Special Areas Management Report, ADF&G/DWC/SAMR-2019-1

McNeil River State Game Sanctuary Annual Management Report 2018

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2019

Alaska Department of Fish and Game Division of Wildlife Conservation

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Special areas management reports address management activities and goals within specific refuges, critical habitat areas, and sanctuaries managed by the division. Special areas management reports are intended for biologists or other technical professionals, as well as to inform the general public about the special areas.

This publication was reviewed and approved for publication by Joe Meehan, Lands and Refuges Program Coordinator for the Division of Wildlife Conservation, Anchorage.

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This document, published as PDF only, should be cited as follows:

Griffin, T. M., and E. W. Weiss. 2019. McNeil River State Game Sanctuary annual management report 2018. Alaska Department of Fish and Game, Special Areas Management Report ADF&G/DWC/SAMR-2019-1, Juneau.

Cover Photo: Brown bears (*Ursus arctos*) at McNeil Falls, McNeil River State Game Sanctuary. ©2018 ADF&G, photo by Thomas M. Griffin.

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Executive Summary

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

The sanctuary supports the largest gathering of brown bears in the world as they congregate to feed on migrating salmon. The Alaska Department of Fish and Game (ADF&G) operates a world-renowned bear-viewing 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.

Bear viewing was extremely good this season. Bear index count numbers at McNeil River falls, the primary bear gathering and viewing location, averaged 53 bears, above the historic average (bear threshold criteria) of 40.8 bears and higher than the averages of the last 3 years. Staff observed 110 individual bears this season; these spent approximately 2,641 bear use days within the sanctuary. The long-term (1976–2018) average number of individual bears annually identified is 94.4 and the long-term average of bear use days (1980–2018) is 2,104.

The bear-viewing program at MRSGS attracted 862 applicants from 13 different countries, who vied for 185 regular permits and 57 standby permits issued through a lottery. Forty one percent of applicants were Alaska residents and 59% were nonresidents. The 211 permits issued were distributed to Alaska residents (56%) and nonresidents (44%). The 187 participants who used their permits came from 7 countries, including Austria, Canada, Germany, Slovenia, Switzerland, Turkey and the United States. The MRSGS permit program generated approximately $96,060.00 in 2018, which is ultimately allocated to the state's Fish and Game Fund.

The 2018 cumulative McNeil River chum salmon (*Onchorynchus keta*) aerial survey escapement index was estimated at 37,331 fish, within the sustainable escapement goal (SEG) range of 24,000–48,000. The 2018 run timing of McNeil River chum salmon was earlier than the historic average. ADF&G-Division of Commercial Fisheries (CF), continued working on a remote video project designed to estimate bear predation on chum salmon at McNeil River falls.

During 2018 the Cook Inlet Aquaculture Association (CIAA) opened the Paint River fish ladder from 16 July through 11 October for potential salmon colonization. CIAA also began construction of a staff cabin at the Paint River ladder site, completing a perimeter fence and staging materials for 2019 construction. The video fish enumeration system was not installed during 2018 and aerial surveys were not completed in the Paint River system. Observations at the ladder were infrequent and could not confirm any fish within the Paint River. Thus, confirmation or escapement estimates of any fish colonizing the Paint River could not be made for 2018.

CIAA staff visited McNeil River camp to gain knowledge on MRSGS management issues and concerns and how those pertain to CIAA operations at Paint River.

A total of 10 ADF&G special areas permits, and 13 ADF&G commercial access permits were issued during 2018. These included the special areas and commercial access permits issued to commercial transport companies in the McNeil River, Paint River, Kamishak River, and Chenik Creek areas. There were no mineral resource developments or activities permitted or reported to the department within MRSGS or MRSGR during 2018. The recently applied for Pebble Mine project has the potential for impacts to wildlife resources, management and public uses within the MRSGR and MRSGS. ADF&G staff are working within the Army Corps of Engineers (ACOE) process to identify and address MRSGS/SGR issues and concerns.

♦ ♦ ♦

Introduction

McNeil River, located in southwestern Alaska (Fig. 1), supports the world's largest congregation of brown bears (*Ursus arctos*). The Alaska State Legislature established the McNeil River State Game Sanctuary (MRSGS) 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) above and to maintain and enhance the unique bear-viewing opportunities within the sanctuary; and 3) provide opportunities that are compatible with 1) above 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.

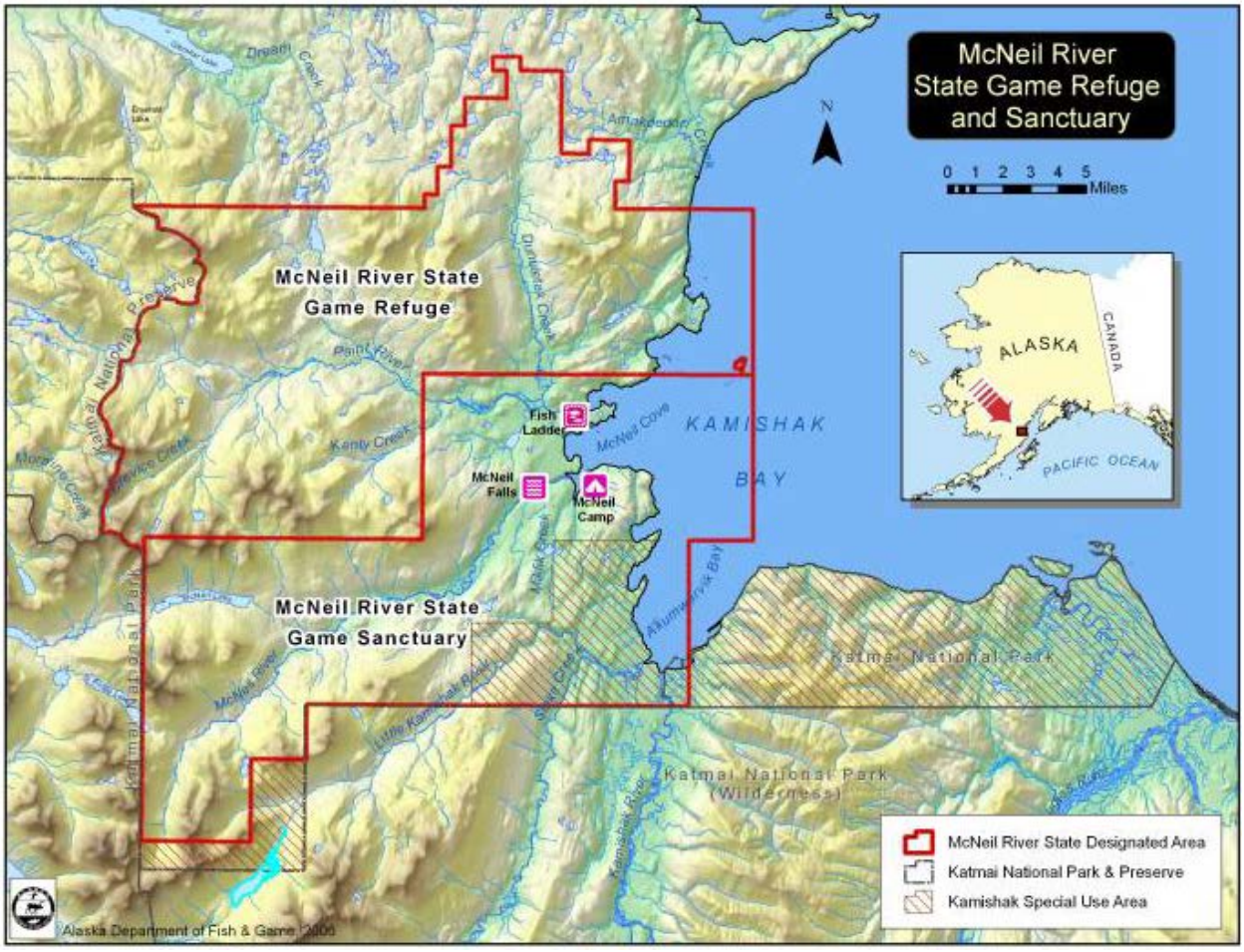

Figure 1. Location of the McNeil River State Game Sanctuary and McNeil River State Game Refuge in Southwest Alaska.

The sanctuary was expanded and the adjoining McNeil River State Game Refuge (MRSGR) was created in 1991; however, implementation of this legislation was delayed until January 1993 when the commissioner of the Alaska Department of Fish and Game (ADF&G) 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 are allowed in the refuge at the discretion of the Alaska Board of Game (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. Mineral entry in the refuge is permitted.

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 hunting, fishing, trapping, fishery enhancement activities, and resource development on these resources; and public use and management issues. A condensed version of 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).

Wildlife

BROWN BEAR MONITORING PROGRAM

MRSGS and MRSGR encompass approximately 388 mi^2. The department does not conduct bear surveys or have bear use data on the entirety of the sanctuary or refuge. Most of the brown bear monitoring and use data are connected with the bear-viewing program centered at McNeil River falls, lower McNeil River, and the Mikfik Creek area. Some additional information is provided through self-reporting by commercial sport fish and bear-viewing guide services that operate within MRSGS and MRSGR. Monitoring and reporting statistics and subsequent management decisions are based on the data gathered as part of the McNeil River bear-viewing program at McNeil River falls-Mikfik Creek area.

The number of bears at McNeil River fluctuates daily and annually. Variability in bear use may be influenced by various factors, including food availability, the strength and timing of salmon runs in McNeil River and surrounding river systems, changes in the regional bear population, as well as 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. It was 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. The department uses 3 different indices to monitor bear use at MRSGS: hourly index counts (the average of the 7 highest hourly counts each season at McNeil River falls), individual counts (the minimum number of individual bears observed during the season), and bear use days (the sum of the number of days each individual bear was present).

Overall bear viewing at McNeil River State Game Sanctuary was very good in 2018, as indicated by the three indices. Up to 20 individual brown bears per day were viewable throughout June. Brown bears began fishing at McNeil River falls by 23 June and staff started regularly guiding visitors to McNeil River falls by 29 June, viewing 7–12 bears fishing there, in late June. Sixteen to seventy-seven individual bears were observed per day at McNeil River falls throughout July, with viewing switching to a combination of lower river/lagoon and McNeil River falls viewing after 30 July. Family groups using the lagoon, spit, and nearby sedge meadows were easily

viewable from camp and provided good bear viewing throughout the season as they came and went past camp.

Hourly Index Counts

The index count monitoring program involves counting all bears in view once each hour during the viewing day to develop an index of bear-viewing quality. Historically these index counts were only done from the viewing pad at McNeil River falls each hour from 15 July through 5 August. The number of hourly counts that occur from year to year is variable due to the changing and opportunistic nature of the daily bear-viewing schedule. In order to obtain the index, only counts between 11:00 a.m. and 8:00 p.m. are used in the analyses and cubs are excluded from the overall count numbers. While viewing cubs actually enhances the bear-viewing experience, cubs are more prone to mortality and may not return in future years; therefore, they are not included in the index averages until they mature. The average of the 7 highest hourly counts for the season is then calculated for the index. Since 2011, staff has implemented these hourly counts throughout the bear viewing day at all locations for the entire season in order to gather additional data on bear use and the quality of the bear viewing at locations in addition to the McNeil River falls viewing pad.

During 2014–2015 a review of historic data and newer data gathered since 2011 revealed several factors that affect the index counts traditionally gathered at the falls viewing pad. For example, variations in the fish runs and high-water events affect the number of bears present at the falls. Thus the 7 highest hourly counts do not always fall during the 15 July–5 August period; this can skew the index towards a lower number in some years, if only the 15 July–5 August period is considered. Additionally, the practice of not including cubs in these index counts, and the range of viewing hours used were not consistently applied over the years. And finally, the Shewhart-CUSUM control monitoring scheme used to assess if the index number is within normal variation has not accounted for yearly variations in bear numbers.

In order to address these issues, ADF&G staff reviewed historic data and the Shewhart-CUSUM control monitoring scheme and determined that changes were needed to account for these issues. Consequently, data for 1993–2015 were reanalyzed to apply the following rules consistently from year to year and develop a more accurate model assessment of the index:

1. Hourly counts between 11:00 and 20:00 from McNeil River pad during 1 July–5 August are included (except that prior to 2005 counts only began 15 July)
2. Cubs were not included in analysis.
3. The 7 highest hourly counts are averaged to yield the index number.
4. The Shewhart-CUSUM analysis incorporates a cumulative mean value of the 7 highest counts and uses an error of 2 standard deviations as the lower limit that would indicate a potential issue with viewing at McNeil River falls.

Data presented in Table 1 and Figure 2 represent data revised after having consistently applied these rules across all years.

Table 1. High hourly index counts of brown bears at McNeil River State Game Sanctuary, Alaska, 2000–2018. (Underlined bold numbers = 7 highest hourly counts/season used for index.)

