

McNeil River State Game Sanctuary Annual Management Report 2019

Thomas M. Griffin

Edward W. Weiss



©2019 ADF&G, photo by Beth Rosenberg



2020

McNeil River State Game Sanctuary Annual Management Report 2019

Thomas M. Griffin

Alaska Department of Fish and Game
Division of Wildlife Conservation
333 Raspberry Road
Anchorage, AK 99518-1565

Edward W. Weiss

Alaska Department of Fish and Game
Division of Wildlife Conservation
333 Raspberry Road
Anchorage, AK 99518-1565

© 2020 Alaska Department of Fish and Game

Alaska Department of Fish and Game
Division of Wildlife Conservation
PO Box 115526
Juneau, AK 99811-5526



The State of Alaska's wildlife refuges, sanctuaries, and critical habitat areas are managed cooperatively by the Alaska Department of Fish and Game (Divisions of Habitat and Wildlife Conservation) and the Alaska Department of Natural Resources. The McNeil River public use and viewing program, and its publications, are managed by the Lands and Refuges Program at the Alaska Department of Fish and Game, Division of Wildlife Conservation. Funding comes from appropriations made by the Alaska Legislature and program receipts deposited to the State of Alaska's Fish and Game Fund.

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.

Special areas management reports are available from the Alaska Department of Fish and Game, Division of Wildlife Conservation, PO Box 115526, Juneau, AK 99811-5526; telephone (907) 465-4190; email: dfg.dwc.publications@alaska.gov; or website: www.adfg.alaska.gov. The report may also be accessed through most libraries, via interlibrary loan from the Alaska State Library or the Alaska Resources Library and Information Service (www.arlis.org).

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

Griffin, T. M., and E. W. Weiss. 2020. McNeil River State Game Sanctuary annual management report 2019. Alaska Department of Fish and Game, Special Areas Management Report ADF&G/DWC/SAMR-2020-1, Juneau.

The State of Alaska is an Affirmative Action/Equal Opportunity Employer. The Alaska Department of Fish and Game complies with Title II of the Americans with Disabilities Act of 1990. This document is available in alternative communication formats. If you need assistance, please contact the Department ADA Coordinator via fax at (907) 465-6078; TTY/Alaska Relay 7-1-1 or 1-800-770-8973.

Product names used in this publication are included for completeness but do not constitute product endorsement.

Cover Photo: Brown bears (*Ursus arctos*) at McNeil Falls, McNeil River State Game Sanctuary. ©2019 ADF&G, photo by Thomas M. Griffin.

Contents

Executive Summary	iii
Introduction.....	1
Wildlife	2
Brown Bear Monitoring Program	2
Hourly Index Counts	3
Individual Counts	4
Bear Use Days	12
Sex and Age Composition.....	12
Bear Photo Identification Project	12
Other Areas.....	13
Other Wildlife	13
General Observations	13
Hunting and Trapping	14
Brown Bear.....	15
Other Species.....	15
Fisheries	18
Commercial Fisheries.....	18
McNeil River Drainage	18
McNeil River Chum Salmon Stock Status	18
Mikfik Creek and Lake System.....	20
Chenik Creek and Lake System	20
Sport Fishing	21
McNeil Lagoon.....	21
Kamishak River	21
Fisheries Enhancement.....	22
Paint River Fish Ladder.....	22
Public Use and Land Management	25
McNeil River Falls-Mikfik Creek	25
Kamishak River.....	28
Chenik Lake-Creek Area.....	28
Bear-Human Conflicts.....	28
Land Use Permitting.....	29
Fish and Wildlife Research.....	29
Mikfik Creek Video Research.....	29
McNeil River Brown Bear and Chum Salmon Research	30
Sanctuary Administration and Management.....	30
Staffing	30
Volunteers.....	31
Facilities	31
Trails.....	31
Camp.....	31
Acknowledgments.....	31
References Cited	32
Appendix.....	33

List of Figures

Figure 1. Location of the McNeil River State Game Sanctuary and McNeil River State Game Refuge in Southwest Alaska.	1
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, 1993–2019.....	8
Figure 3. Daily and hourly index counts of brown bears at McNeil River falls, McNeil River State Game Sanctuary, Alaska, 2019 compared to 1993–2018 historic mean.	9
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, 1976–2019. ...	10
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).....	17
Figure 6. McNeil River chum salmon escapement 1976–2019, McNeil River State Game Sanctuary, Alaska.	20

List of Tables

Table 1. High hourly index counts of brown bears at McNeil River State Game Sanctuary, Alaska, 2000–2019. (Underlined bold numbers = 7 highest hourly counts/season used for index.)	5
Table 2. Composition of brown bears observed at McNeil River State Game Sanctuary, Alaska, 1976–2019.	11
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 2000–2018.	16
Table 4. Escapement estimates of salmon into Mikfik Lake and McNeil River, McNeil River State Game Sanctuary, Alaska, 2019.....	19
Table 5. Visitor use and sport fish harvest reported from Kamishak River drainages, McNeil River State Game Sanctuary, Alaska, 2019.....	22
Table 6. Summary of Paint River observations, McNeil River State Game Sanctuary, Alaska, 2019.	24
Table 7. Visitor use at McNeil River State Game Sanctuary and McNeil River State Game Refuge, Alaska, 1984–2019.....	27

Executive Summary

The McNeil River State Game Sanctuary (MRS GS) and McNeil River State Game Refuge (MRS GR) were created by the Alaska State Legislature in 1967 and 1991, respectively. The sanctuary was established primarily to provide permanent protection for brown bears (*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.

The bear index count numbers at McNeil River falls, the primary bear gathering and viewing location, averaged 35.6 bears; while below the historic average (i.e., the bear threshold criteria) of 40.8 bears and lower than the averages of the last 2 years, bear viewing was still considered good this season. Staff observed 106 individual bears this season, which spent a total of 2,366 bear use days within the sanctuary for the full 7 June–25 August season. The long-term (1976–2019) average number of individual bears annually identified is 94.7 and the long-term average of bear use days (1980–2019) is 2,106.

The bear-viewing program at MRS GS attracted 1,097 applicants from 13 different countries, who vied for 185 regular permits and 57 standby permits issued through a lottery. Fifty four percent of applicants were Alaska residents and 46% were nonresidents. The 223 permits issued were distributed to Alaska residents (60%) and nonresidents (40%). The 200 participants who used their permits came from 5 countries, including Canada, Germany, Sweden, Switzerland and the United States. The MRS GS permit program generated \$108,360.00 in 2019, which is ultimately allocated to the state's Fish and Game Fund.

The 2019 cumulative McNeil River chum salmon (*Onchorynchus keta*) aerial survey escapement index was estimated at 9,205 fish, below the sustainable escapement goal (SEG) range of 24,000–48,000. The 2019 run timing of McNeil River chum salmon was earlier than the historic average. ADF&G-Division of Commercial Fisheries, continued working on a remote video project designed to estimate bear predation on chum salmon at McNeil River falls.

During 2019 the Cook Inlet Aquaculture Association (CIAA) opened the Paint River fish ladder from 17 June through 26 September for potential salmon colonization. CIAA also completed construction of a staff cabin at the Paint River ladder site. The video fish enumeration system was not installed during 2019. Limited aerial surveys noted a few chum salmon in the Paint River system above the ladder and a few thousand pink and chum salmon were noted below the ladder in the tidal area of the Paint River and Akjemguiga Cove. Extremely low water levels with insufficient water to operate the fish ladder during at least half of August likely impaired

any escapement. CIAA hopes to house a crew on site in 2020 to facilitate ladder operation and escapement estimates.

A total of 9 ADF&G special areas permits, and 10 ADF&G commercial access permits were issued during 2019. 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 MRS GS or MRS GR during 2019. The Pebble Mine project, which is making its way through the federal permitting process, has the potential for impacts to wildlife resources, management and public uses within the MRS GR and MRS GS. ADF&G staff are working within the Army Corps of Engineers (ACOE) process to identify and attempt to address MRS GS/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.

