on 6/29/08. Groups of 3 swan were observed off an on in the lagoon in June and July. Peregrine Falcons and Merlin were observed periodically from June through August. Two American Black Oystercatchers were observed on the McNeil Spit on 6/1/08. Oystercatchers are more often observed in the north east portion of McNeil Cove. Short eared owls, Black Turnstones, and Black Scoters were observed a number of times in the vicinity of the camp.

III. Fisheries

The McNeil River SGS / SGR contain a number of river and stream systems that support both anadromous and resident fish populations. The Kamishak River drainages support all five species of Pacific salmon as well as Dolly Varden. The McNeil River drainage contains Dolly Varden (*Salvelinus malma*), chum salmon (*O. keta*), some coho salmon (*O. kisutch*), pink salmon, and small numbers of Chinook salmon (*O. tshawytscha*). The Mikfik Creek / Lake drainage contains sockeye salmon (*Oncorhynchus nerka*) and Dolly Varden. Chenik Creek / Lake system supports sockeye salmon, some coho salmon, lake trout (*Salvelinus namaycush*) and Dolly Varden. The Paint River system contains rainbow trout (*Oncorhynchus mykiss*), Arctic grayling (*Thymallus arcticus*) and lake trout and has the potential for supporting a number of anadromous salmon species through fisheries enhancement. These fish resources contribute to annual sportfishing and commercial fishing effort and harvests within the Lower Kamishak district.

Commercial Fisheries

As part of the escapement goal review for the 2007 Lower Cook Inlet (LCI) Alaska Board of Fisheries meeting, Division of Commercial Fisheries staff conducted an in-depth retrospective analysis of historical chum salmon escapements above and below McNeil Falls (Otis and Szarzi 2007). That analysis utilized recent findings from a two-year radio telemetry study on McNeil River chum salmon that was conducted collaboratively by the Divisions of Commercial Fisheries and Wildlife Conservation during 2005-2006 (Peirce 2007). As a result of the retrospective analysis and some minor adjustments in the methods used to estimate annual escapement, the Department increased the McNeil River chum salmon sustainable escapement goal (SEG) range from 13,750-25,750 up to 24,000-48,000 fish and implemented the new range beginning with the 2008 field season. The increase is intended to stimulate greater future utilization of the currently underused spawning habitat available above McNeil Falls, which in turn, should provide higher and more consistent stream-wide production. Further details on the telemetry study and retrospective analysis are provided below in the Fisheries Research section.

Periodic aerial surveys are flown to index the escapement of sockeye and chum salmon to Mikfik Creek and McNeil River, respectively. The cumulative Mikfik Creek/Lake sockeye salmon aerial survey escapement index for 2009 was 15,130 fish while the McNeil River chum salmon escapement was estimated at 18,766 fish (Table 3). Warm sunny weather led to extremely high glacial turbidity in McNeil River and precluded effective aerial surveys on July 7th, 10th, and 23rd. Linear interpolation was used to estimate the number of fish present on those days. However, because adjacent surveys during the peak of the return were also compromised by poor conditions, the 2009 escapement index for chum salmon should be considered conservative. No commercial fishing effort targeted sockeye salmon in McNeil River Subdistrict this season, and the subdistrict was closed for the duration of the chum run. Consequently, the entire Mikfik sockeye and McNeil chum salmon runs entered their respective freshwater drainages this season. The 2009 Mikfik Creek estimated escapement slightly exceeded the SEG range of 6,300 - 12,150 sockeyes. Post-season evaluation indicated that run timing of sockeye salmon into Mikfik Lake was fairly typical, despite a slightly (one week) later than normal run entry into McNeil Lagoon. A video camera attached to a digital video recorder to record the video images (see below), was used to document sockeye salmon escapement Mikfik Creek/Lake again this season.

The 2009 season was the 21st consecutive year the McNeil River chum salmon run failed to produce a significant harvestable surplus and chum salmon escapement into the system also failed to achieve the low end of the recently revised SEG range of 24,000-48,000 chums (Figure 7). Chum returns to other Kamishak Bay District systems in 2009 were reasonably strong for the 9th time in the past 10 seasons, contributing to a district-wide commercial harvest of 36,600 chums, the eighth highest total since 1988.

The number of spawning chum salmon documented upstream of McNeil River Falls in 2009 increased substantially over 2008, and was the second highest number observed during the past five seasons. Chum salmon were consistently seen above the falls during aerial observations from June 29 through the last survey on August 6th. A peak daily aerial estimate of 890 chums upstream of McNeil River Falls occurred on July 16. The run timing of McNeil River chum salmon seemed somewhat earlier than previous years.

Area-under-the-curve (AUC) remains the best available method for deriving the total annual escapement index for McNeil River chum salmon, as well as most other pink and chum salmon stocks in LCI. The AUC method calculates the area under the escapement curve, points for which are determined by periodic aerial surveys, and then divides the resulting total “fish-days” by an average streamlife (SL) factor to estimate the total annual escapement. The AUC method resulted in a cumulative estimate of 18,766 chum salmon for McNeil River in 2009.

Chenik Lake, located approximately 5.5 miles north of McNeil Lagoon, is the site of another sockeye salmon stock. The stream mouth of Chenik Creek, which drains the lake, was partially blocked as a result of the 1964 earthquake. A Cook Inlet Aquaculture Association (CIAA) fishery enhancement project modified the stream mouth in 1981-82 and again in 1986 in an effort to allow easier fish access to the creek. Hatchery-raised sockeye salmon fry were stocked into Chenik Lake annually between 1986 and 1996 (except for 1994), and the lake was also fertilized in an effort to increase sockeye numbers. Unfortunately, due to an outbreak of Infectious Hematopoietic Necrosis Virus (IHNV), the return of adult sockeyes to the system dropped to very low levels between 1994 and 2002, but more recent returns resulting exclusively from natural production rebounded considerably. In fact, commercial fishing effort directed at this stock was allowed each year from 2004 through 2009, the first time for such activity in over a decade, with resulting annual commercial harvests ranging from just under 12,000 sockeyes (2006) to over 171,000 fish (2008). Additionally, the established sockeye salmon sustainable escapement goal (SEG) for Chenik Lake was slightly exceeded each year between 2003 and 2009, also a first for this system in over 10 years. The 2009 escapement of sockeye salmon into Chenik Lake, as determined by remote video, was 15,300, while the 2009 commercial harvest of sockeye salmon from the Chenik Subdistrict was 65,700 fish.

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 Kamishak Bay District sockeye stocks have, at times in the past, made significant contributions to commercial salmon harvests.

CIAA – Paint River Fish Ladder

The Paint River fish ladder, constructed in the early 1990s but never operated, to allow upstream fish passage, provides potential access to currently unutilized salmon spawning and rearing habitat in the Paint River drainage in Lower Cook Inlet. 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 1988 to 1996, and also in 2002, between 0.5 million and 2.2 million sockeye salmon juveniles were stocked annually in the Paint River Lakes. Although construction of the Paint River fish ladder was completed in October 1991, and formally declared operational in 1993, the number of returning adult sockeye salmon resulting from stocking efforts 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. A Paint River Salmon Enhancement Project Operational Plan was drafted in 1993 but never completed. And while CIAA intends to complete the plan, currently no specific plans to stock the Paint River system have been

identified. In 2009, no adult sockeye salmon returned to the mouth of the Paint River, located approximately two miles north of McNeil River.

CIAA began seeking monies to complete and operate the fish ladder in 2000. In 2008, CIAA informed the ADF&G that they had received grant monies to conduct maintenance on the Paint River Fish ladder. CIAA intends to make repairs, cover open cells, and perform other maintenance to get the ladder into operating condition. CIAA anticipates completion of two improvements to the CIAA-owned Paint River fish ladder during 2009 – 2010. To reduce potential bear problems associated with the operation of the ladder, the open cells on the lower end of the ladder will be covered and other needed maintenance work will also be completed. The fish exit pool at the top of the ladder will be investigated to identify modification options, if necessary.

Sport Fishing

McNeil Lagoon

Limited sport fishing occurs in McNeil Lagoon and is incidental to bear-viewing activities. Fishing effort was low in 2009. Visitors and ADF&G staff harvested approximately 6 sockeye salmon, 10 chum salmon, and 3 coho salmon.

Kamishak River

The only area in the sanctuary that attracts significant sport fishing interest is the Kamishak River and, to a lesser extent, the Little Kamishak River and its tributary, Strike Creek. The target species are coho, chum, and pink salmon and Dolly Varden

Fishing activity at the Kamishak River and tributaries typically begins in mid July and ends in mid September. During the 2009 season, four lodges and transporters reported 379 visitor use (angler) days during 98 days within the sanctuary for sportfishing (Table 5). The reported catch was 1,472 coho salmon (1,068 released), 214 chum salmon (210 released), 36 pink salmon (all released) and 2,542 Dolly Varden (2,518 released). Wildlife viewing, primarily brown bears, was also a significant part of their activities reporting an average of 9 bears per guide day.

IV. Fish & Wildlife Research

This section summarizes new or ongoing fish and wildlife research projects within the MRSGS/SGR.

Mikfik Creek Video Research

A remote video escapement recorder (RVER) was installed at the outlet of Mikfik Lake for the 11th consecutive season. This project has already proven invaluable to both inseason and postseason 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 11 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 led to the development of alternative equipment. The present setup, first implemented at Mikfik Creek in 2006, uses a time-lapse digital video recorder (DVR) in place of the personal computer. Recurring power issues in previous seasons led to the relocation of the DVR unit in 2009 to a location on the lake with more solar exposure, and consequently transmitting wireless signals from the camera to the relocated DVR. Additionally, in an effort 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 was previously tested with mixed success. The Department believes these problems can be successfully resolved and plans to continue investigating this promising technology, ultimately incorporating it into the Mikfik remote video recording system.