Date	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	MEAN
Jun-07												3	5	4	8	5	2	2	6	4.14
Jun-08												8	5	4	4	3	1	3	6	4.00
Jun-09												5	7	4	3	2	2	4	4	3.86
Jun-10												6	8	5	5	2	2	9	4	5.29
Jun-11												5	10	7	4	10	2	6	3	6.29
Jun-12												5	10	7	5	7	4	3	4	5.86
Jun-13												4	14	4	3	6	2	6	6	5.57
Jun-14												10	8	6	4	3	2	3	4	5.14
Jun-15												4	7	7	6	4	1	4	1	4.71
Jun-16												10	12	4	3	4	5	5	7	6.14
Jun-17												11	8	9	4	7	4	4	7	6.71
Jun-18												13	9	2	7	4	4	5	3	6.29
Jun-19												12	13	3	5	7	4	4	5	6.86
Jun-20												10	22	5	5	5	6	9	6	8.86
Jun-21												13	22	9	5	6	4	7	8	9.43
Jun-22												11	18	5	1	3	4	5	9	6.71
Jun-23												8	16	9	6	5	8	6	15	8.29
Jun-24												4	16	5	9	6	7	6	9	7.57
Jun-25												7	11	6	14	11	10	8	10	9.57
Jun-26												12	11	11	12	12	15	3	10	10.86
Jun-27												14	7	6	17	14	20	7	2	12.14
Jun-28												6	8	3	22	5	25	12	6	11.57
Jun-29												18	6	9	28	12	20	15	12	15.43
Jun-30						11						21	11	7	18	18	25	19	16	16.25
Jul-01							1			13	7	18		14	**38**	19	**27**	28	17	18.33
Jul-02						13				14	14	18		17	35	18	**27**	16	22	19.11

Date	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	MEAN
Jul-03									3	16	16	17	20	18	30	15	24	23	28	18.20
Jul-04						16	3			15	26	13	20	30	**44**	18	26	31	20	22.00
Jul-05						20	12	4	9	15	27	14	18	28	**37**	17	18	35	32	19.54
Jul-06						20	12	4	8	19	19	10		27	28	31	24	32	38	19.50
Jul-07						**22**	18		16	21	27	12	13	26	33	24	**29**	36	39	23.08
Jul-08						21	14	4	10	25		24	25	35	**47**	**38**	**29**	33	**45**	25.42
Jul-09						**25**	15		14	26		27	41	34	**48**	**33**	**33**	**48**	**47**	31.27
Jul-10						**23**	21	11	14	33	17	31	**45**	36	7	**47**	25	**46**	39	27.38
Jul-11					15	**28**	18	11	17	28	27	30	37	45	7	**33**	**30**	**54**	38	27.14
Jul-12					10	**24**	19	17	24	32	33	33	0	**49**	16	30	24	**41**	37	25.14
Jul-13					**20**	**28**	26	20	22	25	30	40	36	**50**	28	28	**30**	40	25	30.21
Jul-14					**20**	21	**34**	21	18	27	42	42	40	**48**	32	31	21	35	27	30.86
Jul-15	**34**	25	**30**	**36**	19	19	**31**	29	25	**41**	54	**50**	**48**	**57**	**40**	**31**	23	**47**	40	34.95
Jul-16	31	**39**	26	**27**	**24**	19	**31**	**35**	32	**34**	**64**	**54**	**50**	39	**36**	23	20	**47**	34	34.36
Jul-17	30	**40**	28	**32**	**20**	21	**31**	32	28	**35**	53	42	**63**	44	29	31	22	37	**65**	34.32
Jul-18	29	**40**	**31**	**31**	**21**	19	30	**37**	37	**34**	**54**	**64**	**66**	**51**	23	30	15	25	**54**	34.71
Jul-19	**33**	**35**	**31**	**31**	**25**	20	**33**	29	38	**39**	**70**	**75**	**62**	**50**	25	24	14		**59**	39.21
Jul-20	20	**37**	26	**29**	**22**	**22**	**37**	**42**	**42**	**40**	**54**	**62**	**43**	40	21	**36**	15	32	**55**	35.12
Jul-21	25	**39**	**36**	21	19	11	21	**40**	40	21	**70**	**65**	35	42	19	**32**	12	28	38	32.20
Jul-22	**34**	32	21	**26**	18	16	24	**34**	**42**	10	**54**	**60**	24	41	12	25	13	38	41	30.32
Jul-23	**33**	30	**33**	23	15	16	**31**	30	**41**	14	50	47	32	36	11	17	8	35	**47**	30.68
Jul-24	**33**	**42**	**30**	16	18	12	26	21	**40**	25	32	37	21	**45**	9	14	5	**47**	16	28.32
Jul-25	**33**	33	28	18	11	2	27	29	**51**	**40**	21	39	26	35	7	14	4	41	22	27.24
Jul-26	**32**	24	24	16	7	6	25	**36**	**49**	21	41	38	31	33	9	7	3	27	17	27.04
Jul-27	23	29	20	20	6	5	31	**33**	34	30	**62**	26	20	24	8	8	4	23	22	26.40
Jul-28	20	23	26	12	10	6	27	33	35	32	49	43	26	15	9	8	3	18	21	24.20
Jul-29	21	20	**30**	14	9	6	25	29	**42**	33	44	45	25	11	12	7	4	16	19	23.28
Jul-30	25	15	23	14	8	8	20	17	33	29	35	38	18	10	7	8	3	16	19	20.64

Date	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	MEAN
Jul-31	16	11	25	11	10	7	20	22	35	18	31	24	19	7	7	12	3	19	18	18.48
Aug-01	12	7	21	9	8		12	15	30	14	23	22	14	3	4	8	3	17	12	15.71
Aug-02	17	5	19	11	9		11	13	18	10	28	11	10	3	5	8	2	12	17	13.38
Aug-03	22	3	15	5	8		10	16	19	8	19	7	9	5	3	6	3	14	16	11.95
Aug-04	11	3	9		4		10	14	19	-	12	5	10	3	6	4	2	9	12	8.74
Aug-05	4	4	8	6	5		6	7	18	9	19	9	11	6	5	4	1	12	7	8.80
Aug-06												8	13	3	4	5	1	13	10	6.71
Aug-07												7	15	3	3	4	2	14	8	6.86
Aug-08												6	10	3	7	2	1	15	8	6.29
Aug-09												5	7	6	3	5	1	5	8	4.57
Aug-10												7	5	5	2	4	2	14	10	5.57
Aug-11												6	2	0	1	7	1	6	5	3.29
Aug-12												8	4	2	1	3	4	12	12	4.86
Aug-13												6	3	2	1	4	0	7	3	3.29
Aug-14												7	4	2	2	5	2	9	9	4.43
Aug-15												7	5	2	1	2	2	8	6	3.86
Aug-16												8	3	1	1	5	1	5	7	3.43
Aug-17												5	3	1	1	1	1	6	4	2.57
Aug-18												7	3	2	2	3	1	6	3	3.43
Aug-19												2	4	2	0	2	3	7	2	2.86
Aug-20												3	2	1	0	2	3	7	4	2.57
Aug-21												2	3	1	1	3	1	7	5	2.57
Aug-22												4	2	2	1	1	2	7	2	2.71
Aug-23												4	2	2	2	1	3	5	8	2.71
Aug-24												3	4	3	1	1	2	3	5	2.43
Aug-25												3	2	0	2	2	1	1	6	1.57
Mean of 7 Daily Highs	33.1	38.9	31.6	30.3	21.7	24.6	32.6	36.7	43.9	37.6	61.1	61.4	53.9	50.0	41.4	35.7	29.3	47.1	53.1	39.7

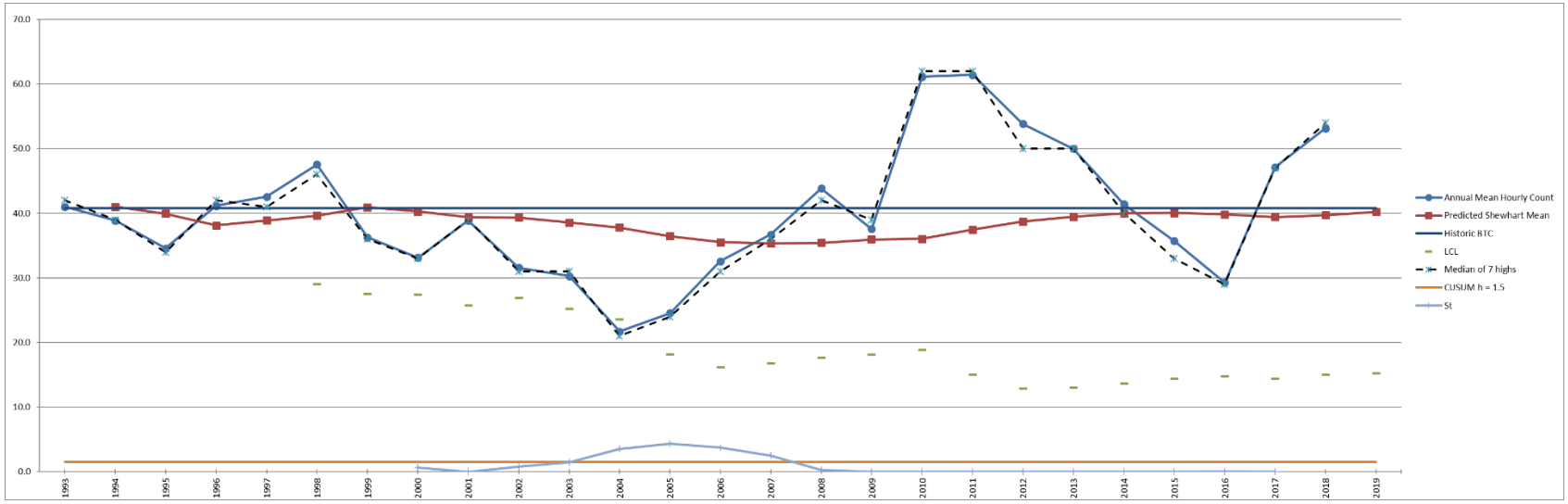

Figure 2. Historic hourly index counts (annual mean of 7 highest daily counts) of brown bears at McNeil River falls, McNeil River State Game Sanctuary, Alaska, 1993–2018.

In 2018 the overall average of the 7 highest hourly counts of 53 bears was above the historic average of 40.8 bears, as were all 7 of the highest hourly counts used to compute the average. As noted above, historically these highest counts are derived from data collected between 15 July and 5 August; however, during 2018, 2 of the highest counts used in computing the index occurred outside this typical window (8 and 9 July). Bear index count numbers during 2018 were above the levels observed 2014–2017 but still below the high numbers observed in 2010–2012. The 2018 average of 53 bears was higher than the annual averages for the past 5 years (2013–2017) of 40.7 bears.

Review of the high hourly index counts for each day of the 2018 season showed that viewing was generally consistent with the 2011–2017 mean for the June period above the July 1993–2017 mean and slightly above the 2011–2017 mean for August (Fig. 3). High hourly index counts between 2000 and 2017 are presented in Table 1.

Individual Counts

A second method of monitoring bear use and the quality of the bear-viewing program at MRSGS is by tallying the number of individually identifiable bears (adults, subadults, and cubs) observed by sanctuary staff daily and throughout the season (Fig. 4 and Table 2). Using unique identifying characteristics such as sex, age, size and shape, maternal status, claw color, scars, coat color, and behavior, a record of individually identifiable bears visiting the sanctuary has been documented every year since 1976. This monitoring method records the presence of an individual bear within MRSGS, if observed during viewing, on a daily basis. While it does not provide the true count of all bears present at MRSGS, it does provide an additional index in evaluating the overall bear use and the quality of the bear-viewing program. Only individual bears that are known or recorded a minimum of 3 times are included in this count. Hence, this method provides an inherently conservative estimate.

There were 110 individual bears identified at MRSGS during the 2018 season. This is about 14% higher than the long-term (1976–2017) average of 94.4 bears. Since 1976 the lowest count was 58 (1976) and the highest count was 144 (1997).

Bear Use Days

The quality of the bear-viewing experience is not just a matter of the number of bears that visit the area in a season, but also the number viewed on a daily basis and how many days the bears stay in the sanctuary. By summing the individual adult and subadult bears observed daily throughout the season an index of the number of bear use days is calculated. While these counts include bears in all viewing areas within MRSGS, only data from McNeil River falls, 15 June–25 August, is used for historical comparison (Fig. 4). One bear or family group (female with cubs) at McNeil River falls seen during a day is counted as 1 bear use day. This monitoring method may be less reliable than the index counts discussed above due to variability of bear identification among sanctuary staff and the variable timing of the counts. However, it can be used to further the interpretation of these other monitoring methods and it generally follows the same trends as the other methods. Bear use days are useful because they track how many days per season individual bears use the sanctuary. These data have been recorded since 1980, but no data were recorded in 1999, 2000, or 2001.