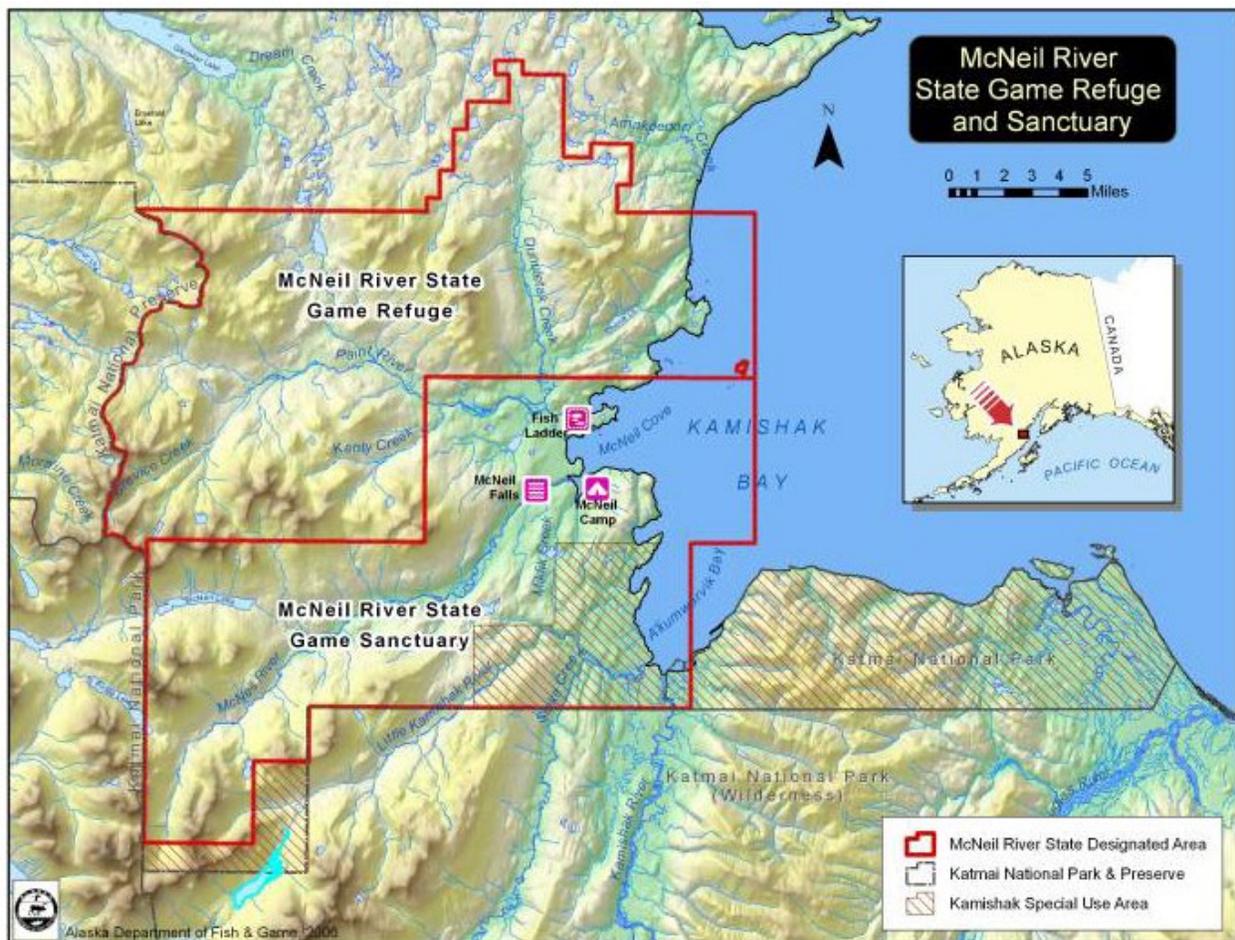


Figure 1. Location of the McNeil River State Game Sanctuary and McNeil River State Game Refuge in Southwest Alaska.

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

MRS GS and MRS GR encompass approximately 388 mi². 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 relate to 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 MRS GS and MRS GR. 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, and human-caused disturbance and 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 MRS GS: 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 good in 2019. While viewing at McNeil River falls in July was below average; viewing during June and August were above average. Up to 15 individual brown bears per day were viewable throughout June. A single brown bear was observed fishing at McNeil River falls on 22 June and staff started regularly guiding visitors to McNeil River falls by 28 June, viewing 6–18 bears fishing there in late June. Eighteen to fifty-two 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 23 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 were above average for the June period; below average in July; and above average in August. The 106 individual bears identified using MRS GS during the 2019 season is about 12% higher than the long-term average of 95 bears (1976–2018). Bear use days at McNeil River falls (855) was below average; however, total bear use days for the full season (2,366) were higher than average. We believe the above average individual bear count and bear use days in June and August and lower use at McNeil River falls is a result of bears visiting McNeil River falls but then moving on to other areas, likely due to low chum salmon escapement and extremely low flows within McNeil River, and strong salmon runs in other area streams such as the Big and Little Kamishak Rivers. Details on each of the indices for 2019 are presented below.

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 done only 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 other 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 traditional 15 July–5 August period; this can skew the index toward 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. 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.

Review of the 2019 hourly index counts for each day of the 2019 season showed above average viewing numbers for the June period; below average in July; and above average for August (Fig. 3). Daily high hourly index counts between 2001 and 2017 are presented in Table 1.

In 2019 the highest hourly count at McNeil Falls of 40 bears was seen at McNeil River falls on 10 July. The index average (average of the 7 highest hourly counts) of 36 bears was below the historic average of 40.8 bears, as were all 7 of the counts used to compute the average. All 7 of the highest counts used in computing the index occurring between 3 - 10 July, outside the typical 15 July - 5 August window. Bear index count numbers during 2019 were above the low levels observed in 2016 (29.3) but below the numbers observed in 2017–2018. The 2019 average of 36 bears was lower than the annual averages for the past 5 years (2014–2018) of 41.3 bears.

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 106 individual bears identified at MRSGS during the 2019 season (Table 2). This is about 12% higher than the long-term (1976–2018) average of 95 bears. Since 1976 the lowest count has been 58 (1976) and the highest 144 (1997).

Table 1. High hourly index counts of brown bears at McNeil River State Game Sanctuary, Alaska, 2000–2019. (Underlined bold numbers = 7 highest hourly counts/season used for index.)

Date	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	1993 to 2019 MEAN	
Jun-07											3	5	4	8	5	2	2	6	10	5.00	
Jun-08											8	5	4	4	3	1	3	6	8	4.67	
Jun-09											5	7	4	3	2	2	4	4	7	4.22	
Jun-10											6	8	5	5	2	2	9	4	8	5.44	
Jun-11											5	10	7	4	10	2	6	3	8	6.11	
Jun-12											5	10	7	5	7	4	3	4	10	6.11	
Jun-13											4	14	4	3	6	2	6	6	6	5.67	
Jun-14											10	8	6	4	3	2	3	4	8	5.33	
Jun-15											4	7	7	6	4	1	4	1	10	4.89	
Jun-16											10	12	4	3	4	5	5	7	12	6.89	
Jun-17											11	8	9	4	7	4	4	7	16	7.78	
Jun-18											13	9	2	7	4	4	5	3	12	6.56	
Jun-19											12	13	3	5	7	4	4	5	13	7.33	
Jun-20											10	22	5	5	5	6	9	6	11	8.78	
Jun-21											13	22	9	5	6	4	7	8	9	9.22	
Jun-22											11	18	5	1	3	4	5	9	10	7.33	
Jun-23											8	16	9	6	5	8	6	15	11	9.33	
Jun-24											4	16	5	9	6	7	6	9	14	8.44	
Jun-25											7	11	6	14	11	10	8	10	10	9.67	
Jun-26											12	11	11	12	12	15	3	10	17	11.44	
Jun-27											14	7	6	17	14	20	7	2	13	11.11	
Jun-28											6	8	3	22	5	25	12	6	11	10.89	
Jun-29											18	6	9	28	12	20	15	12	12	14.67	
Jun-30					11						21	11	7	18	18	25	19	16	16	16.20	
Jul-01						1					13	7	18	14	38	19	27	28	17	26	18.91
Jul-02					13						14	14	18	17	35	18	27	16	22	26	20.00

Date	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	1993 to 2019 MEAN
Jul-03								3	16	16	17	20	18	30	15	24	23	28	35	20.42
Jul-04					16	3			15	26	13	20	30	44	18	26	31	20	21	21.77
Jul-05					20	12	4	9	15	27	14	18	28	37	17	18	35	32	31	21.13
Jul-06					20	12	4	8	19	19	10		27	28	31	24	32	38	34	21.86
Jul-07					22	18		16	21	27	12	13	26	33	24	29	36	39	36	25.14
Jul-08					21	14	4	10	25		24	25	35	47	38	29	33	45	35	27.50
Jul-09					25	15		14	26		27	41	34	48	33	33	48	47	38	33.00
Jul-10					23	21	11	14	33	17	31	45	36	7	47	25	46	39	40	29.00
Jul-11				15	28	18	11	17	28	27	30	37	45	7	33	30	54	38	30	28.00
Jul-12				10	24	19	17	24	32	33	33	0	49	16	30	24	41	37	27	26.00
Jul-13				20	28	26	20	22	25	30	40	36	50	28	28	30	40	25	30	29.88
Jul-14				20	21	34	21	18	27	42	42	40	48	32	31	21	35	27	27	30.38
Jul-15	25	30	36	19	19	31	29	25	41	54	50	48	57	40	31	23	47	40	18	34.46
Jul-16	39	26	27	24	19	31	35	32	34	64	54	50	39	36	23	20	47	34	26	34.00
Jul-17	40	28	32	20	21	31	32	28	35	53	42	63	44	29	31	22	37	65	21	35.04
Jul-18	40	31	31	21	19	30	37	37	34	54	64	66	51	23	30	15	25	54	22	34.96
Jul-19	35	31	31	25	20	33	29	38	39	70	75	62	50	25	24	14		59	24	39.38
Jul-20	37	26	29	22	22	37	42	42	40	54	62	43	40	21	36	15	32	55	22	35.37
Jul-21	39	36	21	19	11	21	40	40	21	70	65	35	42	19	32	12	28	38	13	31.70
Jul-22	32	21	26	18	16	24	34	42	10	54	60	24	41	12	25	13	38	41	11	30.00
Jul-23	30	33	23	15	16	31	30	41	14	50	47	32	36	11	17	8	35	47	13	30.63
Jul-24	42	30	16	18	12	26	21	40	25	32	37	21	45	9	14	5	47	16	12	27.26
Jul-25	33	28	18	11	2	27	29	51	40	21	39	26	35	7	14	4	41	22	11	26.44
Jul-26	24	24	16	7	6	25	36	49	21	41	38	31	33	9	7	3	27	17	6	25.89
Jul-27	29	20	20	6	5	31	33	34	30	62	26	20	24	8	8	4	23	22	3	25.37
Jul-28	23	26	12	10	6	27	33	35	32	49	43	26	15	9	8	3	18	21	15	23.74
Jul-29	20	30	14	9	6	25	29	42	33	44	45	25	11	12	7	4	16	19	13	22.74
Jul-30	15	23	14	8	8	20	17	33	29	35	38	18	10	7	8	3	16	19	19	20.52