In 2009, the video system at Mikfik Creek/Lake was installed on June 11 and shut down on August 13. The system operated continuously during daylight hours (~ 20 hrs/d) and successfully recorded images 92% of the time that it was programmed to operate between June 11 and August 13 (2,208 hrs). The peak of the run into Mikfik Lake occurred during June 15-18, with a daily average of 3,033 sockeye salmon escaping over that four-day period. Unfortunately, because of camera failure, the DVR failed to record any images between July 15-22, resulting in 195 hrs of “down time”, but fish passage during this period was believed to be minimal based on the extremely low number of fish observed before and after the camera failure.

As was the case in 2001 and 2003 - 2008, a single camera mounted on the original (north bank) light pole, was used to collect all video images of fish passage in 2009. Recordings were made using a compression rate of five frames per second, which resulted in excellent image quality. Fish were very easy to see, and the new DVR facilitated efficient and convenient video review to estimate escapement. Upon review of the images collected at Mikfik Creek, 20,965 sockeye salmon were counted, representing over 5,835 more fish than were estimated by aerial surveys system wide. Moreover, the video-based estimate should be considered conservative, because the RVER system is not designed to count fish during hours of darkness and, as mentioned previously, the DVR experienced about a week of “down time” during July. In order to remain consistent with the historical Mikfik Creek database and with the methods used to derive the Mikfik sockeye SEG, aerial survey data were used to generate the 2009 spawning escapement index (15,130 sockeyes). LCI staff are currently studying the best approach for integrating the video counting estimates into the historical escapement database and for developing a new escapement goal tailored to video-based escapement monitoring.

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. During 2,208 hrs of recorded video between June 11 and August 13, reviewers documented 127 instances where brown bears transited the field of view of the camera, an average of just over 2 bears per day of successful video operation (n=57 d). Most of these bears were recorded from August 9-12, just prior to shutdown of the video site. Nearly all sightings were of individual bears, but one sighting of a pair of bears occurred (a sow with a cub). Other wildlife observed included moose (with calf), fox, eagles, various waterfowl, and river otters.

Sea Otter Carcass Surveys

In August of 2005 the Southwest Alaska population of northern sea otters was listed as threatened under the ESA. The listed population ranges from Kamishak Bay in lower Cook Inlet to Attu Island in the western Aleutians. Disease is one of several lines of investigation being explored to understand the reasons for the decline in the listed population. Since 2001 the U.S. Fish and Wildlife Service (the Service) has been developing a sea otter stranding network in Alaska in order to obtain baseline data on health and disease of this nearshore-sentinel species. Data obtained from dead otters is compared to health assessments of live-captured otters to determine impacts (if any) disease may have on the population. The Service has had great success in receiving carcasses from areas adjacent to large human population but lacks data from many areas in the state due to their remote location.

In September of 2006 an Unusual Mortality Event was declared for northern sea otters in Alaska. This was prompted by a large number of animals dying from *Streptococcus bovis* endocarditis/septicemia (SBE/S) in the area of Kachemak Bay. In the summer of 2008 the Service had numerous reports from Kamishak Bay about dead sea otters. The ADF&G camp at McNeil Cove responded to this event by retrieving dead otters and shipping them to the Service in Anchorage for necropsy. Every carcass was examined by a veterinarian familiar with marine mammal necropsy techniques or a board-certified veterinary pathologist. Samples from dead otters were submitted for testing at the Wildlife Health Center located at U.C. Davis for histological examination. It was discovered that these otters were succumbing to *Streptococcus bovis* endocarditis/septicemia (SBE/S). Prior to 2008 the Service had no data from Kamishak Bay to assess whether SBE/S was a factor for listed otters from this area.

In response to this event ADF&G invited Verena Gill, a wildlife biologist with the Service's Marine Mammals Management office, to visit McNeil in July 2008 and assess the potential for collaboration between the two agencies. During this time over twenty miles of coastline were surveyed, 3 sea otter carcasses were retrieved and processed, staff were trained in collection procedures, and a procedure for future systematic beach walks was established.

In 2009 Verena Gill (USFWS) and ADF&G secured Federal Aid funding (Cooperative Endangered Species Conservation Fund (Section 6 ESA – 75% plus 25% state match) for a three year (2009-2011) project to search for and gather northern sea otter carcasses in the Kamishak Bay area and to have necropsy, histology, and diagnostic analysis conducted. The project consists of the following: Foot surveys from Contact Point (Amakdedori Beach) to the Kamishak River and around Augustine Island for an annual survey of winter kill sea otters in Kamishak Bay; Systematic weekly beach surveys in and adjacent to McNeil Cove looking for dead sea otters found; sending tissues samples to UC Davis for further analysis; and entering data into an existing Access database.

On June 1, 2009- during a beach survey from McNeil camp to Horseshoe Cove. One sea otter skull was found in Horseshoe Cove. Augustine Island was surveyed June 7, 2009 via helicopter and foot surveys of three beaches to search for winter-kill otters. One adult male skeleton and one female skeleton were found within a few hundred feet of each within the main lagoon. Skulls from both were collected for tooth aging.

Between June 7th and June 9, 2009 Tom Griffin, Larry Aumiller and Verena Gill conducted the initial beach survey from the north end of Amakdedori Beach to McNeil camp. During transport to Amakdedori, the tideline north from McNeil Cove was surveyed via helicopter at 200ft looking for fresh dead otters. None were found. The shoreline from the north end of Amakdedori Beach to McNeil camp was then surveyed on foot concluding on June 9th. The skeletal remains of 6 sea-otter carcasses were found along the northern half of the 10 mile long Amakdedori beach on July 7th. Skulls were collected for aging and sexing purposes. Scattered bones of possible sea otters were also found but since it could not be confirmed with 100% certainty these were not counted. At Chenik Head a cache of dead (suspected) sea otters were found in the grass above high tide and it was speculated that wolves had drug beach cast otters up there to feed upon. Only one skull was recovered so it could not be confirmed if these were all sea otters but it is suspected there were at least four animals. On the new tideline between the Paint River and Polly Cove a dead female sea otter pup (~2 months) was found - estimated to have died 2 days prior. A necropsy of this pup was performed at McNeil camp the next day. Necropsy reports (FW09018-FW09028) were completed for all 11 confirmed sea otters found during the survey.

Between June 23 and August 23, 2009 four foot surveys were conducted of the collector beaches in the McNeil River area between Pinkidulia cove on the south and McNeil Head on the north. No sea otter carcasses were found during these surveys.

A more detailed summary of observations during the 2009 surveys can be found in Appendix C.

McNeil River Brown Bear & Chum Salmon Research

Western Washington University graduate student Ian Gill (former McNeil Technician) and his assistant Larry Aumiller (former McNeil River Sanctuary manager) spent July 1 through August 3 researching the predator-prey dynamic between brown bears and the chum salmon at McNeil Falls in an effort to calculate the number of salmon harvested by bears and to understand the factors affecting the success of individual bears, how they learn, and how this interaction affects the health of both populations. Ian has been assisted in and out of the field by his graduate advisor Jim Helfield and by Ted Otis (ADF&G Division of Commercial Fisheries Research Biologist).

Between July 1st and August 3rd of 2009 daylight observations were made at McNeil Falls. With few exceptions these observations occurred every day between the hours of 1100 and 2300 (July 1st through July 18th), and between 1000 and 2200 (July 19th through August 3rd). The McNeil Falls area was divided into six discreet sectors. On the hour counts were made of all bears in view, including the demographic composition (i.e., male, female, unknown, cub, sub-adult, adult) of the individuals located in each area. The number of chum salmon caught by bears in each area during each consecutive hour was also recorded. Additionally, a sample of individual bears were followed throughout their visits to McNeil Falls, recording the time and length of visit, fishing locations, time and length of fishing bouts, and number of fish caught.

These data yielded a total of 7,590 observed bear hours (total of all bears counted each hour). The daily average of all 13 hourly counts ranged from 3.25 to 32.75 bears in view, with an average of 18.60 bears in view. The maximum number of bears in view recorded on the hour was 48 at 2100 hours on July 19th. Daytime observations recorded a grand total of 12,041 chum salmon caught by bears at McNeil Falls. The percentage of fish caught in each sector was also calculated.

To supplement daylight observations an infrared camera (with accompanying digital recorder and two 12 volt batteries) was installed on downstream edge of the upper McNeil Falls viewing padd. Two 85W solar panels were installed out of view on the knoll just upstream of the viewing pad, and were wired into the charge controller via 200 feet of cable buried in a trench. The camera was housed in an aluminum casing and surrounded by 133 infrared LED's, which were programmed to turn on when the ambient light dropped below 10 LUX. The camera lens was a 16mm video lens, with a corresponding field of view of approximately 50 feet wide by 40 feet tall. This field of view matched the infrared beam from the LED's, but did not provide a view of the entire falls. A particular area was chosen for recording each night.

The infrared camera was programmed to record twelve hours of footage each night, covering the time the research crew was away from the falls, which it did successfully from July 5th through the night of July 16th. However, a faulty wire, consistently cloudy weather, and unanticipated power consumption from the DVR caused the batteries to be taxed beyond their abilities. Between the nights of July 17th to July 28th there was only one full 12-hour night of data collected (July 20th), with other nights ranging between one and five hours. After recharging the batteries using ADF&G's generator on July 29th, four more consecutive full nights of data were recorded (July 29th through August 2nd), though by the final night the batteries were again over-taxed and shut off after 3 hrs and 18 minutes of operation.