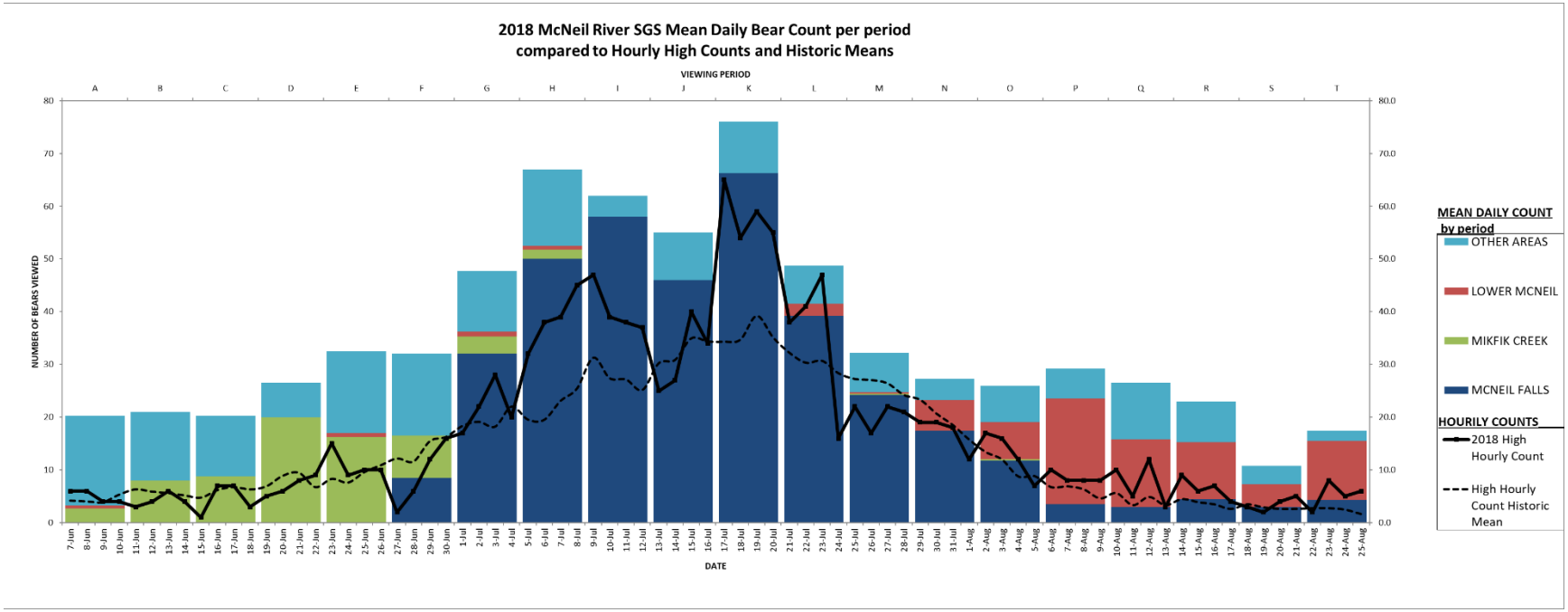

Figure 3. Daily and hourly index counts of brown bears at McNeil River falls, McNeil River State Game Sanctuary, Alaska, 2018 compared to 1993–2017 historic mean.

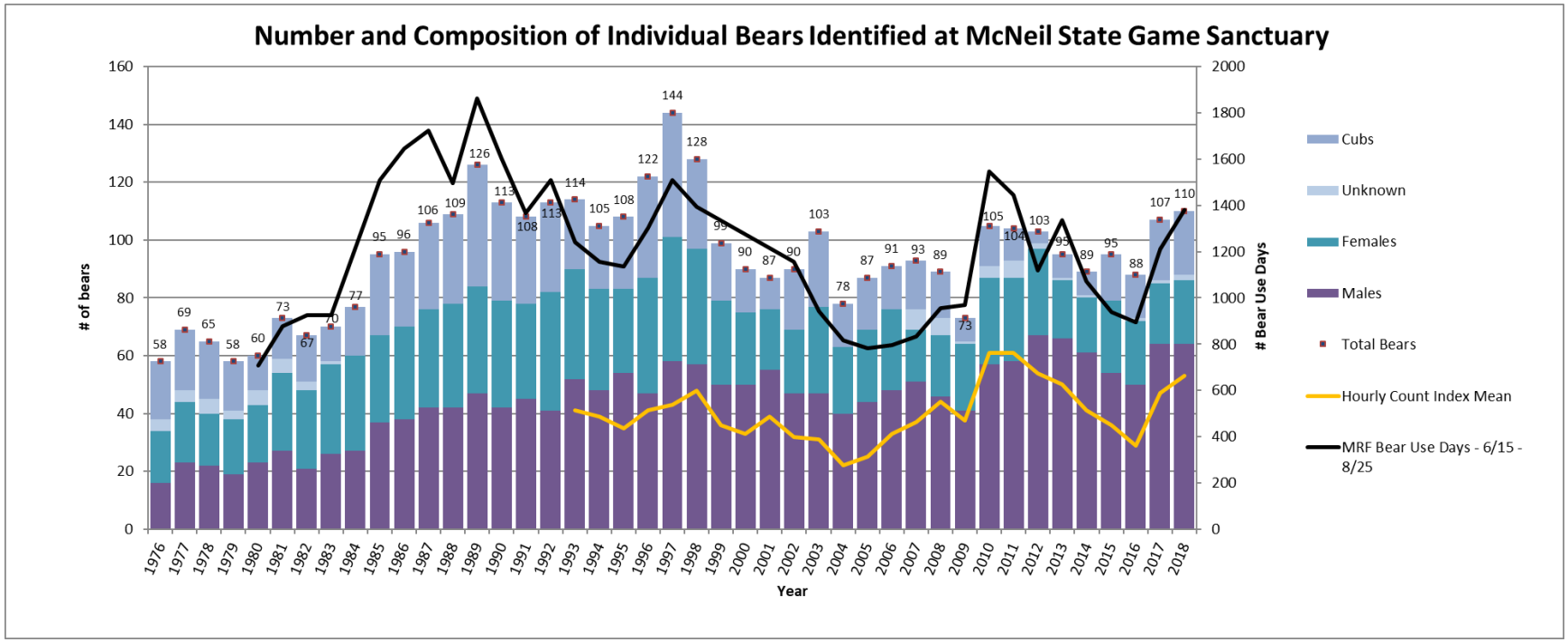

Figure 4. Annual number of individual brown bears observed, bear use days, and index counts compared to bear composition, McNeil River State Game Sanctuary, Alaska, 1976–2018.

Table 2. Composition of brown bears observed at McNeil River State Game Sanctuary, Alaska, 1976–2018.

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	2010	2011	2012	2013	2014	2015	2016	2017	2018
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	7	5	2	4	4	10	7	10	10
Single Adult Females	5	8	6	8	8	10	9	15	16	12	11	13	13	14	16	12	19	19	15	12	14	19	19	**14**	**14**	12	8	16	12	13	14	7	9	16	20	22	24	16	15	14	15	9	9
Single Adult Males	16	18	18	19	23	26	20	22	22	27	31	34	34	42	37	41	39	48	45	49	46	55	54	**48**	**48**	53	45	45	39	41	40	46	45	40	56	56	65	66	61	53	46	59	61
Adult Sex Unknown	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Adults	31	36	32	36	38	44	36	44	47	55	56	61	61	75	69	68	74	78	71	75	80	93	88	**73**	**69**	70	63	73	58	64	62	62	64	61	83	83	91	86	80	77	68	78	80
Subadult Females	4	3	4	2	6	9	11	9	8	2	7	7	9	4	5	6	6	8	9	3	6	5	6	**4**	**4**	4	4	2	4	2	6	2	2	2	3	2	4	0	0	1	0	2	3
Subadult Males	0	5	4	0	0	1	1	4	5	10	7	8	8	5	5	4	2	4	3	5	1	3	3	**2**	**2**	2	2	2	1	3	8	5	1	1	1	2	2	0	0	1	4	5	3
Subadult Sex Unknown	3	4	5	3	4	5	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0**	0	0	0	0	0	0	7	6	1	4	6	2	1	1	0	1	1	2
Total Subadults *(1)*	7	12	13	5	10	15	15	14	13	12	14	15	17	9	10	10	8	12	12	8	7	8	9	**6**	**6**	6	6	4	5	5	14	14	9	4	8	10	8	1	1	2	5	8	8
Total Adults & Subadults *(2)*	38	48	45	41	48	59	51	58	60	67	70	76	78	84	79	78	82	90	83	83	87	101	97	**79**	**75**	76	69	77	63	69	76	76	73	65	91	93	99	87	81	79	73	86	88
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	14	11	4	8	8	16	15	21	22
Total Bears	58	69	65	58	60	73	67	70	77	95	96	106	109	126	113	108	113	114	105	108	122	144	128	**99**	**90**	87	90	103	78	87	91	93	89	73	105	104	103	95	89	95	88	107	110

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

(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 the minimum number of bears present at the sanctuary.

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

There were 1,379 bear use days at McNeil River falls in 2018, which is above both the long-term average (1980–2018) of 1,203 and the recent 10-year average of 1,198. There was a total of 2,806 bear use days (all bears including cubs) within the sanctuary for the full 7 June–25 August season, higher than the long-term (1980–2018) average of 2,104. These days in 2018 were distributed 22%, 58%, and 20%, across June, July, and August, respectively.

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. While males have typically outnumbered females at McNeil River, this difference has become more pronounced over the last 30 years. The percentage of male bears observed throughout the season has steadily increased while the number of females has slightly declined. Following a general increase in the numbers of both sexes through the late 1990s, there was a general decrease in all bears after 2000. This decrease was more pronounced in the females. And in the years since 2005, while numbers of male bears have increased, the overall numbers of females have remained fairly flat. This was due in part to an overall decline in maternal females offset by an increase in single adult females. In 2018 the number of maternal females was unchanged from 2017, with a total of 10 maternal females and 22 cubs observed. The number of nonmaternal females in 2018 was also unchanged with a total of 9, so the overall number of females remained the same. The historic sex and age composition of bears using the McNeil River–Mikfik Creek viewing areas during the viewing season are presented in Fig. 4 and Table 2.

Bear Photo Identification Project

Sanctuary staff continued the task of photo documenting identifiable bears observed at McNeil. Digital images of individual bears and their defining characteristics were collected using a Canon EOS 7D Mark II SLR camera with a Canon 100–400 mm zoom and an EF24-105 mm lens. This photo identification project was initiated in 2007 and 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 among 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, and provide basic life history information.

Other Areas

The department currently does not conduct bear surveys or monitoring in other areas of MRSGS or MRSGR. Some information is available through opportunistic surveys, fisheries escapement videos, and commercial guide reporting from the Mikfik Lake, Paint River, Chenik Creek–Lagoon, and from the Kamishak–Little Kamishak–Strike Creek areas. Mikfik Lake observations are detailed below under Other Wildlife | General Observations; Paint River observations are noted in the Fisheries Enhancement | Paint River Fish Ladder section below.

Kamishak River Drainage

The lower stretches of the Kamishak River, Little Kamishak River, and Strike Creek are within MRSGS. Bears fish these waters, graze in the Kamishak sedge flats, and dig clams in the Kamishak River mudflats. The department does not conduct bear surveys in these drainages. However, commercial sport fishing guide services operate in the area from approximately early July to early October and brown bears are typically observed daily. Based on reporting by 5 of the 7 guide services operating in 2018, there were up to 20 bears seen per day (mean = 8) in the Kamishak-Little Kamishak-Strike Creek areas from 10 July to 6 September 2018.

Chenik Creek

The department does not conduct bear surveys in the Chenik Creek area; however, a local Homer guide conducted bear-viewing tours in the lower Chenik Creek–Chenik Lagoon area in 2018. He observed up to 14 individual bears 10–29 July 2018 with the following composition (including cubs): 1 maternal female with 3 cubs of the year, 1 maternal female with 2 cubs of the year, 1 maternal female with 2 yearlings; 1 maternal female with 1 yearling; 1 subadult male and 1 adult female. In addition, 1 river otter (*Lontra canadensis*) was observed at Chenik Lake.

OTHER WILDLIFE

General Observations

During the 2018 season, sanctuary staff recorded general wildlife observations, including birds, terrestrial mammals, and marine mammals opportunistically. Daily observations are summarized in the Appendix.

There were many bird sightings and identifications over the course of the 2018 season. This year less frequently observed species included harlequin duck (*Histrionicus histrionicus*), red-necked phalarope (*Phalaropus lobatus*), pigeon guillemot (*Cepphus Columba*), belted kingfisher (*Megaceryle alcyon*), double-crested cormorant (*Phalacrocorax brasilianus*), peregrine falcon (*Falco peregrinus*), merlin (*Falco columbarius*), black scoter (*Melanitta nigra*), black oystercatcher (Haematopus bachmani), northern fulmar (*Fulmarus glacialis*), long-tailed jaeger (*Stercorarius longicaudus*), and fork-tailed storm petrels (*Oceanodroma furcate*).

Marine mammal sightings during the 2018 season included the usual harbor seals (*Phoca vitulina*) which are generally seen at high tide throughout the season in McNeil River lagoon, McNeil Cove, and the lower tidal areas of McNeil River and Mikfik Creek. Two unusual sightings included: a harbor porpoise (*Phocoena phocoena)* observed on 26 June offshore of camp in McNeil Cove following stormy weather. And an unusual sighting of an orca whale (*Orcinus orca*) occurred on 29 August offshore of McNeil head at high tide. The whale was working the area around McNeil Islet, presumably for marine mammals or fish. Several harbor seals were spotted in the same area at the same time.

Other terrestrial wildlife observed this season included the following: Several sightings of a single gray wolf (*Canis lupus*) occurred at McNeil River falls and the lower river in July and August. Wolf tracks were often observed around the edge of the lagoon, along the Mikfik trail (at

the base of the east bluff) and along the McNeil River trail. A female moose (*Alces alces*) and her calf were observed in the Mikfik sedges on 8 June. Also, several arctic ground squirrels (*Spermophilus parryii*), masked shrew (*Sorex cinereus*), and a pair of red fox (*Vulpes vulpes*) with 4 kits were observed in and around camp. As usual, numerous wood frogs (*Rana sylvatica*) were observed throughout the Mikfik and McNeil River viewing areas. A less common sighting of a porcupine (*Erethizon dorsatum)* was observed at McNeil River falls.