Date	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	1993 to 2019 MEAN
Jul-31	11	25	11	10	7	20	22	35	18	31	24	19	7	7	12	3	19	18	9	18.1
Aug-01	7	21	9	8		12	15	30	14	23	22	14	3	4	8	3	17	12	11	15.4
Aug-02	5	19	11	9		11	13	18	10	28	11	10	3	5	8	2	12	17	7	13.3
Aug-03	3	15	5	8		10	16	19	8	19	7	9	5	3	6	3	14	16	12	12.1
Aug-04	3	9		4		10	14	19	-	12	5	10	3	6	4	2	9	12	12	9.1
Aug-05	4	8	6	5		6	7	18	9	19	9	11	6	5	4	1	12	7	8	8.7
Aug-06											8	13	3	4	5	1	13	10	12	7.7
Aug-07											7	15	3	3	4	2	14	8	7	7.0
Aug-08											6	10	3	7	2	1	15	8	10	6.9
Aug-09											5	7	6	3	5	1	5	8	12	5.8
Aug-10											7	5	5	2	4	2	14	10	8	6.3
Aug-11											6	2	0	1	7	1	6	5	9	4.1
Aug-12											8	4	2	1	3	4	12	12	6	5.8
Aug-13											6	3	2	1	4	0	7	3	6	3.6
Aug-14											7	4	2	2	5	2	9	9	10	5.6
Aug-15											7	5	2	1	2	2	8	6	7	4.4
Aug-16											8	3	1	1	5	1	5	7	6	4.1
Aug-17											5	3	1	1	1	1	6	4	6	3.1
Aug-18											7	3	2	2	3	1	6	3	7	3.8
Aug-19											2	4	2	0	2	3	7	2	3	2.8
Aug-20											3	2	1	0	2	3	7	4	5	3.0
Aug-21											2	3	1	1	3	1	7	5	6	3.2
Aug-22											4	2	2	1	1	2	7	2	2	2.6
Aug-23											4	2	2	2	1	3	5	8	2	3.2
Aug-24											3	4	3	1	1	2	3	5	6	3.1
Aug-25											3	2	0	2	2	1	1	6	7	2.7
Mean of 7 Daily Highs	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	35.6	40.01

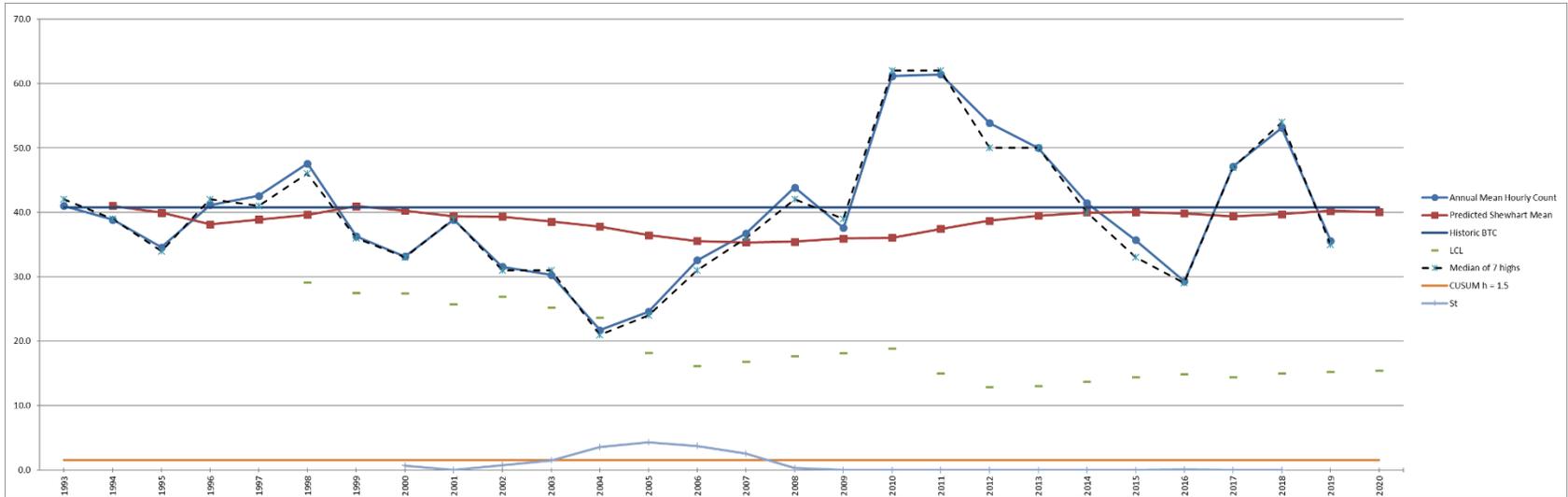


Figure 2. Historic hourly index counts (annual mean of 7 highest daily counts) of brown bears at McNeil River falls, McNeil River State Game Sanctuary, Alaska, 1993–2019.

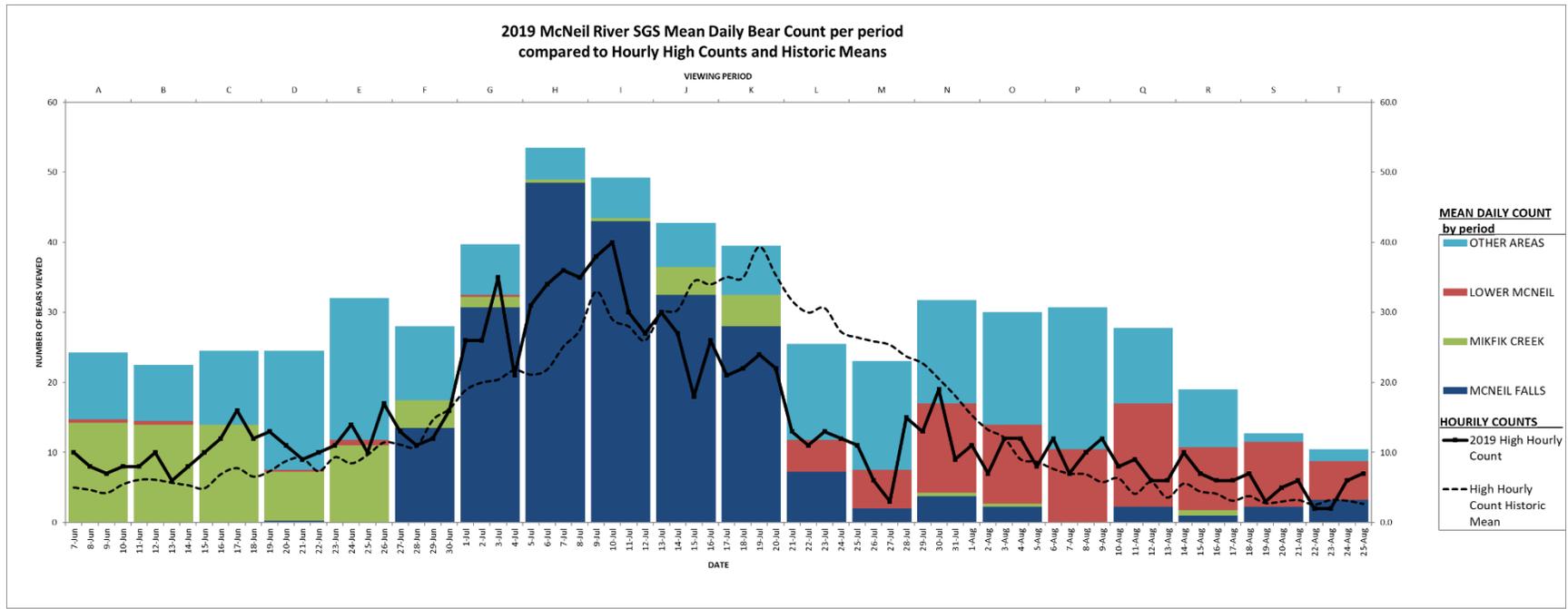


Figure 3. Daily and hourly index counts of brown bears at McNeil River falls, McNeil River State Game Sanctuary, Alaska, 2019 compared to 1993–2018 historic mean.

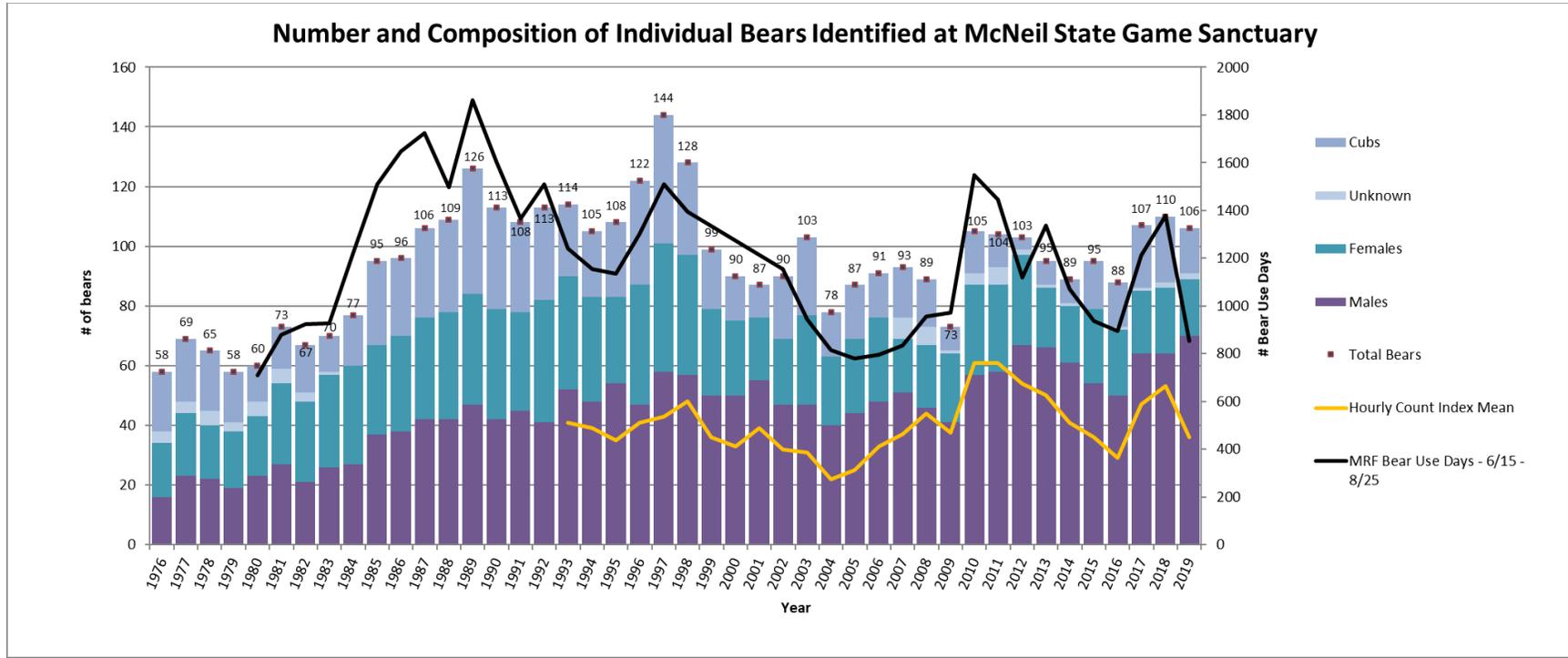


Figure 4. Annual number of individual brown bears observed, bear use days, and index counts compared to bear composition, McNeil River State Game Sanctuary, Alaska, 1976–2019.