The result was 240.5 hours of video footage on the nocturnal foraging activity of brown bears at McNeil Falls. Review of this footage revealed an additional 1,733 fish caught by bears, bringing the grand total of documented predation to 13,774. While bear density fluctuated throughout the nocturnal footage, at least one bear was present in 92% of all hourly observations (with a mean of 2.18 bears in view).

Thus far data on bear densities at McNeil Falls during 2009 corroborate the general opinion that bear activity increases from the early morning to the late evening, then drops off as it gets dark. Likewise, predation rates (chum caught per hour) generally increased throughout the day, then decreased after dark.

Bear density may be consistently lower after 0100 hours as foraging efficiency drops in the darkness. As such, available daylight may be an environmental factor influencing bear-salmon predation at McNeil Falls. Additionally, there were two high water events during which heavy rainfall caused the river to rise quickly and bear fishing activity to slow dramatically. This suggests that stream flow may also be an important environmental factor influencing bear density and predation at McNeil Falls.

V. 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. The maximum number of people able to visit the sanctuary each season under the existing permit program is 257 people.

Anyone may apply to the lottery for a Viewing Access Permit provided they did not win the preceding year. Applicants may apply online or with a mail application. The lottery application fee is \$25.00 per person. If selected in the lottery, each Guided Viewing Permit holder is assessed a permit fee of \$150 for each Alaskan resident and \$350 for each non-Alaskan resident. Camp-Standby Viewing Permit holders are assessed a permit fee of \$75 for each Alaskan resident and \$175 for each non-Alaskan resident.

Guided Viewing Permits allow visitors to visit the sanctuary and the bear viewing sites in the sanctuary (McNeil River Falls or Mikfik Creek) during a specified time period. A Camp-Standby Viewing Permit allows visitors to visit the sanctuary, view bears and wildlife in the vicinity of the campground and along a limited portion of the coast, and to go to the bear viewing sites (McNeil River Falls or Mikfik Creek) when a Guided Viewing Permit holder does not utilize their permit. It is rare that a Camp-Standby Viewing Permit holder is unable to visit the bear viewing sites at least once during their visit.

Special Access Permits are available to individuals that have a special need to visit the Sanctuary. These needs may include (but are not limited to) scientists, land managers, educators, public or artistic media representatives, film makers, or others acting in an official capacity and who would benefit professionally by visiting McNeil River. These permits will only be issued to individuals who's work will benefit the McNeil River Sanctuary and/or the general efforts to conserve bears. Access to the McNeil River Sanctuary using these permits during the period of June 7-August 25 is issued by the Commissioner of the Department of Fish and Game following the review of the proposals by the McNeil River Permit Review Panel. Generally, no more than 10 permits (each valid for a 4-day period) may be allocated for scientific, educational and media purposes; and no more than 5 permits (each valid for a 4-day period) are generally allocated for Commissioner's permits.

The Special Access Permit applications application fee is \$50.00 per person.. If selected by the Commissioner of the Department of Fish and Game to receive a Special Access Permit, there is a use fee of \$150.00 for each Alaskan Resident and \$350.00 for each Non-Alaskan Resident.

In 2009, 725 people applied for McNeil River Guided and Standby bear viewing permits. Payments were received for 160 Guided Viewing Access permits and 22 Standby Viewing Access. There were 17

Special Access (Sci-Ed) permits granted by the Commissioner (including 12 permits that were applied for by four groups of three individuals).

In 2009, 181 permit holders (Guided Viewing, Camp Standby, and Special Access) visited the sanctuary (table 4). The 5-year annual visitation average is 176.

The average number of permits used each day (permittees that bear viewed) at the sanctuary in 2009 was 8.0 (out of a maximum of 10.0), which is slightly higher than the low of 6.6 in 2002. This number was in due to 11 guided permit no-shows, 4 standby permit no-shows, 3 guided permit cancellations, 21 standby permits that were not filled in 2009, and on-site permit winners choosing not to participate in the guided bear viewing hike (due to weather, choosing an alternative activity, or resting due to physical limitations).

There were 7 parties (17 permittees) that met the Department's scientific, educational, or media criteria for Special Access permits. Permittees included: Todd Palin, Chuck and Sally Heath (accompanied Governor Sarah Palin and ADF&G Commissioner Denby Lloyd); bear researchers (Washington State University, Transboundary Grizzly Project Team-British Columbia, Minnesota Department of Natural Resources, USGS-Montana, and ADF&G-Kodiak); National Natural Landmark Program staff (Alaska and Arizona); National Park Service resource managers (Anchorage, Katmai National Park, and Kenai Fjords National Park); ADF&G Hunter Education and Wildlife education volunteers.

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 – there was a noticeable increase in 2007 which was likely the result of the Board of Game's proposal to open hunting in the McNeil Special Use Area. Perhaps the reason for the general decline in applicants is the increased availability of commercially guided bear viewing operators in the region. Nonetheless, a number of on-site visitors stated that McNeil River is “deal” in terms of the experience achieved relative to the dollars spent to participate. Anecdotally this seems especially true for professional, semi-professional photographers, and serious amateur photographers. There are a number of dedicated repeat McNeil visitors.

In 2009, \$61,325 was generated from the McNeil River sanctuary permit program and all revenues were deposited in the Fish and Game Fund.

Kamishak River

Lodges and air charter services conduct sport fishing and wildlife viewing trips within the Kamishak River drainages within the MRSGS and adjacent Katmai National Park. This area is also part of the Kamishak Special Use Area, which is managed by the Department of Natural Resources. Businesses store riverboats on the lower reaches of the river and one of the businesses maintains a temporary guide camp on the lower Kamishak River; both activities require an ADF&G Special Area Permit. 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.

Businesses that hold ADF&G Special Area Permits for boat storage at this location are required report the number of guides, clients, fish harvested/released, as well as the number of bear observed on a data sheet titled “Annual Report for Guides, Transporters, and Lodges”.

Four commercial sport fishing guide services were authorized to operate within the Kamishak River area of the MRSGS in 2009. They reported 379 visitor use days and 116 guide use days during the 98 days spent guiding in the sanctuary (Table 5). Three of these operators held Special Area Permits for the storage of boats and operations in the Kamishak River area. Their primary activity was sport fishing; however, they also engaged in wildlife viewing activities, primarily viewing of brown bears. In contrast, National Park Service Katmai National Park information reported from seven companies for the Kamishak River show 721 user days (guide use and visitor use days combined).

Chenik Area

Two commercial bear viewing guide services from Homer brought clients to the Chenik area in 2009. One of these guide services hires a flight service for transport and the other is an air charter/bear viewing operation that conducts day trips.

The “bear viewing only” service guided a BBC film crew (3 clients) from 7/9 through 7/18. The group camped at Chenik Lake and hiked to lower Chenik to film and view bears. The guide and assistant guide were at the site from 7/8 through 7/19. The guide reported a minimum of 19 individual bears (1 female and 2 cubs of the year (COY), 1 female and 2 yearlings, 1 female and 1 yearling, 2 mature females, 4 subadults, 3 young males, 2 mature males). This guide also made an exploratory trip to the mouth of the Kamishak River to plan a walking route for clients.

The “air charter/bear viewing service” brought a total of 60 clients to the Chenik over a period of 7 days (7/2, 7/3, 7/4, 7/5, 7/6, 7/24, and 9/12). The plane landed on Chenik Lake and the group hiked to lower Chenik Creek to view bears.

ADF&G is aware of only one private group recreating in the Chenik area in 2009. A party of seven from Homer camped at Chenik Head. The group bear viewed at lower Chenik Creek and hiked from July 11 through July 14. One member of the group reported observing at least 15 individual bears, mostly sows with cubs (one sow had 3 COY and another sow had two COY).

Other

Air charter services periodically land on Chenik Lake, Paint River Lake, Mikfik Lake, and other water bodies within the sanctuary and refuge when waiting on tides and weather.

Bear-Human Conflicts

There were no known adverse interactions between bears and people in the sanctuary or refuge during the 2009 season.

A brawl erupted at McNeil Falls between a maternal sow and a young male. A tangle of two bears rolled to within 3 feet of one of the 5 bear viewers located on the lower McNeil Falls viewing pad. The brawl was diffused when a folding chair that was pitched from the upper viewing pad landed within a foot of the two entwined bears. The bears separated and departed in a seemingly casual manner.

As usual a few bears wandered into camp and were easily hazed (low level) out of camp without incident by McNeil staff. Bears that wander into camp are usually sub-adults, though there have been a few instances of adult bears in camp.

VI. Land Management

Land use within the MRS GS and the MRS GR are managed through ADF&G Special Area Permits (no fee). Access to MRS GS is managed through Commercial Transporter Permits (\$100.00) and Commercial Guide Access permits (\$100.00). Land use permits are also issued by the Alaska Department of Natural Resources.

McNeil River Area

A Special Area Permit, with a term of 5 years (2009 – 2014), was issued to the ADF&G Wildlife Conservation Division for operation and maintenance of the bear viewing camp, trail maintenance, bear viewing operations, and construction of a new cabin. A Special Area Permit, with a two year term (2009 – 2010), was issued to a Western Washington State University for installation and operation of one or two video cameras at McNeil River Falls.

Commercial Transporter Permits were issued to 3 air carriers that specified interest in transporting clients to the McNeil River ADF&G camp. One of these permits was issued to the flight service that carries the most bear viewing permittees to the McNeil ADF&G camp and the other two permits were issued to flight services occasionally brings bear viewing permittees to McNeil. One of these carriers specified interest in flying to both McNeil River and Kamishak River. The second most frequent carrier neglected to purchase a Commercial Transporter Permit for the 2009 season. The second most frequent commercial bear viewing permittee transporter did not purchase a Commercial Transporter Permit for the 2009 season.