During 2018, staff observed an unusual fork-tailed storm-petrel (*Oceanodroma furcate,* FTSP) mortality event. On 8–9 July thirty or more FTSP were observed flying in the McNeil cove and lagoon area. Some were observed to make landfall and be in a weakened condition. Several carcasses (10) were found in the area over the following days, through 16 July. Four recently deceased intact FTSP were collected and submitted to the USGS National Wildlife Health Center (NWHC) for necropsy and analysis, along with FTSPs from the region submitted by others. All birds were adults in poor body condition with pectoral muscle atrophy and depleted fat reserves. The NWHC found that the FTSPs exhibited emaciation, melena, cestodiasis, and poxvirus infection; and 2 birds had pulmonary edema. According to the NWHC the findings are suggestive of chronic debilitation, either due to lack of food availability or an inability to catch food due to an underlying disease process. Low levels of saxitoxin were also detected in the liver, intestinal tract, and skeletal muscle. However, the significance of this in the birds' demise is unknown due to the low levels found and unknown effects of saxitoxin on birds.

ADF&G—Division of Commercial Fisheries (CF) staff recorded 1,426 hours of video connected with the video monitoring of sockeye salmon (*Onchorynchus nerka*) escapement into Mikfik Lake. In addition to the escapement data, reviewers documented wildlife transiting the camera's view, including bald eagles (*Haliaeetus leucocephalus*), moose, beavers (*Castor canadensis*), wolverines (*Gulo gulo*), various waterfowl, and river otters. Brown bears transited the field of view of the camera in 48 instances, an average of 0.76 bears per day of video operation (n = 63 d). All sightings were of individual bears. The peak daily bear count (3) occurred on several different days.

ADF&G—CF also operates a video weir connected with the monitoring of sockeye salmon escapement at Chenik Lake. In 87 days of operation (6 June through 31 Aug), cameras observed 47 bears transiting the Chenik video. Other species observed included otter (many observations), moose (n = 2), beaver (n = 1), red fox (n = 1), and caribou (*Rangifer tarandus*, n = 11). Caribou observed moving through the Chenik Lake area by the camera were observed on 3 dates—26 June, 1 July, and 17 August—in groups of 2–6 individuals. Caribou use had previously been observed via camera only once in the 15 years of camera operation, in 2017, when 1 caribou crossed the view field.

HUNTING AND TRAPPING

MRSGS is closed to hunting and trapping by Alaska state statute (AS 16.20.162(b)), and MRSGR, while open to hunting and trapping of other species, has been closed to brown bear hunting by the Alaska Board of Game since July 1996. The approximately 388 mi^2 that comprise MRSGS and MRSGR are part of a much larger area of approximately 5,585 mi^2, including Katmai National Park lands and state-owned lands within the Kamishak Special Use area in which brown bears are protected from hunting.

Reported harvest data from units within and surrounding the MRSGS–SGR complex for regulatory years 2000–2017 are summarized in Table 3. Data for regulatory year (RY) 2018 (a regulatory year begins 1 July and ends 30 June, e.g., RY17 = 1 July 2017–30 June 2018) are still being gathered.

Brown Bear

Hunting brown bear and hunting and trapping for other species are allowed on lands within harvest units north and west of MRSGS and MRSGR. During alternating regulatory years brown bear hunts are open during the fall of odd-numbered years and the spring of even-numbered years. Historic levels of reported bear harvests from areas surrounding MRSGS and MRSGR are presented in Fig. 5 and Table 3. The area represented includes about 2,100 mi^2 currently open to hunting. In March 2018, the Board of Game reduced hunting season lengths to 2 weeks each in the fall and spring, an approximately 33% reduction.

The long-term average harvest from areas surrounding MRSGS (outside the sanctuary and refuge) from RY80 through RY10 was 78 brown bears every 2-year hunt period. Average 2-year harvest by decade was 62 in the 1980s, 77 in the 1990s, and 99 in the 2000s. During RY10–RY17 the 2-year harvest in areas surrounding MRSGS and MRSGR averaged 86 bears.

Many brown bears have large home ranges which include MRSGS, MRSGR, Katmai National Park, and other lands open to hunting north and west of the sanctuary and refuge. Data from early studies and staff observations show that some bears using MRSGS and MRSGR are subject to harvest outside the sanctuary and refuge. The effects of these harvests on bear use at McNeil River are unknown; however, currently these harvests do not appear to affect the number of bears using the McNeil River. Based on the available information, legal hunting of bears outside the sanctuary is not a significant factor affecting the regional bear population.

Other Species

As noted above, the MRSGR portion of the MRSGS–MRSGR complex is open for the legal harvest of species, other than brown bear, through hunting or trapping. Other furbearing or big game species that may be in the area include black bear (*Ursus americanus*), caribou, moose, beaver, lynx (*Lynx canadensis*), marten (*Martes americana*), river otter, wolf, wolverine, coyote, red fox, mink (*Neovison vison*), weasel (*Mustela nivalis*), muskrat (*Ondatra zibethicus*), arctic ground squirrel, and marmot (*Marmota caligata*). However, ADF&G maintains harvest records only on the first 9 of these.

Harvest reporting and sealing records indicate that hunting and trapping for species other than perhaps moose in MRSGR is currently almost nonexistent. A few moose are taken from the reporting unit that contains MRSGR; however, this unit also includes lands outside of the refuge.

Table 3. Reported harvests of selected big game and furbearer species within and around McNeil River State Game Sanctuary (MRSGS) and McNeil River State Game Refuge (MRSGR), Alaska, regulatory years[a] 2000–2017.

	Species																			
	Brown bear		Black bear		Caribou		Moose		Beaver		Lynx		Marten		Otter		Wolf		Wolverine	
RY[a]	MRSGS-MRSGR[b]	AA[c]	MRSGS-MRSGR[b]	AA[c]	MRSGS-MRSGR[b]	AA[c]	MRSGS-MRSGR[b]	AA[c]	MRSGS-MRSGR[b]	AA[c]	MRSGS-MRSGR[b]	AA[c]	MRSGS-MRSGR[b]	AA[c]	MRSGS-MRSGR[b]	AA[c]	MRSGS-MRSGR[b]	AA[c]	MRSGS-MRSGR[b]	AA[c]
2000	6	98	0	0	0	114	0	16	0	12	0	1	0	0	0	0	0	3	0	1
2001			0	3	0	97	1	19	0	0	0	0	0	0	0	0	0	1	0	2
2002	6	105	0	1	0	39	3	18	0	0	0	0	0	1	0	0	0	1	0	4
2003			0	7	0	53	1	14	0	9	0	3	0	6	0	10	0	10	0	20
2004	3	102	0	1	0	33	2	15	0	0	0	0	0	0	0	2	0	1	0	2
2005			0	6	0	51	2	17	0	1	0	1	0	0	0	0	0	8	0	0
2006	4	93	0	2	0	25	0	10	0	0	0	4	0	2	0	1	0	2	0	7
2007			0	2	0	0	2	16	0	0	0	1	0	1	0	3	0	3	0	4
2008	4	73	0	1	0	5	0	18	0	4	0	3	0	0	0	0	0	4	0	2
2009			0	1	0	6	1	11	0	2	0	13	0	1	0	1	1	2	0	1
2010	5	75	0	1	0	0	0	6	0	13	0	27	0	0	0	8	0	2	0	2
2011			0	0	0	1	0	11	0	5	0	38	0	0	0	0	0	4	0	1
2012	7	66	0	0	0	0	1	10	0	0	0	33	0	0	0	0	0	5	0	5
2013			0	3	0	1	0	8	0	2	0	4	0	0	0	0	0	3	0	0
2014	4	91	0	0	0	1	1	15	0	3	0	2	0	0	0	2	0	0	0	2
2015			0	3	0	1	0	4	0	7	0	0	0	0	0	0	3	2	0	0
2016	2	96	0	0	0	8	0	14	0	10	0	3	0	0	0	4	0	1	0	8
2017			0	0	2	1	0	9	0	1	0	1	0	0	0	20	0	3	0	2
2018																				

[a] Regulatory year (RY) begins 1 July and ends 30 June, e.g., RY00 = 1 July 2000–30 June 2001.

[b] Harvest numbers for McNeil River State Game Sanctuary (MRSGS) and McNeil River State Game Refuge (MRSGR) are based on data from reporting areas that are largely within but extend slightly outside of the MRSGS–MRSGR complex. MRSGS is closed to hunting and trapping and MRSGR is closed to the hunting of brown bear.

[c] AA = adjacent areas. Harvest numbers for surrounding areas largely from reporting areas outside of the MRSGS-MRSGR complex. Some data may be from within MRSGS and MRSGR where these reporting areas overlap the MRSGS-MRSGR complex boundary. MRSGS is closed to hunting and trapping and MRSGR is closed to the hunting of brown bear.

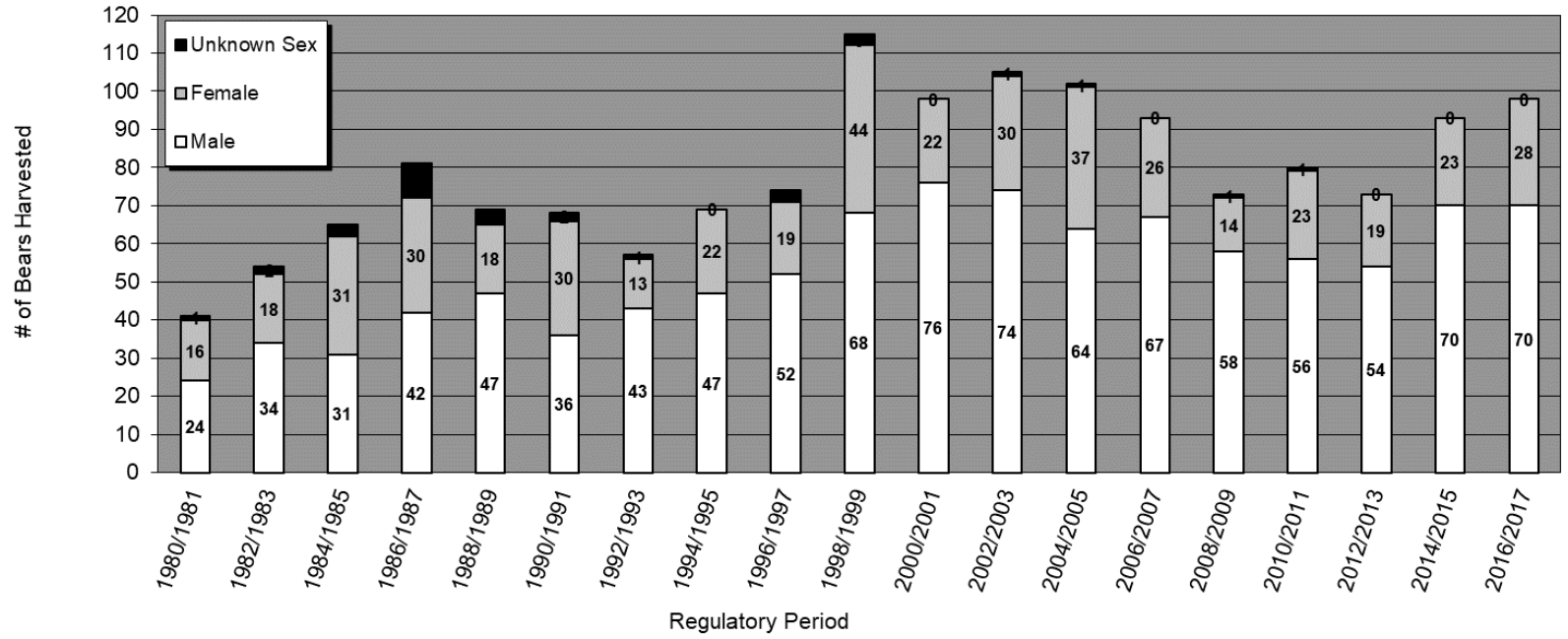

Figure 5. Brown bear harvest from areas surrounding the McNeil River State Game Sanctuary and McNeil River State Game Refuge, Alaska, 1980–2017 presented by 2-year hunt period (harvest from Game Management Units/Uniform Coding Units: 9A/201, 301, 401, 501; 9B/301; and 9C/101, 201, 301, 601, 702, and 703). Even and odd regulatory year seasons are combined (regulatory year begins 1 July and ends 30 June, e.g., regulatory year 1980 = 1 July 1980–30 June 1981).

Fisheries

MRSGS and MRSGR contain several rivers and streams that support both anadromous and resident fish populations. The Kamishak River drainages support 5 species of Pacific salmon as well as Dolly Varden trout (*Salvelinus malma*). The McNeil River drainage contains Dolly Varden trout, chum salmon, some coho salmon (*O. kisutch*), pink salmon (*O. gorbuscha*), and small numbers of Chinook salmon (*O. tshawytscha*). The Mikfik Creek–Lake drainage contains sockeye salmon, Dolly Varden trout, and rainbow trout (*O. mykiss*). Chenik Creek–Lake system supports sockeye salmon, some coho salmon, lake trout (*S. namaycush*) and Dolly Varden trout. The Paint River system contains rainbow trout, 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 sport fishing and commercial fishing effort and harvests within the lower Kamishak district.