Table 2. Composition of brown bears observed at McNeil River State Game Sanctuary, Alaska, 1976–2019.

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	2019
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	7
Single Adult Females	5	8	6	8	8	10	9	15	16	12	11	13	13	14	16	12	19	19	15	12	14	19	19	<u>14</u>	<u>14</u>	12	8	16	12	13	14	7	9	16	20	22	24	16	15	14	15	9	9	8
Single Adult Males	16	18	18	19	23	26	20	22	22	27	31	34	34	42	37	41	39	48	45	49	46	55	54	<u>48</u>	<u>48</u>	53	45	45	39	41	40	46	45	40	56	56	65	66	61	53	46	59	61	59
Adult Sex Unknown	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<u>0</u>	<u>0</u>	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total Adults	31	36	32	36	38	44	36	44	47	55	56	61	61	75	69	68	74	78	71	75	80	93	88	<u>73</u>	<u>69</u>	70	63	73	58	64	62	62	64	61	83	83	91	86	80	77	68	78	80	74
Sub-Adult Females	4	3	4	2	6	9	11	9	8	2	7	7	9	4	5	6	6	8	9	3	6	5	6	<u>4</u>	<u>4</u>	4	4	2	4	2	6	2	2	2	3	2	4	0	0	1	0	2	3	4
Sub-Adult Males	0	5	4	0	0	1	1	4	5	10	7	8	8	5	5	4	2	4	3	5	1	3	3	<u>2</u>	<u>2</u>	2	2	2	1	3	8	5	1	1	1	2	2	0	0	1	4	5	3	11
Sub-Adult Sex Unknown	3	4	5	3	4	5	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<u>0</u>	<u>0</u>	0	0	0	0	0	0	7	6	1	4	6	2	1	1	0	1	1	2	2
Total Sub-Adults (1)	7	12	13	5	10	15	15	14	13	12	14	15	17	9	10	10	8	12	12	8	7	8	9	<u>6</u>	<u>6</u>	6	6	4	5	5	14	14	9	4	8	10	8	1	1	2	5	8	8	17
Total Adults & Sub-Adults (2)	38	48	45	41	48	59	51	58	60	67	70	76	78	84	79	78	82	90	83	83	87	101	97	<u>79</u>	<u>75</u>	76	69	77	63	69	76	76	73	65	91	93	99	87	81	79	73	86	88	91
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	15
Total Bears	58	69	65	58	60	73	67	70	77	95	96	106	109	126	113	108	113	114	105	108	122	144	128	<u>99</u>	<u>90</u>	87	90	103	78	87	91	93	89	73	105	104	103	95	89	95	88	107	110	106
<p>Notes: (1) Defined as 5.5 years old and younger from 1977 through the present.</p> <p>(2) Only the bears that are recognizable as individuals (Known Bears). In addition bears that are recognizable but seen less than three times and not regular users of Mikfik Creek, McNeil River or McNeil Cove are not included. Hence these figures represent the minimum number of bears present at the sanctuary.</p> <p><u>Underlined Bold Numbers</u> represent average of data four years prior and after (No data were recorded in 1999 and 2000).</p>																																												

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. An index of bear use days is calculated by summing the individual adult and subadult bears observed daily throughout the season. While these counts include bears in all viewing areas within MRS GS, 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.

There were 855 bear use days at McNeil River falls in 2019, which is below both the long-term average (1980–2018) of 1,203 and the recent 10-year average (2009–2018) of 1,192. There was a total of 2,366 bear use days (all bears including cubs) within the sanctuary for the full 7 June–25 August season, higher than the long-term (1980–2019) average of 2,106. These days in 2019 were distributed 26%, 51%, and 23%, 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. There were 7 maternal females and 15 cubs observed in 2019, consistent with annual number of females with cubs over the last 4 years (7 – 10 maternal females with 16 – 22 cubs, 2015-2018). The total of 8 nonmaternal females observed in 2019 was consistent with numbers in 2017–2018 but lower than in 2015–2016. Overall number of females was consistent with the prior 5 years (2013-2018). 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 MRS GS or MRS GR. Some information is available through opportunistic surveys, fisheries escapement videos, and commercial guide reporting from the Mikfik Lake, Paint River, Chenik Creek–Lagoon, and 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 MRS GS. 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 5 guide services operating in 2019, there were up to 17 bears seen per day (mean = 9) in the Kamishak–Little Kamishak–Strike Creek areas from 11 July to 26 September 2019.

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 2019. He observed up to 22 individual bears 11–17 July 2019 with the following composition: 1 maternal female with 2 cubs of the year, 2 maternal females with 2 yearlings each; 1 maternal female with 3 yearlings; 3 subadults; 4 adult females without cubs and 2 adult males. In addition, 1 caribou (*Rangifer tarandus*) was observed on the east side of Chenik Lake on 16 July.

OTHER WILDLIFE

General Observations

During the 2019 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 2019 season. This year, less frequently observed species included osprey (*Pandion haliaetus*), short-eared owl (*Asio flammeus*), Lincoln's sparrow (*Melospiza lincolnii*), whimbrel (*Numenius phaeopus*), pine grosbeak (*Pinicola enucleator*), wandering tattler (*Tringa incana*), rough-legged hawk (*Buteo lagopus*), Caspian tern (*Sterna caspia*), red-throated loon (*Gavia stellate*), harlequin duck (*Histrionicus histrionicus*), northern shrike (*Lanius borealis*), pigeon guillemot (*Cephus*

Columba), belted kingfisher (*Megaceryle alcyon*), peregrine falcon (*Falco peregrinus*), merlin (*Falco columbarius*), black scoter (*Melanitta nigra*), and black oystercatcher (*Haematopus bachmani*).

Marine mammal sightings during the 2019 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.

An unusual observation of numerous sea jellies washed up along the spit and beaches during the week of 17 August occurred and they continued to be present through the end of August. They appeared to be moon jelly (*Aurelia labiate*).

Other terrestrial wildlife observed this season included the following: Several gray wolf (*Canis lupus*) sightings occurred in the lagoon, tidal flats, north bluff and the lower McNeil River in June and July. On 4 July, 3 wolves were observed on the north bluff at 9:15 am. 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 lower river. Also, several arctic ground squirrels (*Spermophilus parryii*), masked shrew (*Sorex cinereus*), red fox (*Vulpes vulpes*), and a short-tailed weasel (*Mustela erminea*) were observed in and around camp. As usual, numerous wood frogs (*Rana sylvatica*) were observed throughout the Mikfik Creek and McNeil River viewing areas.

ADF&G—Division of Commercial Fisheries (CF) staff recorded 1,520 hours of video connected with the video monitoring of sockeye salmon (*Oncorhynchus nerka*) escapement into Mikfik Lake. In addition to the escapement data, reviewers documented wildlife transiting the camera's view, including moose (*Alces alces*), beavers (*Castor canadensis*), and various waterfowl. Brown bears transited the field of view of the camera in 33 instances, an average of 0.52 bears per day of video operation ($n = 64$ d). All sightings were of individual bears. The peak daily bear count (3) occurred on 26 July.

ADF&G—CF also operates a video weir connected with the monitoring of sockeye salmon escapement at Chenik Lake. In 90 days of operation (23 May through 20 Aug), cameras observed 39 bears transiting the Chenik video. Other species observed included North American river otter (*Lontra canadensis*, many observations), moose ($n = 1$), porcupine (*Erethizon dorsatum*, $n=1$), and caribou ($n = 3$). Caribou observed moving through the Chenik Lake area by the camera were seen on 3 dates—25 and 26 June and 10 July, with each siting being a single individual. Caribou were not documented by the Chenik Lake camera during its first 15 years of use, but at least one has been seen during each of the past 3 years.

HUNTING AND TRAPPING

MRS GS is closed to hunting and trapping by Alaska state statute (AS 16.20.162(b)), and MRS GR, 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 mi² that comprise MRS GS and MRS GR are part of a much larger area of approximately 5,585 mi², 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 2000–2018 are summarized in Table 3. Data for regulatory year (RY) 2019 (a regulatory year begins 1 July and ends 30 June, e.g., RY19 = 1 July 2019–30 June 2020) 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. Brown bear hunts are open during the fall and the following spring of odd-numbered regulatory 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 mi² 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 94 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 (*Gulo gulo*), coyote (*Canis latrans*), 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 of these species except 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 (MRS GS) and McNeil River State Game Refuge (MRS GR), Alaska, regulatory years^a 2000–2018.