Mikfik Creek

A special area permit was issued to Ted Otis (ADF&G Division of Commercial Fisheries) for the installation and operation of a video fish escapement recorder.

Kamishak River

Lodges/air charter services conduct sport fishing and wildlife viewing trips on the Kamishak River within the MRS GS and adjacent Katmai National Park. This area is also part of the Kamishak Special Use Area, which is managed by the Department of Natural Resources. Businesses store riverboats on the lower reaches of the river and one of the businesses maintains a temporary guide camp on the lower Kamishak River; both activities require an ADF&G Special Area Permit. Businesses that hold ADF&G Special Area Permits for boat storage at this location are required report the number of guides, clients, fish harvested/released, as well as the number of bear observed on a data sheet titled “Annual Report for Guides, Transporters, and Lodges”.

In 2009 there were 3 Special Area Permits distributed for boat storage at the Kamishak River and one of these permits included reauthorization of a guide camp. These 3 permits account for only 7 of 33 boats that were observed during a 2007 interagency site inspection (see below). Commercial Transporter Access Permits were issued to 5 air carriers that specified interest in transporting clients to the Kamishak River. One of these carriers specified interest in flying to both McNeil River and Kamishak River.

An inter-agency site patrol of the Kamishak River has not been conducted since 2007. The 2007 site patrol conducted by ADF&G and Katmai National Park and 33 boats were observed at the Kamishak River. There were 6 boats of unknown ownership and 20 were “on the water” (i.e., being used or had been used in 2007). Both ADF&G and NPS have a boat stored at the Kamishak River. Only three of the lodges had current ADF&G Special Area boat storage permits and 4 of the lodges turned in the ADF&G “Annual Report for Guides, Transporters, and Lodges”. Only one of the two lodges that had guide camps

had a current ADF&G Special area camp permit. Lodges that did have the required permits were notified by ADF&G via mail.

The area will be monitored in the future 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.

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 Area

A special area permit with a term of five years (2008 – 2012) has been issued to ADF&G Division of Commercial Fisheries for the installation and operation of a video fish escapement recorder and maintenance of the cabin at Chenik Lake. A commercial bear viewing guide from Homer obtained a special area permit for a temporary tent camp at Chenik Lake. Cook Inlet Aquaculture Association held an ADF&G Special Area Permit for a weir on Chenik Creek, but did not operate a weir at Chenik Lake in 2008. A special area permit with a term of six years (2004 – 2009) has been issued to the UNAVCO Plate Boundary Observatory (a non-profit, membership-governed consortium that supports and promotes Earth science by advancing high-precision techniques) for the installation and maintenance of a GPS station Chenik Mountain. Data collected from the station will be used in conjunction with seismic monitoring stations to monitor plate tectonic motion and local deformation associated with subduction of the Pacific plate beneath the North American plate along the Aleutian Trench.

VII. Sanctuary Administration & Management

Staffing

Sanctuary Manager Doug Hill completed his fourth season at McNeil River. Assistant Sanctuary Manager Tom Griffin completed his tenth season at McNeil. Missy Epping (Wildlife Technician III) completed her first season as a McNeil River bear viewing guide. We were very fortunate to have John Hechtel (retired ADF&G bear researcher) and Samantha McNearney (ex-McNeil River bear viewing guide) as a fill-in guides when regular staff were on leave.

Volunteers

A crew of 6 volunteers arrived during the third week of May and departed during the first week of June. This group opened the camp, razed the old rotting and leaking toolshed/guest quarters, prepared a building site for the new toolshed/guest quarters, moved cabin materials from a landing craft to the building site, graveled trails, assisted 2 hired carpenters and 1 ADF&G employee in the construction of the new building, assisted in a sea otter carcass survey, cut and split firewood, and carried out a number of other general camp maintenance chores. Under the guidance of Assistant Sanctuary Manager Tom Griffin this group completed a very impressive amount of work and deserves much praise and thanks!

VIII. Acknowledgements

Sanctuary Manager Doug Hill, Assistant Sanctuary Manager Tom Griffin, ADF&G-DWC Technician Missy Epping collected data on bear use and visitor activities. Doug Hill drafted this report. Ed Weiss (ADF&G-DWC) edited and finalized this report. Lem Butler (ADF&G-DWC) provided bear harvest data. Lee Hammarstrom and Ted Otis (ADF&G-CF) prepared the narrative on fish escapement, commercial fisheries, fish enhancement, and fish research. Gary Fandrei (CIAA) provided information about Cook Inlet Aquaculture Association Paint River fish ladder activities. Kenton Henry (ADF&G-DWC) provided bear viewing permit information. Donna Monaghan (ADF&G) provided special area permit information. Sandy McIntosh (ADF&G-DWC) provided commercial transporter permit and resale permit information. Verena Gill (USFWS) provided sea otter carcass survey information. Earl Becker (ADF&G-DWC) provided the Shewart Control Chart and Liz Solomon (ADF&G-DWC) prepared the GIS map. Information on Sportfishing effort was provided by Area Sportfish biologist Nicole Szarzi and participating area sportfish guides.

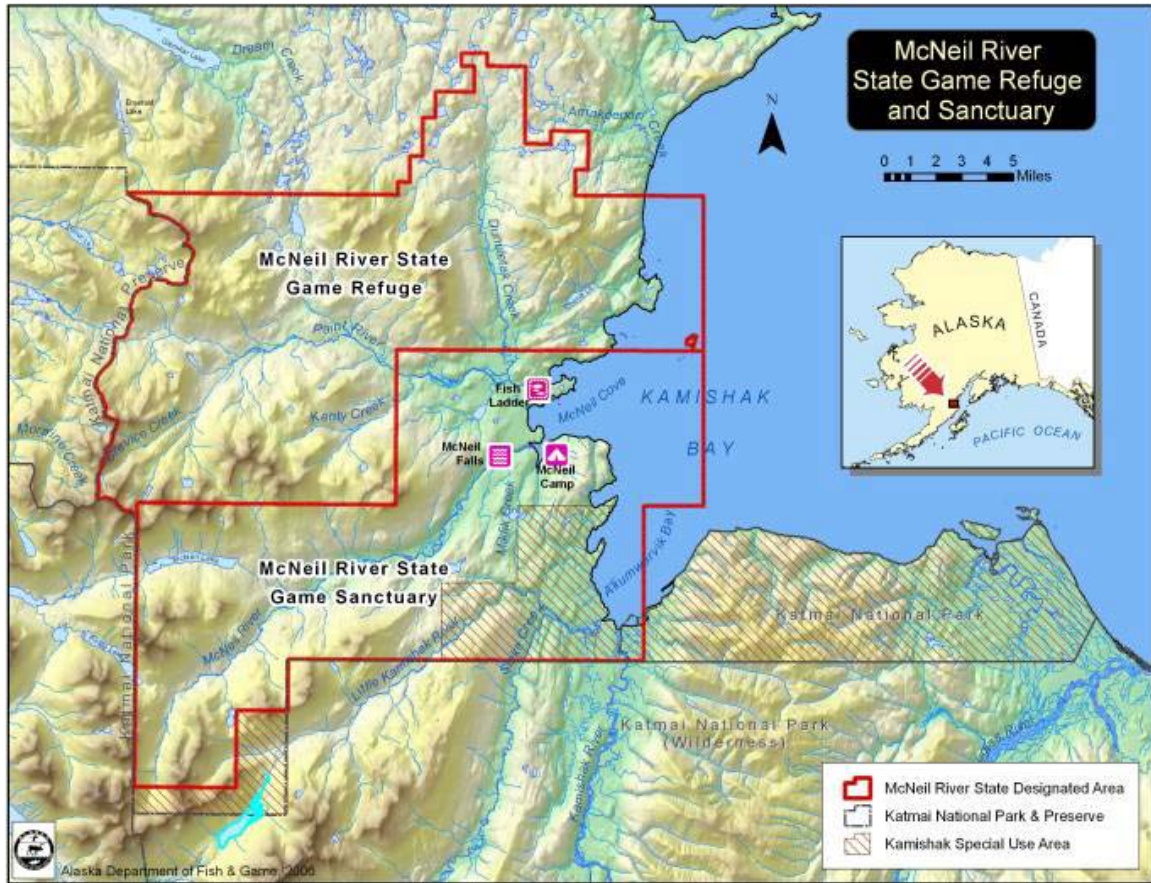


Figure 1. Map showing location of the McNeil River State Game Sanctuary and Refuge in southwestern Alaska.