COMMERCIAL FISHERIES

Periodic aerial surveys are flown to index the escapement of chum salmon to McNeil River and remote video is used to monitor the escapement of sockeye salmon into Mikfik and Chenik lakes. In 2018, generally favorable stream conditions allowed for 5 effective aerial surveys of McNeil River and the video system at Mikfik Lake operated successfully through 1 August. There was no commercial fishing effort targeting the Mikfik return and the McNeil River subdistrict was closed for the duration of the chum salmon run. Consequently, the entire Mikfik sockeye and McNeil chum salmon runs entered their respective freshwater drainages this season.

McNeil River Drainage

The 2018 McNeil River chum salmon aerial survey escapement index was estimated at 37,331 fish (Table 4, Fig. 6). This value is within the sustainable escapement goal (SEG) range of 24,000–48,000. Chum salmon were consistently seen in robust numbers above the falls during aerial observations from 25 June through the last survey on 1 August. A peak daily aerial estimate of 14,160 chum salmon occurred on 12 July, of which 10,360 were upstream of McNeil River falls. The McNeil River subdistrict was closed 18 June without any commercial fishing inside the subdistrict. A single harvest of fewer than 1,000 chum salmon occurred just outside the district, in the nearby Paint River subdistrict; these fish were likely bound for McNeil River. This was the largest catch of chum salmon since 1992. Chum runs to other Kamishak Bay district systems in 2018 were also generally strong. However, strong pink salmon runs in other districts resulted in reduced fishing effort in the Kamishak District and a district-wide commercial harvest of just under 8,300 chum salmon. The 2018 run timing of McNeil River chum salmon was earlier than the historical average.

McNeil River Chum Salmon Stock Status

In response to guidelines established in the Policy for Management of Sustainable Fisheries (5 AAC 39.222), in November 2016 at the Lower Cook Inlet Board of Fisheries meeting, ADF&G recommended that McNeil River chum salmon be designated as a “stock of management concern.” A “management concern” is defined as “a concern arising from a chronic inability, despite use of specific management measures, to maintain escapements for salmon

stocks within the bounds of the sustainable escapement goal (SEG)…". Two natural conditions unique to McNeil River presumed to contribute to the present status of chum salmon are 1) a physical obstacle (McNeil River falls) located low in the drainage impedes consistent use of upriver spawning habitats; and 2) a high density of brown bears aggregated at McNeil River falls to feed, essentially creating a biological impediment to upstream migration (Otis and Szarzi 2007) and also contributing to high predation rates on pre-spawning chum salmon in McNeil River below the falls (Pierce et al. 2011, 2013). Further details on the status of McNeil River chum salmon, including a review of past and current research and management actions, can be found in Otis et al. (Otis, Hollowell, and Erickson 2016).

Table 4. Escapement estimates of salmon into Mikfik Lake and McNeil River, McNeil River State Game Sanctuary, Alaska, 2018.

2018 Date	Mikfik sockeyes cumulative total	McNeil chums (daily)[a]
1 Jun	0	
8 Jun	0	
15 Jun	9	
22 Jun	357	
25 Jun		6,400
29 Jun	386	
3 Jul		8,020
6 Jul	4,304	
12 Jul		14,160
13 Jul	4,401	
18 Jul		9,827
20 Jul	4,604	
27 Jul	4,921	
1 Aug		5,570
3 Aug	4,966	
10 Aug	4,966	
17 Aug	4,966	
Escapement index	4,966[b]	37,331[c]

[a] Daily estimate from individual aerial surveys and considered to be conservative.

[b] The escapement index for Mikfik sockeyes is the cumulative total from the remote video system at Mikfik Lake; data above in the column reflect cumulative totals as of dates noted.

[c] The escapement index for McNeil chums is 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.

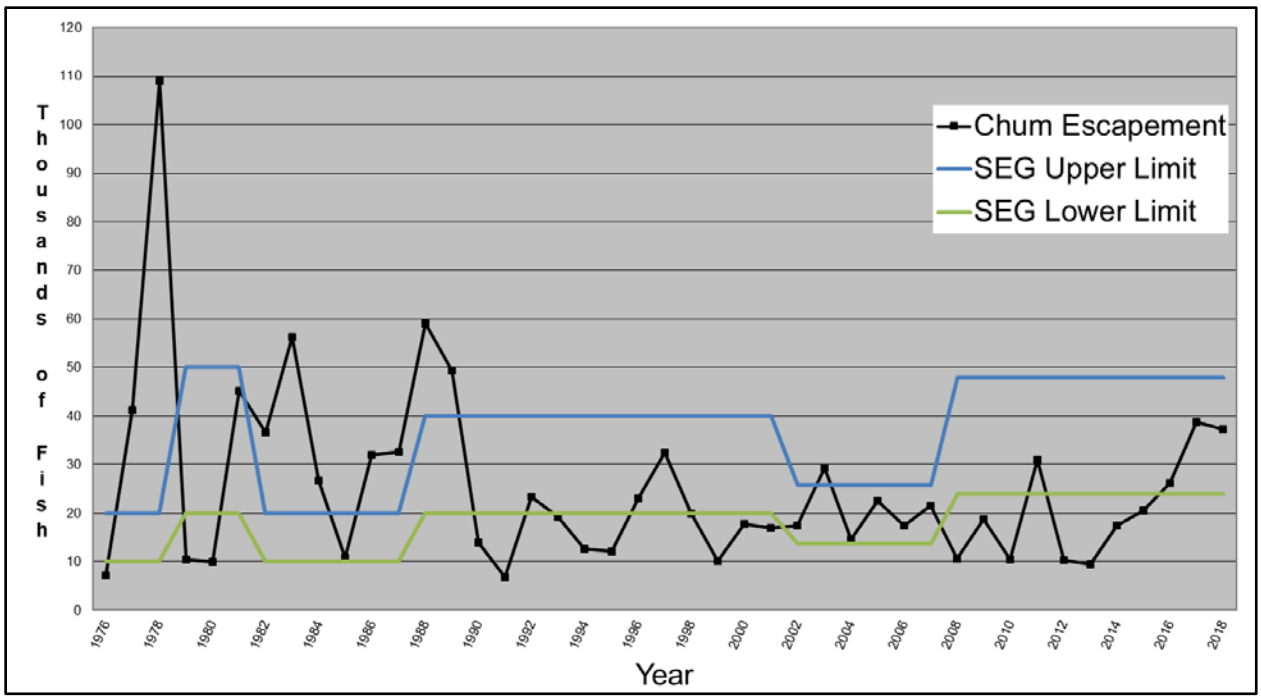

Figure 6. McNeil River chum salmon escapement 1976–2018, McNeil River State Game Sanctuary, Alaska.

Mikfik Creek and Lake System

A video camera attached to a digital video recorder used to document sockeye salmon escapement into Mikfik Lake showed a cumulative total of 4,966 fish escaping into the lake in 2018. Significant predation by bears occurs in Mikfik Creek, so only those fish documented reaching the lake are considered escapement. The video estimate of 4,966 fish was used as the final escapement estimate. This value is within the sustainable escapement goal (SEG) range of 3,400–11,000, the upper end of which decreased slightly following the 2016 Lower Cook Inlet Board of Fisheries meeting (Otis, Erickson, Kerkvliet, and McKinley 2016). Post-season evaluation indicated that run timing of sockeye salmon into Mikfik Lake was more compressed than normal, with 75% of the run entering the lake in just 2 days (30 June–1 July).

The McNeil River subdistrict was open to commercial fishing for Mikfik Creek sockeye salmon from 1 June to 18 June. No sockeye salmon were harvested in the McNeil River subdistrict in 2018.

Chenik Creek and Lake System

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 27 March 1964 earthquake. A Cook Inlet Aquaculture Association (CIAA) fishery enhancement project modified the stream mouth in 1981–1982 and again in 1986 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, 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 2018, with resulting annual commercial harvests ranging from no harvest (2015) to more than 171,000 fish (2008). Additionally, the established sockeye salmon SEG for Chenik Lake of 2,900–13,700 sockeye salmon has been met or exceeded each year beginning in 2003, with the 2018 escapement cumulatively estimated by remote video as 6,651 sockeye salmon. A total of 25,489 sockeye salmon were commercially harvested from the Chenik subdistrict in 2018.

SPORT FISHING

A limited amount of sport fishing occurs within MRSGS and MRSGR. This occurs primarily in the Kamishak River area (Table 5). There is also a small amount of effort in the McNeil lagoon area by participants in the bear-viewing program.

McNeil Lagoon

Sporadic sport fishing occurs in McNeil Lagoon (from the end of the spit) associated with staff and visitors in camp for recreational activities. Fishing effort was low in 2018. Due to the high bear activity in the lagoon this season, sport fishing effort by staff and visitors was limited for safety reasons. A total of 5 silver salmon and 3 chum salmon were harvested and 1 Dolly Varden was caught.

Kamishak River

The only area in the sanctuary that attracts significant sport fishing interest is the Kamishak River area including 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 2018 season, 5 of the 7 permitted lodges and transporters operating in the Kamishak Special Use Area reported. One company had incomplete records, so data presented below is a conservative minimum. Reporting companies spent at least 191 angler use days and at least 106 guide use days during 67 days of sport fishing in the Kamishak area of sanctuary. These anglers reported catching at least 2,382 fish, of which 33% were Dolly Varden, 42% were coho salmon, and 15% were chum salmon. All pink and chum salmon were released as were nearly all Dolly Varden. Eighty-five percent of all fish caught were released.

Table 5. Visitor use and sport fish harvest reported from Kamishak River drainages, McNeil River State Game Sanctuary, Alaska, 2018.

				COHO SALMON		CHUM SALMON		PINK SALMON		DOLLY VARDEN		Avg bears /day
No. of days in MRSGS	No. of guide use days	No. of angler use days	No. of non-angler days	Kept	Released	Kept	Released	Kept	Released	Kept	Released	
67	106	191	1	331	675	0	355	0	218	18	785	8

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.

Paint River Fish Ladder

Paint River lakes were first stocked with sockeye salmon fry in 1986 in an effort to test the feasibility of developing a new sockeye salmon run to this salmon-barren drainage. Paint River, located approximately 2 miles north of McNeil River, is blocked to upstream fish migration by a steep waterfall at tidewater. The Paint River fish ladder was envisioned to potentially provide access to unutilized salmon spawning and rearing habitat upstream of the falls. Construction of the Paint River fish ladder was completed in October 1991, and it was formally declared operational in 1993. From 1986 to 1996 (except for 1987), and also in 2002, between 0.5 million and 2.2 million sockeye salmon juveniles were stocked annually in the Paint River lakes. However, the number of returning adult sockeye salmon resulting from these stocking efforts were disappointing and only ranged from 30 (in 2000) to 2,000 (in 2005). At that time, the structure was never opened to allow returning adult fish passage upstream through the ladder. CIAA, responsible for building and operating the Paint River fish ladder, has been performing maintenance and repair improvements to the ladder since 2008. In 2011 it began opening the ladder each summer to allow for colonization by salmonids. Additionally, in 2015 CIAA released 1.02 million unfed pink salmon fry into ice free leads of Paint Lake during 4–5 April. The anticipated 1–2% return of these fish to Paint River in 2016 did not materialize. Since 2014 a small number (<200) of salmon or salmon carcasses (presumably coho) have been observed in most years within or above the ladder in mid- to late September. A few chums have also been observed passing the ladder in July via video weir recently. While detailed surveys have not been conducted and video weir monitoring attempts have been unsuccessful thus far, available information indicates that some colonization from stray salmon may be occurring.

On May 15, 2018, CIAA planted 305,000 Bruin Bay stock pink salmon fry into Paint Lakes via floatplane. It is estimated 10,000 adult pink salmon will return in summer 2019 from this release. The Paint River fish ladder was opened to water flow between 16 July through 11 October 2018

for potential salmon colonization. Numerous attempts by CIAA to access the site throughout the summer were thwarted by bad weather and other scheduling difficulties. Consequently, ladder opening, construction of perimeter fencing, and cabin construction were delayed. Visits were made on 16 - 18 July, 19 September, and 8 - 12 October.

The video fish enumeration system was not installed during 2018 and aerial surveys were not completed of the Paint River system. Observations at the ladder were infrequent and could not confirm any fish within the Paint River. Thus, confirmation or escapement estimates of any fish colonizing the Paint could not be made for 2018. No bears were observed at the fish ladder site during the 3 visits. However, an unusual sighting of one brown bear on Nordyke Island was made during an 8 October trip to Paint River.

CIAA staff visited McNeil River camp in early August to gain firsthand knowledge on management issues and concerns at the adjacent McNeil River bear viewing area, and how those pertain to CIAA operations at Paint River.

Public Use and Land Management

To protect the bears, their habitat, and the unique visitor experience, access to MRSGS is restricted; an access permit issued by ADF&G is required for entry into the sanctuary. Under regulations developed by ADF&G (5AAC 93.030) and those adopted by the Alaska Board of Game (5AAC 92.065), ADF&G—DWC uses the following types of permits to manage visitation to the sanctuary: viewing permits, special access permits, non-viewing permits, transporter permits, and commercial guide permits.