RY ^a	Species																			
	Brown bear		Black bear		Caribou		Moose		Beaver		Lynx		Marten		Otter		Wolf		Wolverine	
	MRS GS- MRS GR ^b	AA ^c																		
2000			0	0	0	114	0	16	0	12	0	1	0	0	0	0	0	3	0	1
2001	6	98	0	3	0	97	1	19	0	0	0	0	0	0	0	0	0	1	0	2
2002			0	1	0	39	3	18	0	0	0	0	0	1	0	0	0	1	0	4
2003	6	105	0	7	0	53	1	14	0	9	0	3	0	6	0	10	0	10	0	20
2004			0	1	0	33	2	15	0	0	0	0	0	0	0	2	0	1	0	2
2005	3	102	0	6	0	51	2	17	0	1	0	1	0	0	0	0	0	8	0	0
2006			0	2	0	25	0	10	0	0	0	4	0	2	0	1	0	2	0	7
2007	4	93	0	2	0	0	2	16	0	0	0	1	0	1	0	3	0	3	0	4
2008			0	1	0	5	0	18	0	4	0	3	0	0	0	0	0	4	0	2
2009	4	73	0	1	0	6	1	11	0	2	0	13	0	1	0	1	1	2	0	1
2010			0	1	0	0	0	6	0	13	0	27	0	0	0	8	0	2	0	2
2011	5	75	0	0	0	1	0	11	0	5	0	38	0	0	0	0	0	4	0	1
2012			0	0	0	0	1	10	0	0	0	33	0	0	0	0	0	5	0	5
2013	7	66	0	3	0	1	0	8	0	2	0	4	0	0	0	0	0	3	0	0
2014			0	0	0	1	1	15	0	3	0	2	0	0	0	2	0	0	0	2
2015	4	91	0	3	0	1	0	4	0	7	0	0	0	0	0	0	3	2	0	0
2016			0	0	0	8	0	14	0	10	0	3	0	0	0	4	0	1	0	8
2017	2	95	0	0	2	1	0	9	0	1	0	1	0	0	0	20	0	3	0	2
2018			0	0	0	12	2	19	0	0	0	0	0	0	0	0	0	0	0	2
2019 ^d																				

^a Regulatory year (RY) begins 1 July and ends 30 June, e.g., RY18 = 1 July 2018–30 June 2019.

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

^c AA = adjacent areas. Harvest numbers for surrounding areas largely from reporting areas outside of the MRS GS–MRS GR complex. Some data may be from within MRS GS and MRS GR where these reporting areas overlap the MRS GS–MRS GR complex boundary. MRS GS is closed to hunting and trapping and MRS GR is closed to the hunting of brown bear.

^d Harvest reporting is not yet complete for regulatory year 2019, which ends 30 June 2020.

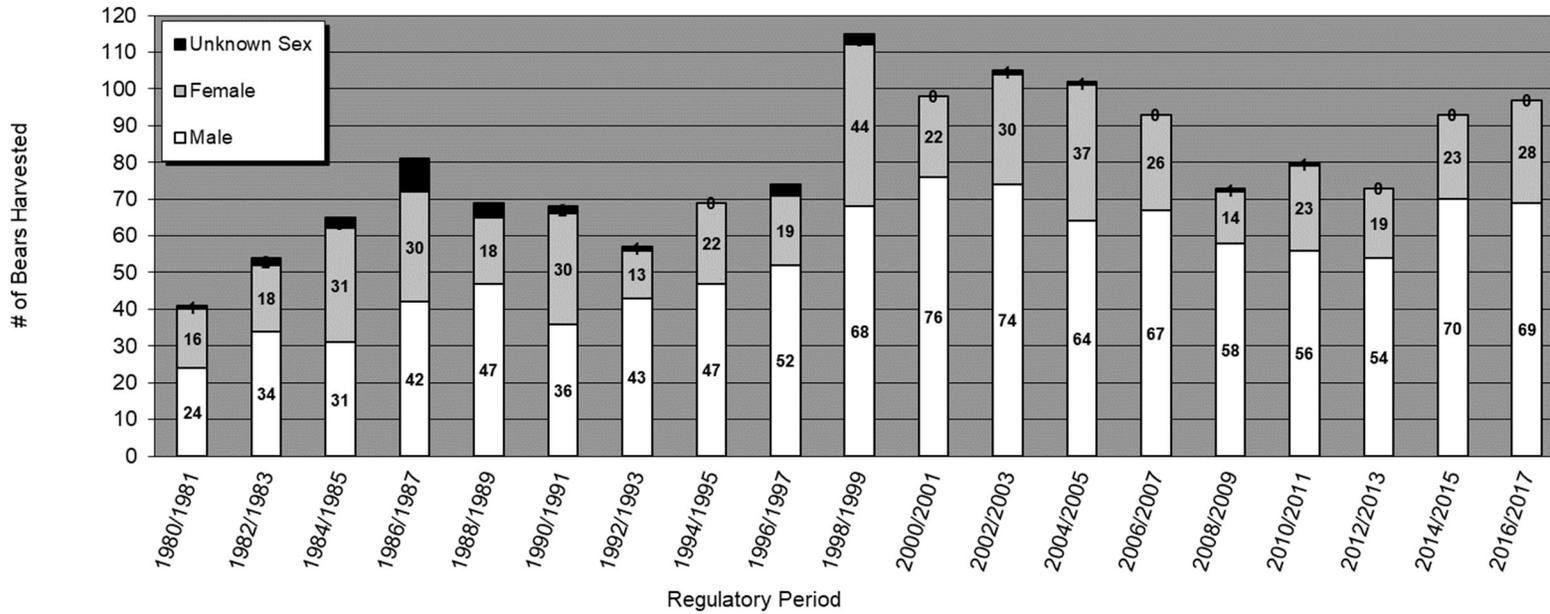


Figure 5. Brown bear harvest from areas surrounding the McNeil River State Game Sanctuary and McNeil River State Game Refuge, Alaska, 1980–2017 presented by 2-year hunt period (harvest from Game Management Units/Uniform Coding Units: 9A/201, 301, 401, 501; 9B/301; and 9C/101, 201, 301, 601, 702, and 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

MRS GS and MRS GR 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 (*Salvelinus malma*). The McNeil River drainage contains Dolly Varden, 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, and rainbow trout (*O. mykiss*). Chenik Creek–Lake system supports sockeye salmon, some coho salmon, lake trout (*S. namaycush*) and Dolly Varden. 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 2019, generally favorable stream conditions allowed for 7 effective aerial surveys of McNeil River and the video system at Mikfik Lake operated successfully through 31 July. 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 2019 McNeil River chum salmon aerial survey escapement index was estimated at 9,205 fish (Table 4, Fig. 6). This value is below the sustainable escapement goal (SEG) range of 24,000–48,000. Chum salmon were consistently seen in low numbers above the falls during aerial observations from 2 July through the last survey on 31 July. A peak daily aerial estimate of 4,411 chum salmon occurred on 2 July, of which 501 were upstream of McNeil River falls. The peak above falls count of 1,071 chum salmon occurred on 8 July. The McNeil River subdistrict was closed 17 June without any commercial fishing inside the subdistrict. Chum runs to other Kamishak Bay district systems in 2019 were generally strong. However, strong pink salmon runs in other districts resulted in modest fishing effort in the Kamishak District and a districtwide commercial harvest of just over 31,600 chum salmon. The 2019 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. (2016a).

Table 4. Escapement estimates of salmon into Mikfik Lake and McNeil River, McNeil River State Game Sanctuary, Alaska, 2019.

2019 Date	Mikfik sockeyes cumulative total	McNeil chums (daily) ^a
1 Jun	0	ND
8 Jun	2,291	ND
15 Jun	2,898	ND
22 Jun	2,901	ND
24 Jun	-	131
29 Jun	2,901	ND
2 Jul	-	4,411
6 Jul	2,901	ND
8 Jul	-	2,921
13 Jul	2,901	ND
18 Jul	-	1,391
20 Jul	2,901	ND
22 Jul	-	3,954
27 Jul	2,901	ND
31 Jul	-	850
3 Aug	2,901	ND
10 Aug	2,901	ND
17 Aug	2,901	ND
Escapement index	2,901 ^b	9,205 ^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.

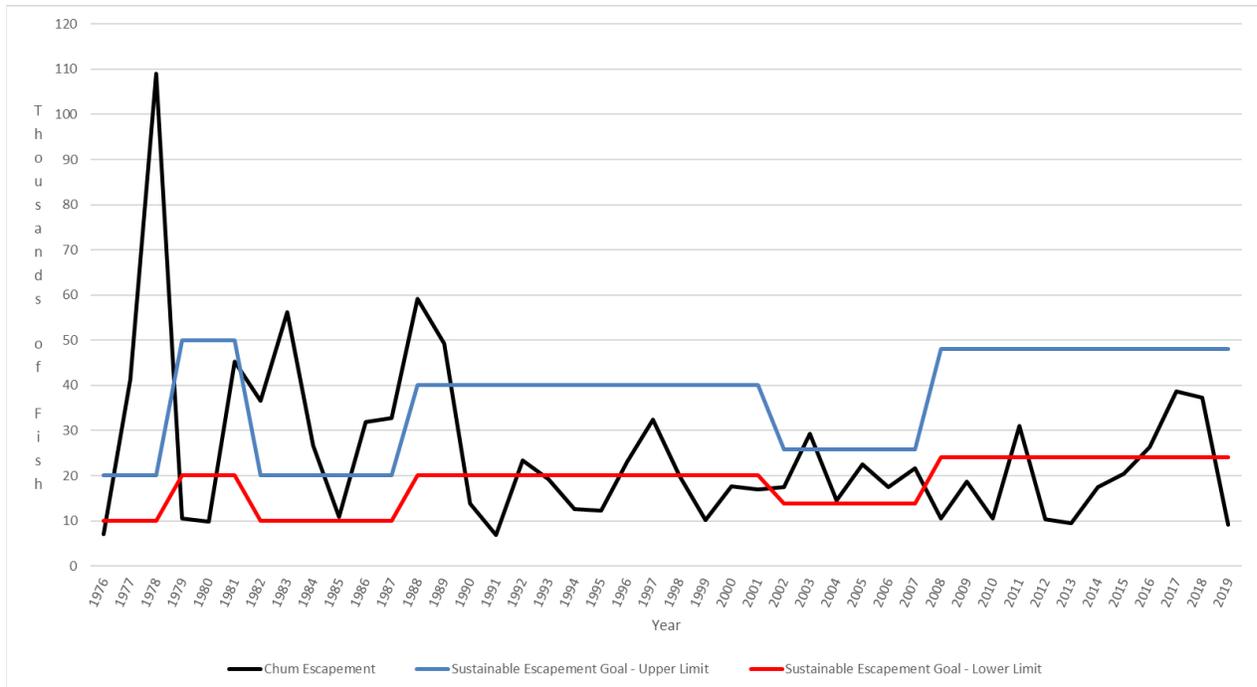


Figure 6. McNeil River chum salmon escapement 1976–2019, McNeil River State Game Sanctuary, Alaska.