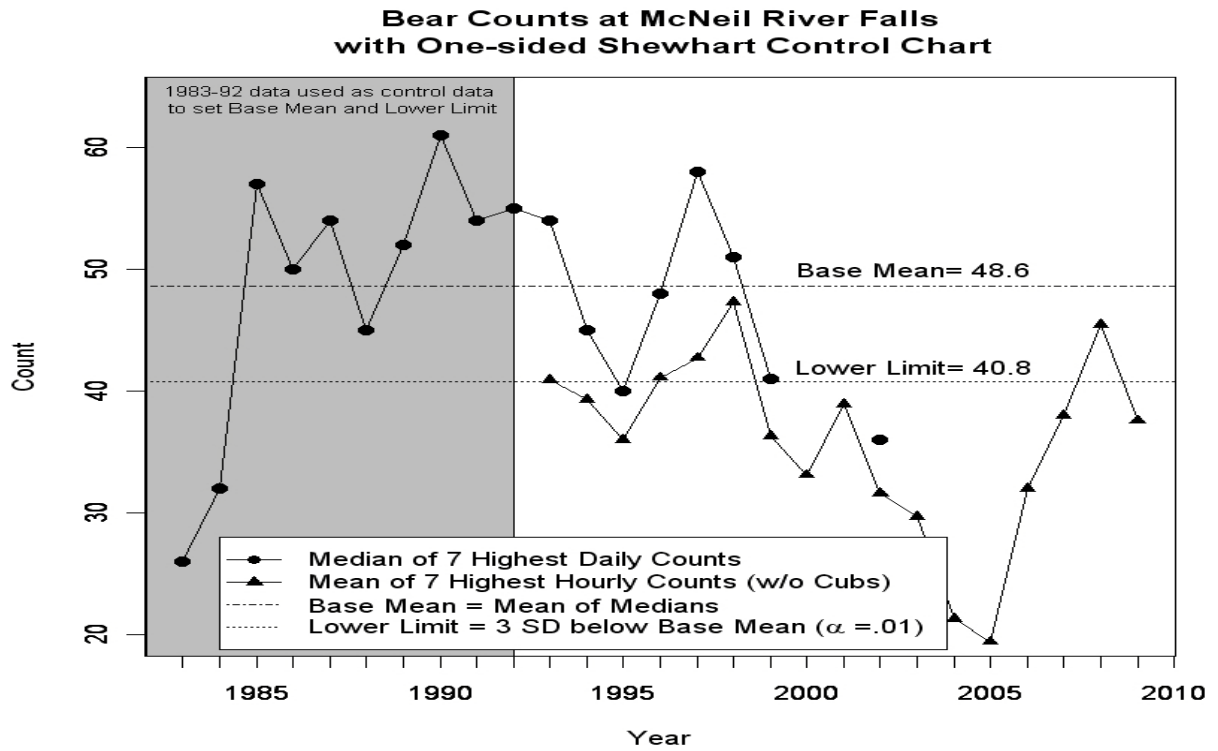


Figure 2. Chart of the daily and hourly bear index counts at McNeil River Falls, Alaska, 1983 – 2009.

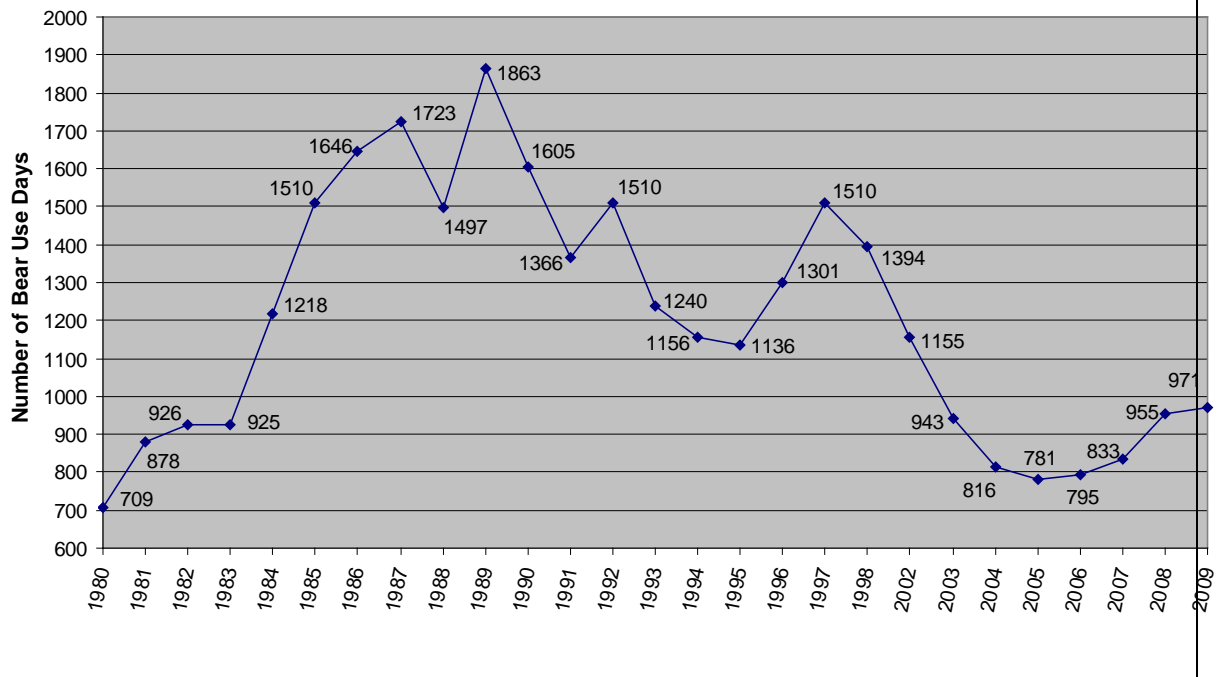


Figure 3. Bear Use Days at McNeil River Falls, McNeil River SGS, Alaska, 1982 - 2009.

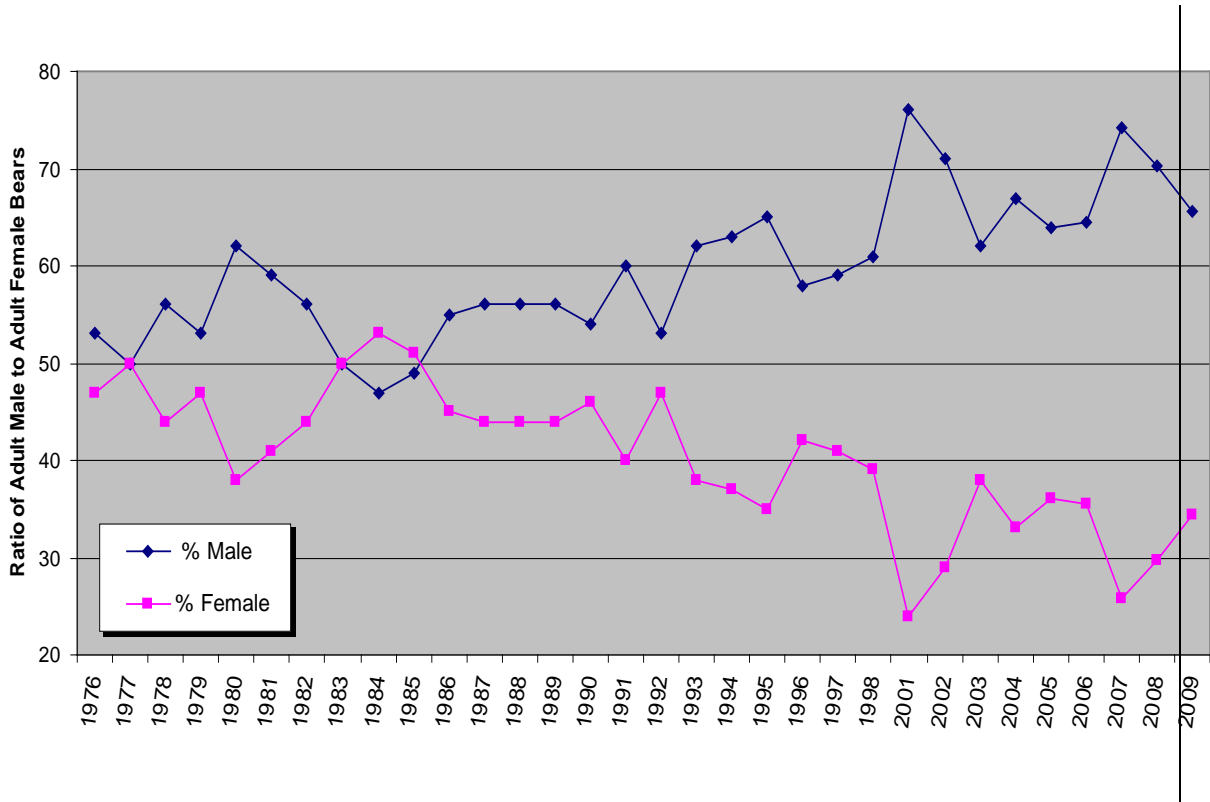


Figure 4. Annual proportion of adult male to female bears observed at McNeil River SGS, 1976 – 2009.

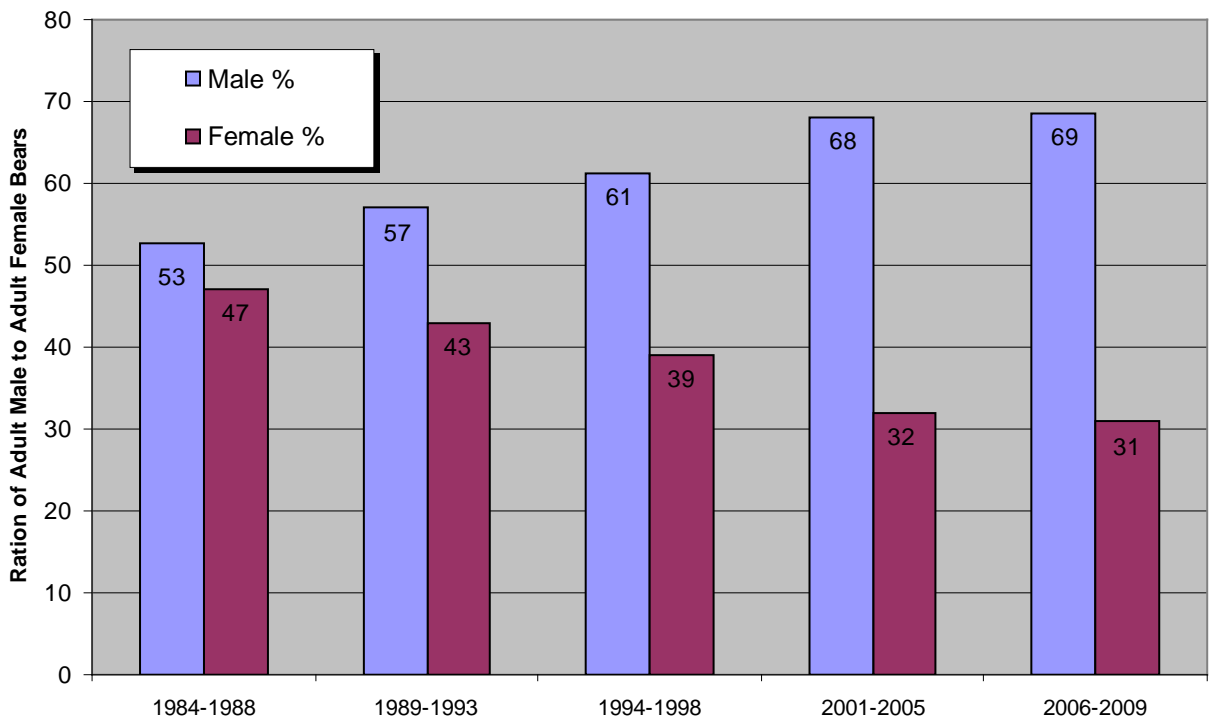


Figure 5. 5 year average proportion of adult male to female bears observed at McNeil River SGS, Alaska, 1986 – 2009. (except for 2006-2009; no data collected in 1999 or 2000).