MRSGR is open to most public uses provided the activity does not damage refuge resources, disturb wildlife, or disrupt existing public uses. Allowed activities generally include legal hunting, trapping, fishing, wildlife watching, hiking, boating, snowmachining, and camping; except that MRSGR is closed to brown bear hunting. Other activities and land uses are managed through an ADF&G special areas permit issued by the Division of Habitat. Land use permits are also issued by DNR.

McNeil River Falls-Mikfik Creek

Public use and access to the sanctuary, except for 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 10 people daily between 7 June and 25 August and viewing access permits for this period are issued by lottery. Ten regular and 3 standby permits are issued for each of the established 4-day permit periods. 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 guided viewing permits are issued as special access permits at the commissioner’s discretion for scientific, educational, media and other purposes. The maximum number of people able to visit the sanctuary each season under the existing permit program is 257 people.

Guided viewing permits allow visitors to visit the sanctuary and the bear-viewing sites in the sanctuary (McNeil River 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 beach, and to go to the bear-viewing sites (McNeil River or Mikfik Creek) when there are vacancies in the guided group. 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, filmmakers, or others acting in an official capacity and who would benefit professionally by visiting McNeil River. These permits are issued only to individuals whose work will benefit the McNeil River Sanctuary and/or general efforts to conserve bears.

Application and permit fee prices increased in March 2018. The new lottery application fee is $30.00 per person. If selected in the lottery, each guided viewing permit holder is assessed a permit fee of $225.00 for Alaska residents and $525.00 for nonresidents. Camp-standby viewing permit holders are assessed a permit fee of $112 .00 for each Alaskan resident and $262.00 for each nonresident. The special access permit application fee is $60.00 per person. If selected by the commissioner of ADF&G to receive a special access permit, there is a use fee of $225.00 for each Alaska resident and $525.00 for each non-Alaska resident.

In 2018, ADF&G received 862 applications for McNeil River guided and standby bear-viewing permits. Applications were received from residents of 13 different countries and 41% of applicants were Alaska residents. This represents a reduction in resident applications from the last several years; it is more similar to resident participation 2007–2010. Payments were received for 175 guided viewing access permits, 24 standby viewing access permits, and 7 special access viewing permits. There were 12 special access permits granted by the commissioner. Overall, 211 permits were issued and 187 permit holders (guided viewing, camp standby, and special access) visited the sanctuary (Table 7). Of the 211 people who purchased permits, 56% were resident and 44% were nonresident. The 5-year annual visitation average (2014–2018) is 182. The average number of permits used each day (permittees that bear viewed) at the sanctuary in 2018 was 8.7 (out of a maximum of 10.0). There were 17 guided permit holder no shows, 6 standby permit holder no shows, and 1 special access permit holder no shows. The 187 participants in bear viewing during the 2018 season came from 7 countries, including Austria, Canada, Germany, Switzerland, Turkey, Slovenia and the United States. Of the 187 bear-viewing visitors to McNeil River, 52% were Alaska residents and 48% were nonresidents.

Visitor use days connected with the McNeil River bear-viewing program totaled 1,173 in 2018, which included all permitted bear-viewing visitors and administrative visitors. Permitted bear-viewing visitors spent a total of 1,057 days within the sanctuary, logging 700 actual bear-viewing days. On average there were 12.9 visitors at McNeil River camp on any day, higher than both the 5- and 10-year averages of 12 and 11.9, respectively. Bear viewers per day averaged 8.7, higher than the 5- and 10-year averages of 8.2 and 8, respectively. Permitted visitors spent an average of 5.5 days each in the sanctuary and participated in the bear-viewing group an average of 3.7 days each.

The 12 special access permits issued in 2018 included the following recipients: ADF&G biologist and hunter education personnel, National Park Service Alaska Regional Director, U. S. Forest Service Anan Creek on-site manager, Washington State University bear research facility manager, Alaska Department of Environmental Conservation commissioner, University of Ljubljana professors, and CIAA staff.

Table 7. Visitor use at McNeil River State Game Sanctuary and McNeil River State Game Refuge, Alaska, 1984–2018.

Year	No. of applicants	No. of bear-viewing visitors 6/7–8/25[a]	Bear-viewing use days 6/7–8/25[b]	Total bear-viewing visitor use days 6/7–8/25[c]	Total sanctuary visitor days 6/7–8/25[d]	Visitor days viewing @ McNeil falls 7/1–8/25 (560 possible)[e]	Season length
1984	992	159			574	377	5 Jun – 27 Aug
1985	832	216			816	449	10 Jun – 25 Aug
1986	806	255			967	430	9 Jun – 25 Aug
1987	1,757	252			1,054	473	9 Jun – 23 Aug
1988	1,094	304			1,328	498	1 Jun – 29 Aug
1989	1,306	264			1,183	488	22 May – 26 Aug
1990	1,481	299			1,435	524	8 Jun – 25 Aug
1991	1,818	249			1,415	526	1 Jun – 27 Aug
1992	1,672	245			1,210	478	1 Jun – 25 Aug
1993	2,150	225			1,128	516	7 Jun – 25 Aug
1994	1,766	228			1,086	484	7 Jun – 25 Aug
1995	1,486	212			1,074	475	7 Jun – 25 Aug
1996	1,502	219			1,158	494	7 Jun – 25 Aug
1997	1,474	228			1,197	489	7 Jun – 25 Aug
1998	1,159	219			1,096	504	7 Jun – 25 Aug
1999	1,223	208			1,122	398	7 Jun – 25 Aug
2000	1,322	198			1,051	424	7 Jun – 25 Aug
2001	1,329	186			1,012	437	7 Jun – 25 Aug
2002	1,434	175			930	351	7 Jun – 25 Aug
2003	1,314	188			995	451	7 Jun – 25 Aug
2004	860	201			1,034	462	7 Jun – 25 Aug
2005	960	195			983	431	7 Jun – 25 Aug
2006	783	183			970	420	7 Jun – 25 Aug
2007	1,156	157	540	781	832	356	7 Jun – 25 Aug
2008	932	167	617	863	913	413	7 Jun – 25 Aug
2009	725	181	639	948	1,266	452	7 Jun – 25 Aug
2010	714	176	593	932	1,100	433	7 Jun – 25 Aug

Year	No. of applicants	No. of bear-viewing visitors 6/7–8/25[a]	Bear-viewing use days 6/7–8/25[b]	Total bear-viewing visitor use days 6/7–8/25[c]	Total sanctuary visitor days 6/7–8/25[d]	Visitor days viewing @ McNeil falls 7/1–8/25 (560 possible)[e]	Season length
2011	751	195	674	1,017	1,089	447	7 Jun – 25 Aug
2012	719	180	641	969	1,041	458	7 Jun – 25 Aug
2013	934	156	574	842	890	388	7 Jun – 25 Aug
2014	1,075	171	603	882	923	424	7 Jun – 25 Aug
2015	983	178	678	916	946	471	7 Jun – 25 Aug
2016	819	175	596	895	929	397	7 Jun – 25 Aug
2017	972	199	714	1,080	1,092	488	7 Jun – 25 Aug
2018	862	187	694	1,032	1,044	466	7 Jun – 25 Aug

[a] Sum of all guided, standby, and special access permittees who visited McNeil River State Game Sanctuary.
[b] Sum of all guided, standby, and special access permittees who bear viewed each day of season (only those who viewed bear/day).
[c] Sum of all guided, standby, and special access permittees in sanctuary each day of season (includes all permittees in sanctuary if viewed or not).
[d] Sum of all guided, standby, and special access permittees and nonviewing permittees (staff subs not included) each day of viewing season.
[e] Sum of all guided, standby, and special access permittees each day during approximate McNeil falls season.

During 2018, 8 commercial transporter permits were issued to commercial operators for the purpose of transporting clients to the ADF&G McNeil River camp for bear viewing.

The MRSGS permit program generated approximately $96,060.00 in 2018, which is ultimately allocated to the state's Fish and Game Fund.

KAMISHAK RIVER

Lodges and air charter services conduct sport fishing and wildlife viewing trips in the Kamishak River drainages within MRSGS and adjacent Katmai National Park. This area is also part of the Kamishak Special Use Area, which is managed by DNR. 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, DNR land use permit, and an ADF&G McNeil River SGS commercial access 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 operating in this area holding ADF&G special area and commercial access permits are required to report the number of guides, clients, fish harvested or released, as well as the number of bears observed on a data sheet titled "Annual Report for Guides, Transporters, and Lodges."

During 2018, 7 commercial transporter permits were issued to commercial operators for the purposes of transporting clients to the Kamishak River area for sport fishing. Five of these companies reported trips into the Kamishak area. As reported, these guide services spent 297 visitor use days in the sanctuary, which included 191 angler use days and 106 guide use days. One company did not report, and another had incomplete reporting; so, numbers should be considered conservative minimums. These operators also held special area permits for the storage of boats and operations in the Kamishak River area. Their primary activity is sport fishing; however, they also engage in wildlife viewing activities, primarily viewing of brown bears. Commercial guides reported seeing an average of 8 bears per day (range 0–20) during operations between 10 July and 6 September.

CHENIK LAKE-CREEK AREA

The mouth of Chenik Creek is another area within MRSGS where low levels of bear viewing have occurred historically. One commercial bear-viewing guide service from Homer obtained a special area permit for a temporary tent camp at Chenik Lake and brought clients to the Chenik Creek mouth area for bear-viewing activities in 2018. He reported 17 guide use days and 54 visitor bear-viewing use days. Private groups were also known to have visited the Chenik area in 2018. From the incidental observations available, there were at least another 20 visitor use days from these private parties. In total there were 91 reported visitor use days at Chenik Creek.

BEAR-HUMAN CONFLICTS

As detailed above, there were 1,044 user days associated with ADF&G's bear-viewing program at the McNeil River camp. An additional 388 user days were reported by area guides or the public using the Kamishak River and Chenik Creek areas of MRSGS and MRSGR. All 1,432 user days represent activities, primarily bear-viewing and sport fishing, spent in close proximity to brown bears. Staff document adverse bear-human interactions associated with ADF&G's bear-viewing program. Commercial sport fishing and bear-viewing entities perform self-reporting to ADF&G on any adverse interactions. During the 2018 season, there were no reported adverse interactions between bears and people in MRSGS or MRSGR.

LAND USE PERMITTING

A total of 10 ADF&G special areas permits, and 13 ADF&G commercial access permits were issued during 2018. These included the special areas and commercial access permits issued to companies involved in commercial transportation, sport fishing, and wildlife viewing in the McNeil River, Kamishak River, and Chenik Creek areas, and permits for fisheries enhancement equipment at Paint River.

There were no mineral resource or development activities applied for, permitted, or reported to the department within MRSGS or MRSGR during 2018. However, in early 2018 Pebble LLC submitted applications to the U.S. Army Corps of Engineers (ACOE) for development of the Pebble Mine in Bristol Bay; including one alternative that would place a road closer than ¼ mile and an industrial port facility within 2 miles of the northern border of McNeil River State Game Refuge. ADF&G staff are working through the ACOE process to identify and address potential impacts to the sanctuary and refuge, area fish and wildlife resources, and public uses of the sanctuary and refuge.

Fish and Wildlife Research

This section summarizes new or ongoing fish and wildlife research projects within MRSGS and MRSGR.

MIKFIK CREEK VIDEO RESEARCH

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

When originally configured in 1998, the Mikfik video system consisted of a single remote video camera and a time-lapse videocassette recorder logging 1 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 1 frame per

second. The next evolution of the Mikfik system, used from 2002 through 2005, recorded up to 5 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. The new configuration reduced the power issues that affected the computer-based version; however, harnessing adequate solar or wind power at the Mikfik Creek site was continuously challenging due to the local topography and the resulting wind patterns. Beginning in 2009, the DVR and its accompanying power generation equipment were relocated a short distance from the camera to a more exposed site on the shore of Mikfik Lake, making power generation for this equipment far less problematic (more wind). Images were delivered to the relocated DVR via a wireless transmitter-receiver configuration, and because the power requirements of the camera and wireless transmitter were modest, power generation at the camera site was provided by a relatively simple solar panel and battery arrangement that proved very successful.

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 when funding allows, ultimately incorporating it into the Mikfik remote video recording system and potentially applying it to similar projects throughout the management area.

In 2018, the video system at Mikfik Creek–Lake was installed on 3 June and shut down on 1 August. The system operated continuously (~24 hr/d) and successfully recorded images approximately 100% of the time that it was programmed to operate between 3 June and 1 August (1,426 hr). The 2018 sockeye salmon run into Mikfik Lake was characterized by 1 distinct pulse of escapement. More than 3,700 sockeye salmon (75% of the run) entered the lake over a 2-day period (30 June–1 July). Unlike some recent years, in 2018 ADF&G--CF staff did not have to breach any active beaver dams on Mikfik Creek to allow migrating sockeye salmon to reach the lake.