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 2,901 fish escaping into the lake in 2019 (Table 4). Significant predation by bears occurs in Mikfik Creek, so only those fish documented reaching the lake are considered escapement. The video estimate of 2,901 fish was used as the final escapement estimate. This value is below the sustainable escapement goal (SEG) range of 3,400–11,000 (Otis et al. 2016b). Post-season evaluation indicated that run timing of sockeye salmon into Mikfik Lake was more compressed than normal, with 76% of the run entering the lake in just 2 days (6–7 June). Drought conditions likely contributed to no fish entering Mikfik Lake after 18 June, as extremely low water was observed by Division of Commercial Fisheries staff servicing the video system from late June through the end of July.

The McNeil River subdistrict was open to commercial fishing for Mikfik Creek sockeye salmon from 1 June to 16 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, has a cascade falls at tidewater which partially blocks fish passage. This cascade has been modified on several occasions by blasting or clearing resting pools in 1926, 1932, and 1958. More recently 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 2019, 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 2019 escapement cumulatively estimated by remote video as 12,079 sockeye salmon. A total of 54,205 sockeye salmon were commercially harvested from the Chenik subdistrict in 2019.

SPORT FISHING

A limited amount of sport fishing occurs within MRS GS and MRS GR. 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 2019. 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 6 silver salmon, 3 chum salmon, 3 pink salmon and 5 Dolly Varden were harvested.

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 2019 season, 5 of the 5 permitted lodges and transporters operating in the Kamishak Special Use Area reported. Reporting companies spent at least 335 angler use days and at least 160 guide use days during 110 days of sport fishing in the Kamishak area of the sanctuary. These anglers reported catching at least 3,700 fish, of which 23% were Dolly Varden, 52% were coho salmon, 9% were pink salmon and 16% were chum salmon. All chum salmon were released as were nearly all Dolly Varden and pink salmon. Eighty-four 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, 2019.

No. of days in MRS GS	No. of guide use days	No. of angler use days	No. of non-angler days	COHO SALMON		CHUM SALMON		PINK SALMON		DOLLY VARDEN		Avg bears/day
				Kept	Released	Kept	Released	Kept	Released	Kept	Released	
110	335	160	0	569	1,351	0	606	4	314	20	836	9

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 as envisioned in a 1987 ADF&G report by Quimby and Dudiak (1987) would 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 estimates ranged from only 30 (in 2000) to 2,000 (in 2005). At that time, the structure had never been 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. CIAA anticipated a 1–2% return of these fish to Paint River in 2016 and planned to enumerate the salmon via video weir. The video equipment was deployed 8 July 2016, but power failures prevented continuous operation and no estimate could be made of escapement; however, no pink salmon were seen in the cove or fish ladder by CIAA staff. Every year since 2014 a small number (<200) of salmon or salmon carcasses have been observed within or above the ladder from mid-July to late September. Salmon species viewed in the ladder since 2014 include sockeye, chum, coho, and pink salmon. Although 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.

During 2019 the CIAA opened the Paint River fish ladder from 17 June through 26 September for potential salmon colonization. The video fish enumeration system was not installed during 2019. CIAA expected a return of an estimated 10,000 adult pink salmon to the Paint River during summer 2019 from a release of 305,000 pink salmon fry into Paint River Lakes in spring 2018.

Observations at the ladder and within the Paint River system for 2019 are summarized below in Table 6. A couple of chum salmon and 10–15 salmon carcasses (some of which were chum) were found within the ladder, in July and August, respectively. ADF&G conducted 5 aerial surveys of portions of the Paint River system between 2 July and 20 August. During these surveys 14 and 22 chum salmon were noted above the fish ladder in the Paint River system on 18 and 22 July, respectively. The remaining 2 surveys on 12 and 20 August found only 2 pink salmon above the fish ladder, on 12 August. The ADF&G aerial surveys in August identified 1,000–2,000 pink salmon and 3,000–4,000 chum salmon within Akjemguiga Cove and the tidal area below the Paint River fish ladder. Although few fish were observed to have escaped above the ladder, extremely low water levels during August likely impaired escapement. There was no flow within the ladder at least a portion of that period (14–29 August). It is also unknown how many of these fish were attempting to return to the Paint River as a result of wild stock, the planting, or stray returns. Pink salmon have historically spawned in tidal areas of the Paint River below the falls and Akjemguiga Cove, and several thousand fish were most recently noted in this area in 2017, when no planted fish were expected. No samples were obtained of Akjemguiga Cove or Paint River pink salmon in 2019 to determine if any of the fish were CIAA fish released in 2018 or wild stock fish. Of 80 readable pink salmon otolith samples obtained at the adjacent McNeil River on 28 August, none contained hatchery thermal marks indicative of CIAA or other hatchery released fish (T. Otis, ADF&G, Fishery Biologist, personal communication, 8 January 2020).

CIAA conducted onsite work at the Paint River Fish Ladder site during 17–21 June, 17–19 July, 14–22 August, 28–29 August, 26–27 September, and 19 October. In addition to opening and closing the ladder they completed installations of an access ladder and new fish weir within the ladder, and construction of a cabin to support operations. CIAA hopes to house a crew on site in 2020 to facilitate ladder operation and escapement estimates.

In 2019, CIAA completed more site visits in 2019 than it has during any year since opening the ladder in 2011. Though CIAA staff reported an increased number of bears in proximity to the fish ladder site as compared to the previous 6 years; it is unknown if this represents an increase in use due to the increase in person/days on the ground at Paint River in 2019 and the opportunistic and sporadic nature of observations. Starting in 2020, CIAA plans to house a weir crew annually from July–September at the fish ladder. In addition to salmon enumeration, staff will keep a logbook of bear sightings throughout the season that can be used in the future to determine trends in bear usage of the site.

Table 6. Summary of Paint River observations, McNeil River State Game Sanctuary, Alaska, 2019.

2019 Date	Activity	Fish in system above ladder	Fish observed @ or below ladder	Bears Observed	Water Observations
17 – 21 June	CIAA site visit	-	0	7 @ Akjemguiga Cove	
17 – 19 July	CIAA site visit	-	2 CH in ladder	7/18. 2 @ Akjemguiga Cove 7/19. 1 @ Akjemguiga Cove	
2 July	ADF&G Aerial Survey	0	120 CH in bay		
18 July	ADF&G Aerial Survey	14 CH	120 CH in bay		
22 July	ADF&G Aerial Survey	22 CH	500 CH in bay		
12 August	ADF&G Aerial Survey	2 PS	3,000 CH in bay 2,000 PS in bay		
14 – 22 August	CIAA site visit	-	6 – 10 CH carcasses in ladder. 300+ PS below ladder	8/14. 3 @ Akjemguiga Cove, 8/18. 1 @ cabin trail & Paint R., 8/19. 1 upstream in Paint R., 8/21. 1 upstream in Paint R. 8/22. several @ Akjemguiga Cove fishing for PS,	Low water, no flow in ladder.
20 August	ADF&G Aerial Survey	0	4,000 CH in bay 1,000 PS in bay		
28 - 29 August	CIAA & ADF&G site visit	5 RT	1 juv. CO 5 juv. UNK 15 carcasses (CH?) in ladder.	8/28. 1 @ cabin trail	Low water no flow in ladder. CO released above ladder.
26 – 27 September	CIAA site visit				
19 October	CIAA site visit		0	None	Water level back up, no fish observed. No bears or sign observed.

CH=chum salmon, CO=coho salmon, PS=pink salmon, RT=rainbow trout, UNK=unknown species, juv.=juvenile

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 the Alaska Department of Natural Resources (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 non-Alaska resident. Camp-standby viewing permit holders are assessed a permit fee of \$112.00 for each Alaska 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 2019, ADF&G received 1,097 applications for McNeil River guided and standby bear-viewing permits. Applications were received from residents of 13 different countries and 54% of applicants were Alaska residents. Payments were received for 175 guided viewing access permits, 35 standby viewing access permits, and 10 special access viewing permits. There were 13 special access permits granted by the commissioner. Overall, 223 permits were issued and 200 permit holders (guided viewing, camp standby, and special access) visited the sanctuary (Table 7). Of the 223 people who purchased permits, 60% were residents and 40% were nonresidents. The 5-year annual visitation average (2015–2019) is 188. The average number of permits used each day (permittees that bear viewed) at the sanctuary in 2019 was 8.7 (out of a maximum of 10.0). There were 12 guided permit holder no shows, 7 standby permit holder no shows, and 4 special access permit holder no shows. The 200 participants in bear viewing during the 2019 season came from 5 countries, including Canada, Germany, Sweden, Switzerland and the United States. Of the 200 bear-viewing visitors to McNeil River, 58.5% were Alaska residents and 41.5% were nonresidents.

McNeil River SGS staff and ADF&G Commercial Fisheries Division staff hosted a post-season group of 8 Homer High School students and 3 teachers during 27–31 August. Educational activities included bear viewing and biology; fish biology and fisheries sampling methodologies; ocean plastics and beach cleanup; MRS GS natural history; and camp skills.

Visitor use days connected with the McNeil River bear-viewing program totaled 1,215 in 2019, which included all permitted bear-viewing visitors and administrative visitors. Permitted bear-viewing visitors spent a total of 1,097 visitor use days within the sanctuary during the viewing season (7 June and 25 August). On average there were 13.7 visitors at McNeil River camp on any day, higher than both the 5- and 10-year averages of 12.6 and 12.1, respectively. On average there were 8.7 bear viewers in the group, higher than the 5- and 10-year averages of 8.5 and 8.1, respectively. And bear viewers used 697 of a possible 800 actual bear-viewing use days. Permitted visitors spent an average of 5.5 days each in the sanctuary and participated in the bear-viewing group an average of 3.5 days each.