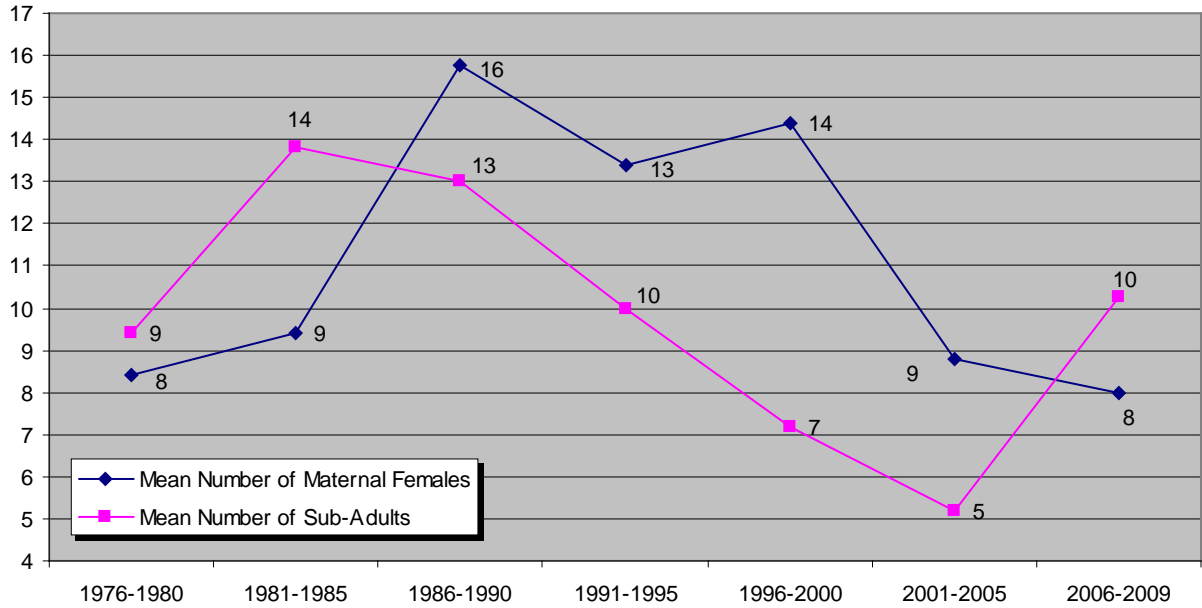


Figure 6. Average annual number of maternal females and sub-adult observed at McNeil River Falls, 1976-2009.

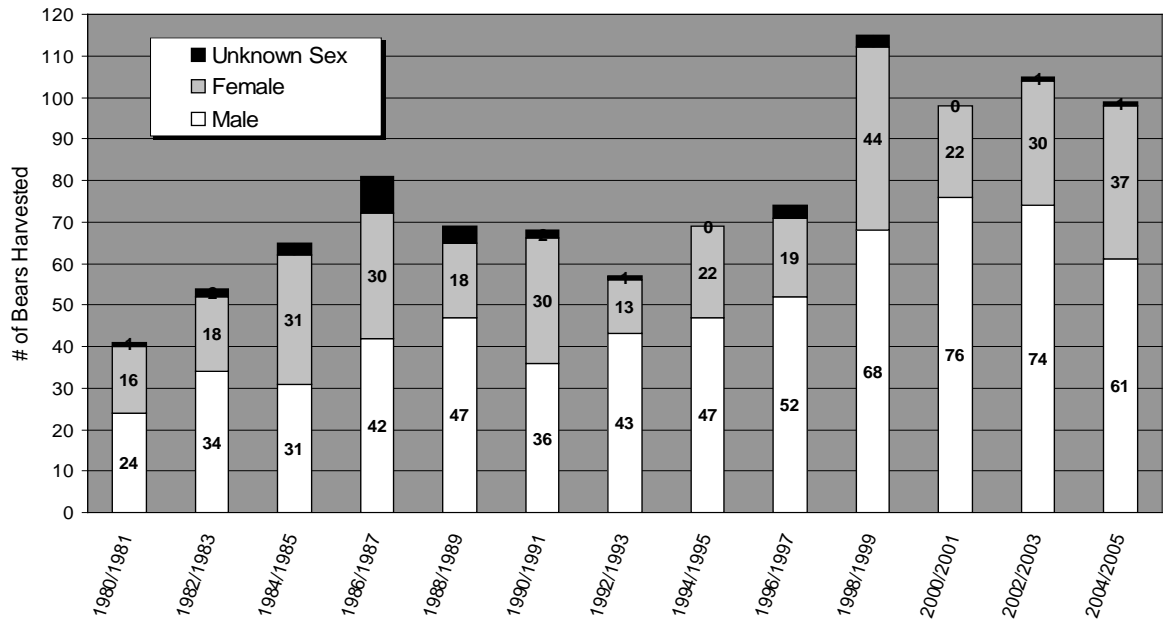


Figure 7. Brown bear harvest from areas surrounding the McNeil River SGS & Refuge, 1976-2009 (harvest from GMU/UCUs: 9A/201, 301, 401, 501; 9B/301; and 9C/101, 201,301, 601, 702, and 703). Two consecutive regulatory years* are lumped

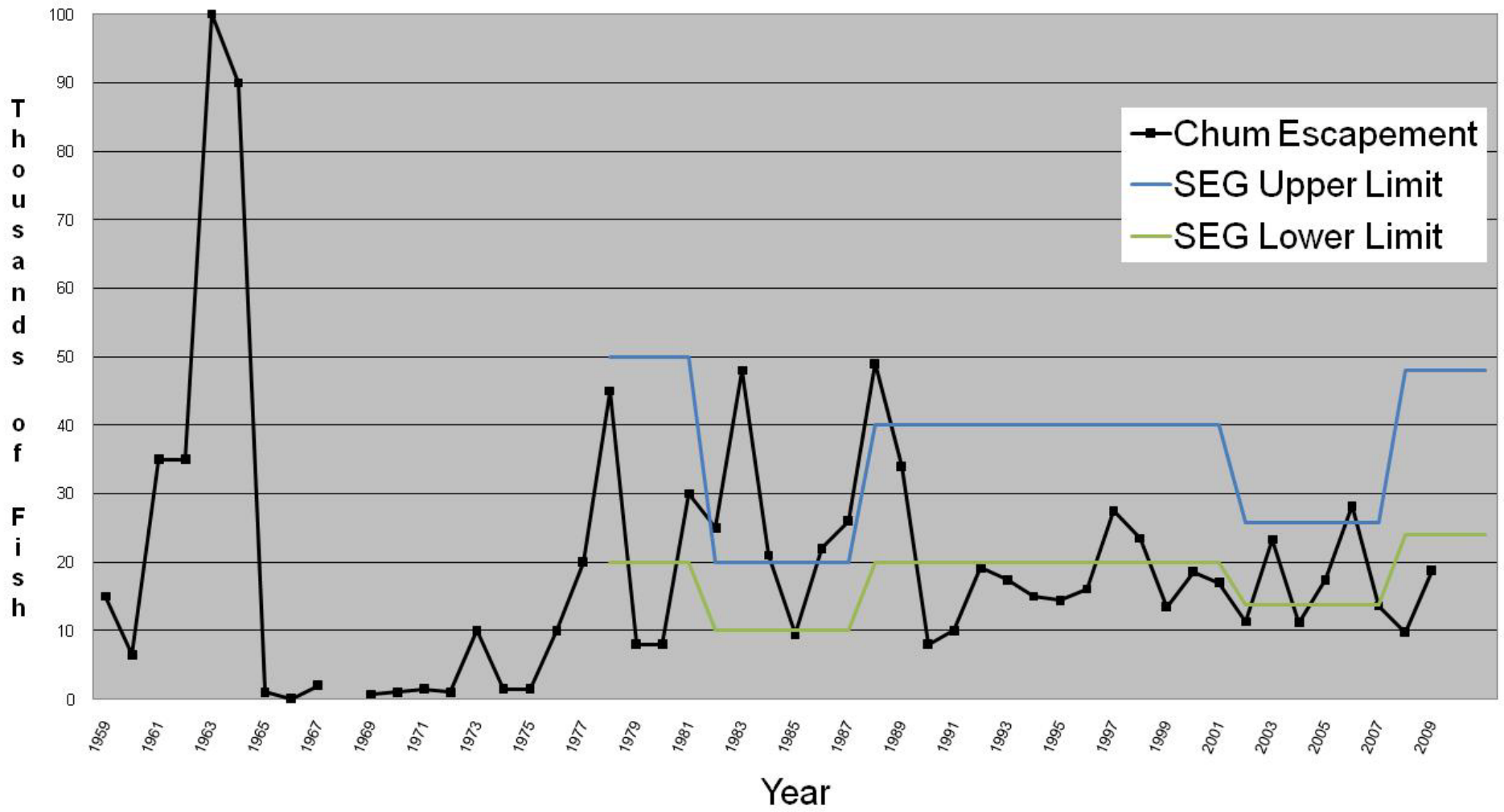


Figure 8. McNeil River chum salmon escapement 1959-2009, McNeil River SGS, Alaska.