A single camera mounted on the original (west bank) light pole was used to collect all video images of fish passage in 2018. Recordings were made using a time-lapse rate of 5 frames per second, which has proven to provide sufficient image quality. Fish were very easy to see, and the DVR facilitated efficient and convenient video review to estimate escapement. Upon review of the images collected at Mikfik Creek, 4,966 sockeye salmon were counted into the lake. In the past, to remain consistent with the historical Mikfik Creek database and with the methods used to derive the Mikfik sockeye salmon SEG, aerial survey data were normally used to generate the spawning escapement index. However, at the 2013 Lower Cook Inlet Board of Fisheries meeting, lower Cook Inlet staff recommended revising the Mikfik Lake sockeye salmon SEG so it is based on remote video, the method currently used to monitor escapement (Otis et al. 2013). As a result, the remote video-based estimate of 4,966 fish was used as the final escapement index in 2018. The video-based escapement goal for Mikfik Creek sockeye salmon is 3,400–11,000 fish (Otis, Erickson, Kerkvliet, and McKinley 2016).

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 1,426 hours of

recorded video between 3 June and 1 August, reviewers documented 48 instances where brown bears transited the field of view of the camera, an average of 0.75 bears per day of video operation (n = 63 d). All sightings were of individual bears. Other wildlife species observed included wolverine, moose, eagle, beaver, various waterfowl, and river otter.

McNeil River Brown Bear and Chum Salmon Research

During 2009 and 2010, Western Washington University graduate student Ian Gill researched the fishing behavior of brown bears and bear-salmon predation at McNeil River falls (Gill and Helfield 2012). This research provided data and streamlined video sampling methodologies that allowed estimating the total number of chum salmon taken by bears at the falls; the information is also beneficial to the management of area fisheries.

ADF&G—CF Research Biologist Ted Otis, worked with Gill to use the methodology and data in developing a model to estimate bear-salmon predation on pre-spawning chum salmon in McNeil River. Since 2011, ADF&G—CF staff has continued the video project to estimate the number of pre-spawning chum salmon killed by bears at McNeil River falls each year. The current project is being conducted in collaboration with Dr. Brad Harris, a professor at Alaska Pacific University (APU), where one of his students is reviewing the video. For the 2017 field season, APU purchased a new high-definition (HD) camera system to enhance the project's ability to collect accurate predation data and to evaluate the potential for identifying individual bears using enhanced video techniques. Use of the HD camera system continued in 2018.

Sanctuary Administration and Management

Staffing

Sanctuary Manager Tom Griffin completed his nineteenth season at McNeil River, his ninth as manager. Beth Rosenberg completed her third season as Assistant Manager. We were very fortunate to have Tim Peltier (Region IV Area Biologist), Ed Weiss (Lands and Refuge Manager), Polly Hessing (biologist, retired), Larry Aumiller (30-year MRSGS Manager, retired) and Ian Gill (biologist) fill-in this year as guides. Staff arrived at the McNeil River camp on 25 May 2018 and pulled camp on 1 September 2018. In addition to their normal duties at the sanctuary, the McNeil staff completed the annual ADF&G firearms safety training in spring 2018.

Volunteers

Volunteers Deb Ajango, Pete Robinson, Sarah Woolley and John Tuckey completed extensive work on the trail system and additional camp maintenance from 26 May through 1 June. Many thanks to this fantastic group of volunteers.

FACILITIES

Trails

Staff and volunteer trail crew conducted several trail maintenance projects during a week of pre-season trail work. These included 1) setting and anchoring 200 feet of the geoblock® trail that runs parallel with the stream/willow trees in Mikfik sedge east, maintenance resetting of some small sections in Mikfik sedge east and installing about 53 feet of geoblock near the McNeil River Trail wetlands. 2) a day was spent widening about 700 feet of the McNeil River trail in places were the trail had become entrenched. 3) the viewing pad at McNeil River falls was cleared of encroaching grasses and plants and graveled. The trail from the eagle rock to the lower McNeil River was cleared of alders to improve visibility.

Camp

Additional maintenance items around camp included trimming alders around camp for better visibility, removal of invasive dandelions, weeding and graveling of several tent sites and sections of trail in camp, replacement of rotten decking and picnic table planks, re-setting and caulking roofing screws, caulking fiberglass seams on cabin rooves and thinning of successional vegetation in the sauna pond, and a rotten single sideband pole was replaced. Stone work was completed at the bases of the wood stoves in the research cabin and staff cabins. A new old stock Paloma water heater was installed in the staff cabin. All 3 outhouses were braced with cables and one new outhouse hole was dug and the outhouse moved. The batteries on the tool shed solar system were replaced with 4 new 12-volt AGM batteries.

Acknowledgments

Thanks to Lands and Refuge Manager Ed Weiss and ADF&G Wildlife Biologist Tim Peltier who filled in during staff absences. Chris Peterson (ADF&G-DWC) provided big game and furbearer harvest data. Glenn Hollowell and Ted Otis (ADF&G-CF) prepared the narrative on fish escapement, commercial fisheries and fish research. Lisa Ka'aihue (CIAA) and Andy Wizik (CIAA) provided information on activities at the Paint River fish ladder. Megan Marie (ADF&G-DOH) provided special area permit information. Patti Harper (ADF&G-DWC) provided final editing and publishing of this report.

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Appendix

Daily wildlife observations during 2018, McNeil River State Game Sanctuary, Alaska.

Date	Location zone[a]	Comments
6/7/2018	MCR	Observed 8 bald eagles, flying all over Mikfik and west bluff.
6/7/2018	MCR	Observed 10 glaucous-winged gulls, flying all over Mikfik creek.
6/7/2018	MSE	Observed 10 green-winged teal, swimming in creek.
6/7/2018	MSE	Observed 20 savannah sparrows calling, flying.
6/7/2018	MSE	Observed 50 tree swallows, flying.
6/8/2018	CAMP	Observed 1 peregrine falcon in flight over spit, camp and lagoon.
6/8/2018	BCB	Observed 2 moose, 1 cow and small calf running along back bench behind camp toward Mikfik.
6/10/2018	MCR	Observed 20+ bald eagles in flight around Mikfik riffles, lower Mikfik falls and upper Mikfik falls.
6/10/2018	MCR	Observed 3 common ravens at Mikfik.
6/10/2018		Observed first bloom: chocolate lilies.
6/10/2018		Observed first bloom: wild geranium.
6/10/2018		Observed first bloom: nagoon berry.
6/12/2018	SPT	Observed 3 black oystercatchers on the spit in front of camp by water edge.
6/12/2018	MCR	Observed 15-20 bald eagles riding thermals.
6/12/2018	MCL	Observed 1 belted kingfisher at Mikfik lower falls.
6/12/2018	MCL	Observed 100 sockeye (red) salmon in mcl pool, 100-150 reds running at mcl at 15:05. 150 reds in Mikfik upper pool.
6/12/2018	MCT	Observed 25+ mergansers in Mikfik creek and Mikfik tidal area.
6/12/2018	LAG	Observed 20+ northern pintails, mixed flock with American widgeons in the lagoon.
6/12/2018	LAG	Observed 20+ American wigeon, mixed flock with northern pintails and American widgeons in the lagoon.
6/14/2018	LAG	Observed 8+ semipalmated plovers on the edge of lagoon mudflats.
6/14/2018	MCR	Observed 10+ bald eagles around riffle.
6/14/2018	MCR	Observed 3 common ravens around riffles.
6/14/2018	MCT	Observed 6 harbor seals, almost up to Mikfik riffles area on high tide following a big slug of red salmon.
6/14/2018	LAG	Observed 2 Caspian terns in the Lagoon, flying and fishing.
6/15/2018	SPT	Observed 4 black oystercatchers resting.
6/15/2018	MSE	Observed 2 least sandpipers.
6/15/2018	MCT	Observed 2 Caspian terns.
6/15/2018	LAG	Observed 24 brant.
6/15/2018	LAG	Observed 8 American wigeon.
6/15/2018	LAG	Observed 8 green-winged teal.
6/15/2018	LAG	Observed 12 red-breasted mergansers swimming and feeding.
6/16/2018	LAG	Observed 25 mergansers in the lagoon, not sure if common or red-breasted.
6/16/2018	MCT	Observed 2 greater yellowlegs in Mikfik creek tidal section.

Date	Location zone[a]	Comments
6/16/2018	MCR, MCL	Observed 25+ bald eagles around Mikfik area, by riffle and in flight over riffle area and lower falls, juveniles and mature eagles.
6/18/2018	LAG	Observed merganser mixed flock: mergansers, green-winged teal and American widgeon.
6/18/2018	LAG	Observed green-winged teal mixed flock: mergansers, green-winged teal and American widgeon.
6/18/2018	LAG	Observed American widgeon mixed flock: mergansers, green-winged teal, American widgeon.
6/18/2018	LAG	Observed 15-20 brant in mudflats at edge of lagoon.
6/18/2018	MCT	Observed 1 greater yellowlegs in walker creek.
6/18/2018	MSE	Observed 1 wood frog in mse along east wall.
6/19/2018	LAG	Observed 10 brant.
6/19/2018	LAG	Observed 12 glaucous-winged gulls.
6/19/2018	MCR	Observed 10 bald eagles.
6/20/2018	MCL	Observed 30+ sockeye (red) salmon in mcl pool. Not many, not running.
6/21/2018	MSE	Observed 2 greater yellowlegs.
6/21/2018	CMP	Observed 1 Wilson's snipe, heard from camp not seen.
6/22/2018	LAG	Observed 20+ brant at edge of lagoon.
6/22/2018	LAG	Observed 15+ American widgeon in a mixed flock.
6/22/2018	LAG	Observed 20+ green winged teal in a mixed flock.
6/22/2018	LAG	Observed 2 greater yellowlegs in Mikfik tidal section.
6/22/2018	LAG	Observed many least sandpipers in lagoon mud flats.
6/22/2018	LAG	Observed 2 Caspian terns flying over the lagoon and near outside water.
6/22/2018	MCR	Observed 1 Wilson's snipe, heard not seen.
6/23/2018	MSE	Observed 1 Wilson's snipe, winnowing.
6/23/2018	SPT	Observed 3 Caspian terns.
6/23/2018		Observed 10 northern pintails.
6/23/2018	MCR	Observed MANY wild irises, blooming.
6/23/2018	MCR	Observed MANY nagoon berry, blooming.
6/23/2018	MSE	Observed MANY Jacobs ladder in mse by willows.
6/23/2018	MCR	Observed MANY wild geraniums, blooming.
6/23/2018	CAMP	Observed MANY nootka lupine, blooming.
6/23/2018	MRT	Observed MANY Alaska violet, blooming.
6/23/2018	MRT	Observed MANY pink pyrea, blooming.
6/23/2018	BCB	Observed 1 northern harrier, hunting along crest in backyard bench.
6/23/2018	BCB	Observed 1 Wilson's snipe, disturbed by grazing bears behind sauna pond. Calling and some winnowing.
6/23/2018	BEACH TWD MCNEIL HEAD	Observed 3 scoters, on a beach walk to McNeil Head.

Date	Location zone[a]	Comments
6/23/2018	BEACH TWD MCNEIL HEAD	Observed 2 American pipits, on a beach walk to McNeil Head.
6/23/2018	BEACH TWD MCNEIL HEAD	Observed 2 black oystercatchers, on a beach walk to McNeil head, pair of nesting black oystercatchers with a clutch of 3 eggs.
6/24/2018	LAG	Observed 3 Caspian terns over tide flats and lagoon.
6/24/2018	MCT	Observed 3+ greater yellowlegs.
6/24/2018	LAG	Observed 2+ Caspian tern, heard and seen.
6/24/2018	MCT	Observed 4+ harbor seals following red salmon on at high tide in Mikfik creek.
6/24/2018	MCT	Observed 25+ American widgeon.
6/24/2018	MCT	Observed mergansers in Mikfik creek and Mikfik tidal.
6/24/2018	CMP	Observed 4 red fox, 4 kits (might be more kits?) plus male and female adults by den. Young kits, still gray.
6/25/2018	CMP	Observed 1 common redpoll flying in camp.
6/25/2018	CMP	Observed 1 Caspian tern flying over camp and outside water.
6/26/2018		Observed 1 harbor porpoise out in front of camp in outside water of McNeil cove.
6/27/2018	MCR	Observed 1 fork-tailed storm petrel flying over and feeding.
6/28/2018	TDF	Observed 8 brant foraging on tide flats in front of camp.
7/1/2018	LAG	Observed 3 harbor seals in lagoon.
7/2/2018	MRT	Observed 1 wood frog on McNeil river trail.
7/2/2018	MSW	Observed Kamchatka rhododendrons blooming on Mikfik west wall.
7/2/2018		Observed 1 harbor seal in McNeil cove in front of camp.
7/5/2018	MRF	Observed 10+ bald eagles at McNeil Falls, notably more than in two previous seasons.
7/4/2018	TDF	Observed 2 black oystercatcher east of camp near point, noted by beach walkers Art Sowls USFWS, Don & Kai Rees.
7/4/2018	MCNEIL HEAD	Observed many double-crested cormorant nesting on rock walls near McNeil Head. Noted by beach walkers Art Sowls USFWS, Don & Kai Rees, between camp and McNeil Head.
7/4/2018	MCNEIL HEAD	Observed 2, (1 pair) peregrine falcon near McNeil head. Noted by beach walkers Art Sowls USFWS, Don & Kai Rees, between camp and McNeil Head.
7/5/2018	MRF	Observed 2 common ravens.
7/6/2018	LAG	Observed 2 Caspian terns over the lagoon.
7/6/2018	CMP	Observed 1 yellow-rumped warbler in camp.
7/7/2018	MCR	Observed 7 mallard chicks in Mikfik creek between riffle and tidal area.
7/7/2018	MCR	Observed 20+ red-breasted mergansers in Mikfik creek between the riffles and tidal area.