The 13 special access permits issued in 2019 included the following recipients: ADF&G staff, a film crew, an Alaskan writer, Montana-based bear researchers and Alaska Pacific University research professors.

During 2019, 6 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 MRS GS permit program generated \$108,360.00 in 2019, which is ultimately allocated to the state's Fish and Game Fund.

Table 7. Visitor use at McNeil River State Game Sanctuary and McNeil River State Game Refuge, Alaska, 1984–2019.

Year	No. of applicants	No. of bear-viewing visitors 6/7–8/25 ^a	Total bear viewing visitor use days 6/7-8/25 ^b	Total sanctuary visitor days 6/7–8/25 ^c	Season length
1984	992	159		574	5 Jun – 27 Aug
1985	832	216		816	10 Jun – 25 Aug
1986	806	255		967	9 Jun – 25 Aug
1987	1,757	252		1,054	9 Jun – 23 Aug
1988	1,094	304		1,328	1 Jun – 29 Aug
1989	1,306	264		1,183	22 May – 26 Aug
1990	1,481	299		1,435	8 Jun – 25 Aug
1991	1,818	249		1,415	1 Jun – 27 Aug
1992	1,672	245		1,210	1 Jun – 25 Aug
1993	2,150	225		1,128	7 Jun – 25 Aug
1994	1,766	228		1,086	7 Jun – 25 Aug
1995	1,486	212		1,074	7 Jun – 25 Aug
1996	1,502	219		1,158	7 Jun – 25 Aug
1997	1,474	228		1,197	7 Jun – 25 Aug
1998	1,159	219		1,096	7 Jun – 25 Aug
1999	1,223	208		1,122	7 Jun – 25 Aug
2000	1,322	198		1,051	7 Jun – 25 Aug
2001	1,329	186		1,012	7 Jun – 25 Aug
2002	1,434	175		930	7 Jun – 25 Aug
2003	1,314	188		995	7 Jun – 25 Aug
2004	860	201		1,034	7 Jun – 25 Aug
2005	960	195		983	7 Jun – 25 Aug
2006	783	183		970	7 Jun – 25 Aug
2007	1,156	157	781	832	7 Jun – 25 Aug
2008	932	167	863	913	7 Jun – 25 Aug
2009	725	181	948	1,266	7 Jun – 25 Aug
2010	714	176	932	1,100	7 Jun – 25 Aug
2011	751	195	1,017	1,089	7 Jun – 25 Aug
2012	719	180	969	1,041	7 Jun – 25 Aug
2013	934	156	842	890	7 Jun – 25 Aug
2014	1,075	171	882	923	7 Jun – 25 Aug
2015	983	178	916	946	7 Jun – 25 Aug
2016	819	175	895	929	7 Jun – 25 Aug
2017	972	199	1,080	1,092	7 Jun – 25 Aug
2018	862	187	1,032	1,044	7 Jun – 25 Aug
2019	1,097	200	1,097	1,097	7 Jun – 25 Aug

^a Sum of all guided, standby, and special access bear viewing permittees who visited McNeil River State Game Sanctuary.

^b Sum of days for all Guided, Standby, & Special Access Permittees (if viewed or not).

^c Sum of days for all visitors to sanctuary each day of viewing season including guided, standby, special access and nonviewing permittees (staff subs not included).

KAMISHAK RIVER

Lodges and air charter services conduct sport fishing and wildlife viewing trips in the Kamishak River drainages within MRS GS 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 2019, 5 commercial transporter permits were issued to commercial operators for the purposes of transporting clients to the Kamishak River area for sport fishing. These guide services spent 495 visitor use days in the sanctuary, which included 335 angler use days and 160 guide use days. 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 9 bears per day (range 0–17) during operations between 11 July and 26 September.

CHENIK LAKE-CREEK AREA

The mouth of Chenik Creek is another area within MRS GS 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 2019. He reported 7 guide use days and 10 visitor bear-viewing use days. Private groups were also known to have visited the Chenik area in 2019. From the incidental observations available, there were at least another 33 visitor use days from these private parties. In total there were 50 reported visitor use days at Chenik Creek.

BEAR-HUMAN CONFLICTS

As detailed above, there were 1,215 user days associated with ADF&G’s bear-viewing program at the McNeil River camp. An additional 545 user days were reported by area guides or the public using the Kamishak River and Chenik Creek areas of MRS GS and MRS GR. All 1,760 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 2019 season, there were no reported adverse interactions between bears and people in MRS GS or MRS GR.

LAND USE PERMITTING

A total of 9 ADF&G special areas permits, and 10 ADF&G commercial access permits were issued during 2019. 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 at the Paint River.

There were no mineral resource or development activities applied for, permitted, or reported to the department within MRS GS or MRS GR during 2019.

During 2019 ADF&G staff reviewed and commented on the U.S. Army Corps of Engineers (ACOE) Environmental Impact Statement for the Pebble LLC 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. The project has the potential for significant impacts to wildlife resources, management, and public uses within the MRS GR and MRS GS. ADF&G staff continue to work within the ACOE process to identify and attempt to 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 MRS GS and MRS GR.

MIKFIK CREEK VIDEO RESEARCH

A remote video escapement recorder was installed at the outlet of Mikfik Lake for the 22nd 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

In 2019, the video system at Mikfik Creek–Lake was installed on 29 May and shut down on 31 July. The system operated continuously (~24 hr/d) and successfully recorded images approximately 100% of the time that it was programmed to operate between 29 May and 31 July (1,520 hr). The 2019 sockeye salmon run into Mikfik Lake was characterized by 1 distinct pulse of escapement. More than 2,200 sockeye salmon (76% of the run) entered the lake over a 2-day period (6–7 June). Unlike some recent years, in 2019 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 2019. 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 digital video recorder facilitated efficient and convenient video review to estimate escapement. Upon review of the images collected at Mikfik Creek, 2,901 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 2,901 fish was used as the final escapement index in 2019. The video-based escapement goal for Mikfik Creek sockeye salmon is 3,400–11,000 fish (Otis et al. 2016b).

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 1,520 hours of recorded video between 29 May and 31 July, reviewers documented 33 instances where brown bears transited the field of view of the camera, an average of 0.52 bears per day of video operation ($n = 64$ d). All sightings were of individual bears. Other wildlife species observed included, moose, beaver, and various waterfowl.

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 2019, however, data are still being analyzed.

Sanctuary Administration and Management

STAFFING

Sanctuary Manager Tom Griffin completed his twentieth season at McNeil River, his tenth as manager. Beth Rosenberg completed her fourth season as Assistant Manager and Jason Rupp completed his first season as F&W Technician III. We were very fortunate to have Ed Weiss (Lands and Refuge Manager), and Larry Aumiller (30-year MRSGS Manager, retired) fill-in this year to assist with guiding and staff training. Staff arrived at the McNeil River camp on 23 May 2019 and pulled camp on 3 September 2019. In addition to the normal season duties, staff conducted a preseason week of trail work and a post-season week of education. Training for 2019 included annual ADF&G firearms safety training.

Volunteers

Volunteers Deb Ajango, Mike Beach, Pete Robinson, Mike Shields, Blaine Smith, John Tuckey and Sarah Woolley completed extensive work on the trail system and additional camp maintenance from 30 May through 6 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 preseason trail work. These included 1) maintenance and repair of the trail at the base of east bluff and setting of some small sections of geoblock in Mikfik sedge east 2) two days were spent widening and repairing the McNeil River trail in places where the trail had become entrenched with poor drainage. 3) the viewing pad at McNeil River falls was cleared of encroaching vegetation, graveled and rock steps reset. Plank and run boards were replaced near the McNeil River Falls viewing pad. Rock steps were set between the upper and lower McNeil Falls viewing pad.

Camp

Maintenance items around camp included trimming alders for better visibility, removal of invasive dandelions, weeding and graveling of several tent sites and sections of trail in camp, replacement of rotten decking on the viewing platform and picnic table planks, re-setting and caulking roofing screws, caulking fiberglass seams on cabin rooftops and thinning of successional vegetation in the sauna pond. Additional camp tasks completed by Larry Aumiller were as follows; rehab of trash cache including replacement of 3 legs on trash cache, rebuilt back wall and a new ladder; new log stools were installed on edge of camp; new sauna pond dock, wood box and porch; replaced many vertical 2x8-inch boards on cook cabin and back cabin; new stand for propane tanks; new towel rack in cook cabin; Timberflex coating on various cabins; and new bridge boards installed at trail head. A repaired Paloma water heater was installed in the back cabin. Two new outhouse holes were dug, and outhouses were moved to new locations. The batteries for the front and back cabin solar systems were replaced with 2 new 12-volt AGM batteries in each.

Acknowledgments

Thanks to Lands and Refuge Manager Ed Weiss and ADF&G (retired) Wildlife Biologist Larry Aumiller 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. Josh Brekken (ADF&G—DOH) provided special area permit information. Patti Harper (ADF&G—DWC) provided final editing and publishing of this report.

A special thanks to Ted Otis, Joe Lowboy, and Brent Fagan for their continued support of McNeil River staff, participation in MRS GS educational programs and their continued research within the MRS GS.