Table 1. Hourly Index Counts of brown bears at McNeil River Falls, McNeil River SGS, Alaska, 1993-2009.

Date	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
July 15	-	-	-	38	40	<u>47</u>	28	<u>37</u>	25	30	<u>42</u>	<u>24</u>	<u>23</u>	<u>31</u>	31	25	<u>41</u>
16	-	-	-	<u>46</u>	32	42	28	31	<u>39</u>	26	<u>31</u>	<u>31</u>	<u>22</u>	<u>31</u>	<u>35</u>	32	<u>34</u>
17	-	-	-	29	47	46	35	31	<u>41</u>	32	<u>36</u>	<u>22</u>	<u>23</u>	<u>31</u>	<u>37</u>	29	<u>35</u>
18	<u>37</u>	30	29	<u>44</u>	43	<u>47</u>	26	32	<u>40</u>	<u>33</u>	<u>40</u>	<u>23</u>	<u>21</u>	30	<u>37</u>	39	<u>34</u>
19	<u>58</u>	<u>50</u>	<u>33</u>	<u>54</u>	<u>66</u>	<u>57</u>	36	<u>36</u>	<u>35</u>	<u>35</u>	<u>40</u>	<u>28</u>	<u>20</u>	<u>33</u>	32	41	<u>39</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>	26	<u>38</u>	<u>27</u>	<u>24</u>	<u>37</u>	<u>42</u>	<u>46</u>	<u>40</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	21	<u>40</u>	40	21
22	<u>54</u>	26	<u>48</u>	<u>49</u>	44	18	<u>38</u>	<u>37</u>	32	25	<u>37</u>	<u>22</u>	16	26	<u>36</u>	<u>42</u>	10
23	<u>49</u>	<u>43</u>	29	<u>47</u>	<u>63</u>	35	<u>42</u>	<u>36</u>	30	<u>41</u>	27	17	<u>18</u>	<u>31</u>	30	<u>42</u>	14
24	30	<u>52</u>	31	33	<u>52</u>	43	32	<u>36</u>	<u>42</u>	32	20	20	13	25	21	40	25
25	18	18	<u>39</u>	40	<u>51</u>	46	29	<u>36</u>	33	30	25	11	2	27	29	<u>53</u>	<u>40</u>
26	28	<u>37</u>	30	31	<u>54</u>	<u>63</u>	35	<u>32</u>	24	30	21	7	8	25	<u>36</u>	<u>51</u>	21
27	<u>34</u>	<u>44</u>	<u>39</u>	37	49	<u>50</u>	31	23	29	22	24	6	7	<u>31</u>	33	34	30
28	24	33	28	33	27	<u>51</u>	<u>37</u>	23	23	<u>34</u>	17	12	8	27	33	38	32
29	28	32	12	21	30	<u>48</u>	36	24	20	<u>36</u>	14	9	6	25	29	<u>42</u>	33
30	21	25	<u>32</u>	29	27	39	<u>41</u>	28	15	31	16	10	8	20	17	33	29
31	19	20	<u>35</u>	26	15	34	<u>42</u>	19	11	<u>33</u>	-	14	7	20	22	<u>42</u>	18
August 1	13	16	23	22	17	35	<u>42</u>	15	7	25	-	9	-	14	15	30	14
2	7	16	16	18	24	31	29	20	5	21	-	12	-	11	14	18	10
3	-	-	-	18	21	23	27	25	3	19	-	10	-	10	16	19	8
4	-	-	-	11	11	12	16	14	3	11	-	4	-	10	16	19	-
5	-	-	-	10	-	18	23	4	1	9	-	7	-	6	6	20	9
Average of 7 high days	48	44	38	47	55	52	40	36	39	36	38	25	22	32	38	45	38

Notes: Hourly counts are made throughout the viewing day of all bears in view from the upper viewing pad at McNeil River Falls.

Counts are generally made between 11:00am and 7:00 pm and average 6.5 hours/day.

The highest hourly count of each day is recorded in this table.

Does not include cubs.

(-) = Counts were not made.

Underlined Bold Numbers = 7 highest hourly counts for the season

Table 2. Composition of brown bears observed at McNeil River SGS, Alaska, 1976-2010.

Year	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
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	9	10	5	
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	<u>14</u>	<u>14</u>	12	8	16	12	13	14	7	9	16	
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	<u>48</u>	<u>48</u>	53	45	45	39	41	40	46	45	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	<u>0</u>	<u>0</u>	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	<u>73</u>	<u>69</u>	70	63	73	58	64	62	62	64	61	
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	<u>4</u>	<u>4</u>	4	4	2	4	2	6	2	2	2	
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	<u>2</u>	<u>2</u>	2	2	2	1	3	8	5	1	1	
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	<u>0</u>	<u>0</u>	0	0	0	0	0	0	7	6	1	
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	<u>6</u>	<u>6</u>	6	6	4	5	5	14	14	9	4	
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	<u>79</u>	<u>75</u>	76	69	77	63	69	76	76	73	65	
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	17	16	8	
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	<u>99</u>	<u>90</u>	87	90	103	78	87	91	93	89	73	
<p>Notes: (1) Defined as 5.5 years old and younger from 1977 through the present.</p> <p>(2) Only the bears that are recognizable as individuals (Known Bears). In addition bears that are recognizable but seen less than three times and not regular users of Mikfik Creek, McNeil River or McNeil Cove are not included. Hence these figures represent a minimum number of bears present at the sanctuary.</p> <p>Underlined Bold Numbers represent average of data four years prior and after (No data was recorded in 1999 & 2000).</p>																																			

Table 3. Aerial escapement estimates of salmon in the Mikfik Creek and McNeil River drainages, McNeil River SGS, Alaska, 2009.

Survey Date	Mikfik Sockeyes (Daily) ^a	McNeil Chums (Daily) ^a
6/5	0	
6/8	0	
6/11	6,020	
6/15	10,790	
6/19	11,300	
6/24	7,100	800
6/26	13,080	3,700
6/29	15,130	4,720
7/3	4,450	6,900
7/7	550	6 ^c
7/10	1,400	3,000 ^c
7/14	not surveyed	1,900
7/16	3,000	3,540
7/23	not surveyed	0 ^c
7/30	200	3,060
8/6		7,300
Escapement Index	15,130 ^b	18,766 ^d

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

^b The escapement index for Mikfik sockeyes is the peak daily count from all the aerial surveys flown that year.

^c Due to extreme glacial turbidity, linear interpolation was used to estimate the number of chums present on July 7, 10, and 23 (5,233, 3,567, and 3,300 respectively).

^d The escapement index for McNeil chums was derived by dividing the area under the escapement curve by a 13.8-day stream life factor and then applying a run-timing expansion factor to account for fish entering the system after aerial surveys were terminated.

Table 4. Historic Visitor Use at McNeil River State Game Sanctuary, Alaska, 1984-2009.

Year	Footnotes	# of Applicants	# of Bear Viewing Visitors 6/7-8/25*	Total Bear Viewing Days in Sanctuary 6/7-8/25**	Total Sanctuary Bear Viewing Visitor Days 6/7-8/25***	Total Sanctuary Visitor Days 6/7-8/25****	Total McNeil Falls Bear Viewing Visitor Days 7/1-8/25 (560 possible)*****	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,	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
2007	D, K, L, M, O, P	1156	157	540	781	832	356	6/7 - 8/26
2008	D, K, L, M, O, P	932	167	617	863	913	413	6/7 - 8/26
2009	D, K, L, M, O, P	725	181	639	948	1266	452	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 MRSGS.
- O = Includes Resale permits (Unissued permits were reissued and used).
- P = Includes "fill in" permits.
- * = Sum of all Guided, Standby, & Special Access Permittees that visited McNeil River State Game Sanctuary.
- ** = Sum of all Guided, Standby, & Special Access Permittees that bear viewed each day of season.
- *** = Sum of all Guided, Standby, & Special Access Permittees in Sanctuary each day of season.
- **** = Sum of all Guided, Standby, & Special Access Permittees & Non-Viewing permittees (staff subs not included) each day of viewing season.
- ***** = Sum of all Guided, Standby, & Special Access Permittees each day during approximate McNeil Falls season.

Table 5. Visitor Use and Sportfish harvest reported from Kamishak River Drainages, McNeil River SGS, Alaska, 2009.

Days in Sanctuary	# of Guide Days	# of angler Days	# of Non-angler Days	COHO SALMON		CHUM SALMON		PINK SALMON		DOLLY VARDEN		# of bears
				Kept	Released	Kept	Released	Kept	Released	Kept	Released	
98	164	379	0	404	1068	4	210	0	36	24	2518	886

Appendix A. List of Bears identified at McNeil River SGS, 2009.