Date	Location zone[a]	Comments
7/7/2018	MRT	Observed artemisia artica, composite plant at eagle rock.
7/7/2018	MRF	Observed 12 to 15 bald eagles many eagles at McNeil falls, more than in previous 2 seasons.
7/7/2018	MCR	Observed 1 greater yellowlegs in flight at Mikfik riffle.
7/8/2018	TDF	Observed 7 fork-tailed storm petrels flying low over the water, observed by visitor on beach walk between camp and McNeil Head.
7/8/2018	TDF	Observed pigeon guillemot, observed by visitors on a beach walk between camp and McNeil Head.
7/8/2018	TDF	Observed white-winged scoter, observed floating in the water offshore by visitors on a beach walk between camp and McNeil Head.
7/8/2018	TDF	Observed 2 (1 pair) black oystercatchers with 3 eggs in rock nest on beach point toward McNeil Head.
7/8/2018	MCNEIL HEAD	Observed 20+ double-crested cormorants in flight, perching, nesting (?) on bluff near McNeil head.
7/8/2018	MCNEIL HEAD	Observed 1 hermit thrush on beach, observed by visitors on a walk between camp and McNeil Head.
7/8-7/9/2018	UMS	Observed many fork-tailed storm petrels in front of camp, on beach to the southeast toward McNeil head, and at McNeil Falls. Two grounded birds seen. One taken in and later deceased. A 2nd bird found on spit, mort. Both FTSP emaciated. No flesh felt on keel of either. Remains of 4 other individual FTSP found. 6 deceased FTSP total for 7/8-7/9.
7/9/2018	MRF	Observed 10+ fork-tailed storm petrel more than 10 fork-tailed storm petrels observed by a visitor fishing for salmon eggs on the water at the falls. An unusual sighting of so many FTSP at mrf.
7/9/2018	MRF	Observed 1 long-tailed jaeger. Spotted and photographed by licensed bird rehabber Marianne Clark.
7/9/2018	MRT	Observed common fireweed first bloom.
7/9/2018	CMP	Observed first fledger seen - savannah sparrow - fledgers can be heard peeping in bushes throughout camp.
7/9/2018	MRF	Observed 20 bald eagles at McNeil falls, more noted than in previous two seasons. Also noted on 7/7/2018.
7/9/2018	MRF	Observed hundreds glaucous-winged gulls, MORE gulls than usually noted at McNeil Falls (several hundred G.W. Gulls) - staff obs. abundance. Hard to photograph bear IDs in some cases because gulls are in photographs blocking bears in such numbers.
7/10/2018	CMP	Observed 6 red fox, 4 fox kits, 2 adults moving around on staff side of camp and in back side of camp. Yellowlegs chick seen in REFO mouth? Dark with white spots and long dark beak, or snipe chick? 3 lemmings seen in REFO mouth (T.G.).
7/10/2018	MSE	Observed 12 red-necked phalarope identified with visitor.

Date	Location zone[a]	Comments
7/10/2018	TDF	Observed 2 black oystercatchers seen on a walk to Driftwood graveyard (3 eggs still in view in nest at tideline), between camp and McNeil Head.
7/11/2018	LAG	Observed 15 red-necked phalarope in lagoon mudflats, observed and photographed by Marianne Clark.
7/12/2018	MRF	Observed 8 mergansers below McNeil falls.
7/12/2018	MRF	Observed 250+ glaucous-winged gulls, an unusually high number of GWGU at McNeil falls, noticeably higher numbers. Attempted count 250+ GWGU made.
7/12/2018	MRF	Observed 7 bald eagles, juvenile and mature at mrf.
7/12/2018	MRF	Observed 1000+ chum (dog) salmon, near pool at mrf is FULL of fish, 1000+?, catch rates are good. Aerial survey today.
7/12/2018	MRT	Observed 2 wood frogs on McNeil trail.
7/13/2018	MRT	Observed 1 fork-tailed storm petrel at eagle rock, not a common place to view FTSP.
7/13/2018	CMP	Observed 1 fork-tailed storm petrel flying over outside water in front of camp.
7/13/2018	MRF	Observed 8 mergansers.
7/13/2018	LAG	Observed 1 loon in lagoon.
7/13/2018	LAG	Observed 4 harbor seals in lagoon.
7/13/2018	LAG	Observed 1 fork-tailed storm petrel over lagoon and outside water. Obs by Marianne Clark.
7/13/2018	TDF	Observed 2 least sandpipers at tideline right before driftwood graveyard point, on a walk with Marianne Clark to driftwood graveyard.
7/13/2018	TDF	Observed 10 double-crested cormorants in the water, observed from the beach on a walk with Marianne Clark to driftwood graveyard.
7/13/2018	TDF	Observed 3 fork-tailed storm petrels flying over the outside cove water, observed from the beach on a walk with Marianne Clark to driftwood graveyard.
7/13/2018	TDF	Observed 2 black oystercatchers, observed on a walk to Driftwood graveyard (3 eggs still in view in nest at tideline).
7/16/2018	MRF	Observed 10+ mergansers below lower falls.
7/17/2018	CMP	Observed 4 red fox, fox kits out in the a.m..
7/17/2018	MRF	Observed 7 mergansers, (2 drakes) below lower falls.
7/19/2018	LAG	Observed 23 mergansers, 15 in the lagoon, 8 in the lower river.
7/19/2018	MRF	Observed 3 glaucous-winged gulls, 3 hybrid gwgu, black wing tips.
7/21/2018	MRF	Observed 1 gray wolf at McNeil falls on the far side, moving along the ridgeline.
7/21/2018	MRF	Observed 5 mergansers (common or red-breasted) in the river below the lower falls.
7/21/2018	MRF	Observed 10 Bonaparte's Gulls at McNeil Falls.
7/22/2018	MRL	Observed 1 glandular willow herb growing on the lower island.
7/23/2018	MRT	Observed 1 wood frog.

Date	Location zone[a]	Comments
7/23/2018	MRT	Observed 3 greater yellowlegs.
7/24/2018	MRF	Observed 5 mergansers, one at the falls and four in lower river.
7/24/2018	MRF	Observed 6 bald eagles.
7/24/2018	MRF	Observed 1 black-billed magpie.
7/25/2018	MRF	Observed 5 mergansers.
7/25/2018	MRF	Observed 40 glaucous-winged gulls.
7/26/2018	CMP	Observed 1 ruby-crowned kinglet outside front staff cabin.
7/26/2018	MRT	Observed 1 northern fulmar, dead bird which had been fed on.
7/26/2018	MRF	Observed 1 common merganser located in the near pool at McNeil falls.
7/26/2018	MRF	Observed 7 mergansers below McNeil River Falls.
7/26/2018	MRL	Observed 2 greater yellowlegs located in the slough behind ender's island.
7/26/2018	SPT	Observed 4 red fox, kits on the beach.
7/27/2018	MRF	Observed 5 mergansers.
7/27/2018	MRF	Observed 100 western sandpipers.
7/28/2018	MRF	Observed 8 mergansers below the lower falls.
7/29/2018	MRF	Observed 20+ mergansers below the lower falls.
7/29/2018	MRF	Observed 3 common ravens.
7/29/2018	MRF	Observed 1 black-billed magpie.
7/29/2018	MRF	Observed 1 silver (coho) salmon caught by a bear (Holden) at 14:15.
7/29/2018	MRF	Observed 1 northern fulmar riding the current downstream, from up river stops in the center pool, floats down and is grabbed by an eagle, consumed.
7/31/2018	MRL	Observed 1 chum (dog) salmon spawned out.
7/31/2018	MRL	Observed 2 silver (coho) salmon, some jumping.
7/31/2018	MRL	Observed pink (humpback) salmon spawning in front of the lower island.
7/31/2018	MRF	Observed 11 mergansers, 10 below the lower falls, juv. in near pool fishing, (been there for several days now).
7/31/2018	MRF	Observed 2 common ravens.
7/31/2018	MRF	Observed 1 dolly varden caught by bear.
7/31/2018	CMP	Observed 1 northern harrier flying over camp.
7/31/2018	CMP	Observed 1 peregrine falcon flying over camp.
8/1/2018	MRL	Observed 6 common mergansers.
8/2/2018	END	Observed 1 greater yellowlegs.
8/3/2018	MCR	Observed 1 belted kingfisher.
8/5/2018	MRL	Observed 15 mergansers.
8/5/2018	MRL	Observed 4 harlequin ducks, juveniles opposite ender's island.
8/6/2018	MRL	Observed 3 harlequin ducks, juveniles.
8/7 - 8/15/2018	MRT	Observed 4+ wood frogs moving around in the geoblock section of the McNeil trail right near the wetlands. Several underfoot!
8/8/2018	SPT	Observed 1 peregrine falcon on the spit.
8/9/2018	MRL	Observed 2 mew gulls.

Date	Location zone[a]	Comments
8/9/2018	MRL	Observed 4 green-winged teal.
8/9/2018	SPT	Observed 1 peregrine falcon on the spit.
8/10/2018	MRL	Observed 1 Bonaparte's gull.
8/10/2018	MRL	Observed 2 harlequin ducks, swimming.
8/10/2018	MRL	Observed 1 greater yellowlegs.
8/10/2018	MRL	Observed 1 gray wolf fishing on the opposite side of the lower river.
8/12/2018	MRF	Observed 35 mergansers below the lower falls.
8/12/2018	MRF	Observed 2 harlequin ducks.
8/12/2018	MRL	Observed 2 black-billed magpies.
8/12/2018	MRL	Observed 6 common ravens.
8/12/2018	MRF	Observed 150 silver (coho) salmon.
8/14/2018	MRL	Observed 2 mallards.
8/15/2018	MRL	Observed 1 gray wolf sighting at 12:10 pm, across the river, far side of ender, howling at 12:15 pm, moved up river.
8/15/2018	MRF	Observed 25 mergansers grouped below lower falls.
8/15/2018	LAG	Observed 4 harbor seals in the lagoon.
8/16/2018	MRF	Observed 20 mergansers.
8/16/2018	MRL	Observed 2 mallards.
8/16/2018	MRF	Observed 30 glaucous-winged gulls.
8/16/2018	MRF	Observed 2 bald eagles.
8/16/2018	MRF	Observed 1 porcupine far side on the river.
8/16/2018	MRF	Observed 1 gray wolf fishing at 20:35.
8/19/2018	LAG	Observed 3 fork-tailed storm petrels flying low over the lagoon on Mikfik sedge side, in conjunction with storm.
8/19/2018	MRT	Observed 2 Wilson's snipe in the wet area between the notch of the McNeil trailhead and eagle rock.
8/20/2018	MRL	Observed 1 Wilson's snipe.
8/20/2018	MRT	Observed 2 northern harriers.
8/20/2018	MRF	Observed 1 least sandpipers.
8/20/2018	MRL	Observed 4 common mergansers.
8/20/2018	SPT	Observed 1 peregrine falcon.
8/21/2018	CMP	Observed 1 merlin flying over camp and edge of lagoon.
8/25/2018	MRL	Observed 2 Wilson's snipe, flushed.
8/25/2018	MRL	Observed 2 harlequin ducks swimming.
8/25/2018	MRL	Observed 30 mergansers.
8/25/2018	MRT	Observed 1 northern harrier, flying.
8/26/2018	LAG	Observed 1 double-crested cormorant, flying over lagoon.
8/26/2018	MRL	Observed 1 gray wolf on McNeil river lower islands, in the evening, moving through along the river upstream.
8/26/2018	CMP	Observed 1 peregrine falcon, alarming near camp and observed chasing a northern harrier in flight toward mse.
8/26/2018	MSE	Observed 1 northern harrier, flying over mse.
8/26/2018	CMP	Observed 1 northern harrier, flying over camp, chased by a peregrine falcon. Approx. 1 hr. later a recently deceased northern harrier was

Date	Location zone[a]	Comments
		found on the water trail with a puncture wound to the neck. Perhaps it was this same NOHA we saw being chased in flight over camp toward mse.
8/27/2018	CMP	Observed 1 northern harrier northern harrier flying over camp.
8/28/2018	CMP	Observed 1 peregrine falcon flying over camp.
8/28/2018	LAG	Observed 30 brant in flight over lagoon.
8/29/2018	MCNEIL HEAD	Observed 1 Killer Whale from McNeil Head, swimming around the mushroom rock off coast at high tide around 1800 hours, many harbor seals were also observed.
8/29/2018	MCNEIL HEAD	Observed 2 harbor seals at high tide around 1800 hours.
8/29/2018	MCNEIL HEAD	Observed many (raft) black scoters in the water, between camp and McNeil Head.

[a] Location zones: CMP = Camp; END = Enders Island; LAG = Lagoon; MCL = Mikfik Creek Lower Falls; MCR = Mikfik Creek Riffles; MCT = Mikfik Creek Lower Tidal Sect.; MCU = Mikfik Creek Upper Falls; MRF = McNeil Falls; MRL = Lower McNeil River (below lower McNeil Falls to Lagoon); MRT = McNeil/Mikfik Bench; MSE = Mikfik Sedge East; ODP = Opposite Driftwood Pt.; SPT = Spit; TDF = Tidal Flats; UMS = McNeil River Sanctuary General.


ALASKA
DEPARTMENT OF FISH AND GAME