Known McNeil Bears of 2009

	Adult Males	Adult Females	Females w/young	Sub-Adults
1	Derek	Chrisco	Sow Large Brown w/ 1 2-1/2	Female Sibling med/light brown (Waterfall's?)
2	Aardvark	Diamond-eyes	Sow Shed w/ 1 shed cub	Male Sibling med/light brown (Waterfall's?)
3	Ape-man	Dish	Sow w/ 2 yearlings	Spirit Bear (sex unknown)
4	Blonde White Claws	F Late Estrus	Sow w/ 3 blonde yearlings (1 darker)	Female Wall Bear
5	Boog	Flat-head	Wanda w/ 1 yearling	
6	Braveheart	Gimpy		
7	Collar-neck	Holderman		
8	Cornelius	Ivory Girl		
9	Custer	Lioness		
10	Dallas	Schnozz		
11	Dodge	Shed-legs		
12	Donnie	Simba		
13	Droop	Vanilla		
14	Dusty	Waterfall		
15	Ears	Winnie		
16	Elvis	Yolanda		
17	Escargot/Mindy			
18	Ghost Bear			
19	Goofy (7.5 yrs Teddies Boy?)			
20	Holden (7.5 yrs)			
21	Ian			
22	Ivan			
23	Jordan			
24	Leo (left ear curled)			
25	Luther			
26	McDoogle			
27	Not-ears			
28	Otto			
29	Plunger			
30	Pop-pie			
31	Rocky			
32	Scraper			
33	Short Face			
34	Silver Back			
35	Slick			
36	Ted			
37	Ted-Like			
38	True Coat			
39	White Collar			
40	Wolfgang			
Totals	40	16	5	4
	Total Males: 41*	Total Females: 23**		64 + 1 unk sub + 8 cubs = 73 bears

Notes: * = Includes one male sub-adult. ** = Includes two female sub-adults.

Table 4

Appendix B. 2010 Daily Wildlife Observations, McNeil River State Game Sanctuary.

DATE	COMMENTS
5/21/09	Wolf sign observed
Early June/09	Brant (<i>Branta bernicla</i>) observed
6/8/09	Sockeye observed Ocean-side spit
6/9/09	500 Black Scoter (<i>Melanitta nigra</i>) observed
6/9/09	Mallard observed
6/9/09	Northern Shoveler (<i>Anas clypeata</i>) observed
6/9/09	Green-winged Teal (<i>Anas crecca</i>) observed
6/9/09	American Wigeon (<i>Anas americana</i>) observed
6/9/09	Red-breasted Merganser (<i>Mergus serrator</i>) observed
6/9/09	brood Pintail observed Sauna pond
6/9/09	Sockeye observed
6/9/09	Wolf tracks observed Falls trail/Mikfik
6/9/09	Moose tracks observed Falls trail/Mikfik
6/9/09	Alpine Azalea (<i>Loiseleuria procumbens</i>) observed Falls trail
6/11/09	5,000-8,000 Sockeye observed Mikfik - Mostly lagoon and lower creek
6/12/09	(downy) Pintail chick observed Sauna pond
6/14/09	Monkey Flower observed
6/14/09	Geranium observed
6/14/09	Jacob's Ladder observed
6/14/09	Cloudberry observed
6/17/09	Fox pups observed
6/17/09	Iris observed
6/24/09	Chum observed
7/13/09	White-winged Scoters (<i>Melanitta fusca</i>) observed Overhead
7/13/09	Brant observed Overhead
7/15/09	Pintails observed
7/15/09	Mergansers observed
7/15/09	Mallards observed
7/16/09	observed
7/17/09	4 Coho Salmon observed
7/17/09	Chum observed McNeil Falls
7/17/09	Chum observed
7/18/09	Wandering Tattler (<i>Heteroscelus incanus</i>) observed McNeil Falls - middle rock
7/19/10	10 Sabine's Gulls (<i>Xema sabini</i>) observed McNeil Falls
7/20/09	Storm-Petrels observed Lagoon/Outside spit
7/20/09	Jaeger observed Lagoon/Outside spit
7/20/09	Arctic Tern (<i>Sterna paradisaea</i>) observed
7/20/09	Wandering Tattlers observed
7/22/09	Sockeye observed Mikfik Flats area

7/22/09	Gulls observed Mikfik Flats area
7/22/09	Eagles observed Mikfik Flats area
7/23/09	Gulls observed Mikfik Flats area
7/23/09	Eagles observed Mikfik Flats area
7/24/09	2 Pink Salmon observed Behind cabins
7/26/09	150 Black Turnstone (<i>Arenaria melanocephala</i>) observed Mikfik Riffles
7/26/09	6 Sabine's Gulls observed Mikfik Riffles
7/26/09	Female Harlequin Duck observed
7/27/09	2 Oystercatchers observed North of camp
7/28/09	Northern Fulmar (<i>Fulmarus glacialis</i>) observed Over spit
7/28/09	Brant observed Tide flats north of camp
7/28/09	Wolf track observed On beach near camp
7/31/09	Peregrine Falcon (<i>Falco peregrinus</i>) observed Mikfik Flats / Lagoon
7/31/09	Wolf tracks observed McNeil Falls trail
7/31/09	Western Sandpiper (<i>Calidris mauri</i>) observed Lagoon
7/31/09	White-winged Scoters observed Numerous flocks overhead
7/31/09	Brant observed Tide flats
8/1/09	Boreal Chickadees (<i>Poecile hudsonica</i>) observed In camp
8/4/09	Eagle nest - one adult, one young in nest observed On water creek drainage tree
8/9/09	Silver Salmon observed Ender's Island
8/12/09	Wood Frog observed McNeil Falls trail
8/13/09	Merlin (<i>Falco columbarius</i>) observed Towards McNeil Head
8/16/09	Trumpeter Swan (<i>Cygnus buccinator</i>) observed
8/16/09	Merlin observed
8/16/09	Northern Harrier (<i>Circus cyaneus</i>) observed
8/16/09	2 Wood Frogs observed
8/16/09	Merganser and ducklings observed
8/16/09	Mallard and ducklings observed
8/16/09	Spotted Sandpiper (<i>Actitis macularia</i>) observed
8/16/09	Starry Flounder observed
8/19/09	Three-toed Woodpecker (<i>Picoides arcticus</i>) observed In camp
8/22/09	Merlin observed
8/22/09	Peregrine Falcon observed
8/22/09	Northern Harrier observed
8/24/09	Northern Goshawk (<i>Accipiter gentilis</i>) observed Flying around camp

Appendix C. Summary of Observations during 2009 Sea Otter Carcass Surveys

June 1, 2009- Tom Griffin (ADFG) and McNeil cabin-building volunteers hiked from the camp to Horseshoe Cove along the tidelines. One sea otter skull was found in Horseshoe Cove.

June 7, 2009- Ed Weiss (ADFG) and Verena Gill (USFWS) travelled from Homer to Augustine Island via helicopter and circumnavigated the island at 200ft searching for fresh carcasses on the tideline. In addition, the helicopter landed at three beaches to search for winter-kill otters. Two complete skeletons were found within a few hundred feet of each other along the lagoon. One was an adult male (baculum present and large skull size) estimated to be about 8 years old and one was a female (no baculum present and small skull size) estimated to be about 12 years old. Skulls from both were collected for tooth aging. One live otter was observed in the lagoon at Augustine Volcano and several were observed along the outside beaches of the island. The most common marine mammal in the lagoon was the harbor seal; moms and pups were observed. On all the beaches that were walked fox tracks were observed and additionally a red fox was spotted from the air sitting on a rock. It is assumed that any freshly-dead otter that washes up is quickly consumed by foxes especially as there is a paucity of food for carnivores on the island. Marmots, passerines and shorebirds (i.e. semi-palmated plovers) were the only other food source for foxes observed. Other fauna seen: steller sea lions foraging just off-shore with gulls. Paucity of avifauna, mostly passerines present.

The survey crew departed Augustine Island and travelled to McNeil camp to drop off Ed Weiss and pick up Tom Griffin and Larry Aumiller for a trip to a point north of Contact Point. On the way the tideline north from McNeil Cove was surveyed at 200ft looking for fresh dead otters. None were found. About one half of the 10 mile long Amakdedori beach was surveyed prior to camping for the night. The skeletal remains of 6 sea-otter carcasses were found. Skulls were collected for aging and sexing purposes. Scattered bones of possible sea otters were also found but since it could not be confirmed with 100% certainty these were not counted.

June 8, 2009- The remains of a humpback whale that washed up summer 2008 at Amakdedori Creek were observed. This was the site where several sea otters were also discovered dead in 2008. The crew arrived at Chenik Head and had to wait for about 5.5 hours before the water was low enough to pass around the head. Right by the Head a cache of dead (suspected) sea otters was discovered next to the partial skeleton of a young wolf. Only one skull was recovered so it could not be confirmed if these were all sea otters but it is suspected there were at least four animals. The cache was in the grass above high tide and it was speculated that wolves had drug beachcast otters up there to feed upon. Camp was made at Amakdedulia Cove for the night.

June 9, 2009- On the new tideline between the Paint River and Polly Cove a dead female sea otter pup (~2 months) had washed up - estimated to have died 2 days prior.

Fauna seen from Amakdedori to McNeil: brown bear, marmot, wandering tattler, golden-crowned sparrow, yellow warbler, peregrine falcon, savannah sparrow, raven, bald eagle, semi-palmated plover, black oystercatcher, glaucous-winged gull, pelagic cormorant, robin, bank swallow. Lots of wolf and brown bear tracks were observed and river otter tracks were observed in Polly Cove.

June 10, 2009- A necropsy was performed at McNeil camp on the dead female sea otter pup from June 9.