References Cited

- Gill, I. D, and J. M. Helfield. 2012. Alternative foraging strategies among bears fishing for salmon: A test of the dominance hypothesis. *Canadian Journal of Zoology* 90(6):766–775. doi:10.1139/z2012-045
- Otis, E. O., L. F. Fair, and J. W. Erickson. 2013. A review of escapement goals for salmon stocks in lower Cook Inlet, Alaska, 2013. Alaska Department of Fish and Game, Divisions of Sport Fish and Commercial Fisheries, Fishery Manuscript No. 13-08, Anchorage.
- Otis, E. O., G. Hollowell, and J. W. Erickson. 2016a. McNeil River chum salmon stock status and action plan, 2016. Alaska Department of Fish and Game, Divisions of Sport Fish and Commercial Fisheries, Special Publication No. 16-12, Anchorage.
- Otis, E. O., J. W. Erickson, C. Kerkvliet, and T. McKinley. 2016b. A review of escapement goals for salmon stocks in Lower Cook Inlet, Alaska, 2016. Alaska Department of Fish and Game, Divisions of Sport Fish and Commercial Fisheries, Fishery Manuscript Series No. 16-08, Anchorage.
- Otis, E. O., and N. J. Szarzi. 2007. A review of escapement goals for salmon stocks in Lower Cook Inlet, Alaska, 2007. Alaska Department of Fish and Game, Divisions of Sport Fish and Commercial Fisheries, Fishery Manuscript No. 07-04, Anchorage.
- Peirce, J. M., E. O. Otis, M. S. Wipfli, and E. H. Follmann. 2011. Radio telemetry to estimate stream life of adult chum salmon in McNeil River, Alaska. *North American Journal of Fisheries Management* 31:315–322.
- Peirce, J. M., E. O. Otis, M. S. Wipfli, and E. H. Follmann. 2013. Interactions between brown bears and chum salmon at McNeil River, Alaska. *Ursus* 24(1):42–53.
- Quimby, A., and N. Dudiak. 1987. Paint River Fish Pass Feasibility Studies 1978–1983. Alaska Department of Fish and Game, Division of Fisheries Rehabilitation, Enhancement and Development, No. 72, Juneau.



Appendix

Daily wildlife observations during 2019, McNeil River State Game Sanctuary, Alaska.

Date	Location zone ^a	Comments
5/24/2019	CMP	Observed 2 glaucous-winged gulls.
5/24/2019	CMP	Observed 40 brant.
5/24/2019	CMP	Observed 15 northern shovelers.
5/24/2019	CMP	Observed 2 savannah sparrows.
5/24/2019	CMP	Observed 2 golden-crowned sparrows.
5/24/2019	CMP	Observed 2 American robins.
5/24/2019	LAG	Observed 3 harbor seals.
5/24/2019	CMP	Observed 2 tree swallows.
5/24/2019	CMP	Observed 1 fox sparrow.
5/24/2019	CMP	Observed 1 Alaska violet, 1st bloom.
5/25/2019	LAG	Observed 60 brant.
5/25/2019	LAG	Observed 2 green-winged teal.
5/25/2019	LAG	Observed 20 red-breasted mergansers (males and females).
5/25/2019	MCU	Observed 4 bald eagles.
5/25/2019	MCU	Observed 1 black-billed magpie.
5/25/2019	SPT	Observed 1 bald eagles flying over spit.
5/25/2019	CMP	Observed 1 nootka lupine, 1st bloom.
5/25/2019	MCU	Observed moose sign, scat along the trail, more than 20 willows scraped, some scraped 8-9 ft. high.
5/27/2019	CMP	Observed many dandelions all thru camp.
5/27/2019	BCB	Observed 1 rough-legged hawk.
5/27/2019	CMP	Observed 1 nagoon berry, 1st bloom.
5/27/2019	CMP	Observed 1 umbrella bittercress, first bloom.
5/27/2019	LAG	Observed 1 unidentified tern flying over lagoon (arctic tern or Aleutian tern).
5/27/2019	CMP	Observed 1 nootka lupine in bloom.
5/28/2019	LAG	Observed 50 brant in the lagoon and floating in the cove as well.
5/29/2019	LAG	Observed 50 brant in the lagoon and floating in the cove as well.
5/30/2019	LAG	Observed 50 brant in the lagoon and floating in the cove as well.
5/31/2019	LAG	Observed 50 brant in the lagoon and floating in the cove as well.
5/31/2019	CMP	Observed 1 Wilson's snipe was heard, not observed.
5/31/2019	MSW	Observed 1 potentilla villosa, 1st bloom on conglomerate rock walls.
5/31/2019	MSE	Observed 1 tall Jacob's ladder, 1st bloom.
5/31/2019	MSE	Observed 1 salmon berry, 1st bloom.
5/31/2019	LAG	Observed 2 unidentified swans in view at the edge of the lagoon and the Mikfik tidal area.
5/31/2019	CMP	Observed 1 wild geranium, 1st bloom.
6/1/2019	CMP	Observed 1 Wilson's snipe.
6/1/2019	CMP	Observed 1 chocolate lily, 1st bloom.

Date	Location zone ^a	Comments
6/1/2019	TDF	Observed 4 bald eagle, sitting in the shallow channel of water on the outside cove.
6/2/2019	CMP	Observed 2 American robins.
6/2/2019	MCR	Observed 2 sockeye salmon (red salmon) jumping, bear got fish from eagle along the outside channel.
6/2/2019	CMP	Observed 1 masked shrew (deceased) by wood pile.
6/2/2019	CMP	Observed 1 red fox, 1st sighting this a.m., then again in the evening on trails around camp, looks bushy, still has coat.
6/3/2019	CMP	Observed 0 4 eggs in an American robins' nest in bushes behind 1st tent site, nest only about 1.5 feet off the ground.
6/3/2019	LAG	Observed 2 bald eagle activity flying over the lagoon, outside cove and Mikfik creek.
6/4/2019	MCR	Observed 1 sockeye salmon (red salmon), 1st observed catch by a bear 2019.
6/4/2019	MCR	Observed 2 common ravens.
6/4/2019	LAG	Observed 6 bald eagles flying over lagoon and mudflats, circling over upper Mikfik creek.
6/4/2019	LAG	Observed 4 northern pintails in the lagoon.
6/4/2019	UMR	Observed 1 purple oxytrope, 1st bloom observed.
6/4/2019	UMR	Observed 1 arctic willow, 1st bloom observed.
6/4/2019	UMR	Observed 1 alpine azalea, 1st bloom observed.
6/4/2019	UMR	Observed 1 dwarf dogwood, 1st bloom observed.
6/4/2019	UMR	Observed 1 beach pea, 1st bloom observed.
6/4/2019	UMR	Observed 1 beach cinquefoil, 1st bloom observed.
6/5/2019	LAG	Observed 3 semipalmated plovers.
6/5/2019	LAG	Observed 1 northern pintail in the lagoon.
6/6/2019	LAG	Observed 4 northern pintails in the lagoon.
6/6/2019	CMP	Observed 1 hermit thrush in the camp alders.
6/6/2019	UMR	Observed 1 starflower, 1st bloom observed.
6/6/2019	UMR	Observed 1 large leaf avens, 1st bloom observed.
6/6/2019	UMR	Observed 1 chocolate lily, blooming.
6/6/2019	TDF	Observed 1 gray wolf, 1st observation at 20:30 fishing in outside cove, looped around down the spit, then out across the lagoon.
6/7/2019	CMP	Observed 1 hermit thrush in view and heard in camp.
6/7/2019	TDF	Observed 3 scaup (greater or lesser unknown) in front of camp.
6/8/2019	TDF	Observed 3 Caspian terns observed outside water in the cove.
6/8/2019	CMP	Observed 1 wild iris, 1st bloom observed on camp water trail.
6/8/2019	LAG	Observed 1 Wilson's snipe heard in the lagoon, observed over Mikfik/lagoon.
6/8/2019	UMR	Observed 1 greater yellowlegs, 1st observation.
6/8/2019	UMR	Observed 1 savannah sparrow.
6/9/2019	MSE	Observed 1 Wilson's warbler, visible on the Mikfik east wall trail, singing (black cap).

Date	Location zone ^a	Comments
6/9/2019	MCR	Observed 3 greater yellowlegs, feeding in the mud along the edge of Mikfik creek near ODP.
6/9/2019	MCR	Observed 1 glaucous-winged gull, flying over Mikfik Creek riffles.
6/9/2019	MSE	Observed 1 Wilson's snipe, observed and calling in MSE.
6/9/2019	MSE	Observed 1 savannah sparrow, observed in MSE, many heard throughout the day.
6/9/2019	MSE	Observed 1 golden-crowned sparrow.
6/10/2019	TDF	Observed 1 red-throated loon, Declan Troy heard calls on the cove side.
6/10/2019	CMP	Observed 1 hermit thrush.
6/10/2019	CMP	Observed 1 yellow warbler.
6/10/2019	CMP	Observed 1 Wilson's warbler.
6/10/2019	CMP	Observed 1 orange-crowned warbler.
6/10/2019	CMP	Observed 1 common redpoll.
6/10/2019	CMP	Observed 2 American robins.
6/10/2019	CMP	Observed 1 golden-crowned sparrow.
6/10/2019	CMP	Observed 1 savannah sparrow.
6/10/2019	CMP	Observed 1 northern harrier.
6/10/2019	CMP	Observed 1 wood frog.
6/10/2019	MCT	Observed 1 northern shoveler.
6/10/2019	MCT	Observed 4 green-winged teal.
6/10/2019	MCT	Observed 2 greater yellowlegs.
6/11/2019	CMP	Observed 1 wild iris, blooming in camp.
6/12/2019	MCR	Observed 1 mew gull, with glaucous-winged gulls in the riffles.
6/12/2019	CMP	Observed 1 gray-cheeked thrush, singing in camp.
6/12/2019	CMP	Observed 3 yellow warbler, singing in camp on morning bird walk.
6/12/2019	MCR	Observed 1 herring gull, with glaucous-winged gulls in the Mikfik riffles.
6/12/2019	CMP	Observed 2 Wilson's warbler, singing in camp, observed during morning bird walk.
6/12/2019	CMP	Observed 2 orange-crowned warbler, singing in camp, observed during morning bird walk.
6/13/2019	MCR	Observed 19 bald eagles in view from MCR at 11:45 am (adult and juvenile).
6/13/2019	CMP	Observed 1 rough-legged hawk, soaring very high about the lagoon.
6/13/2019	UMR	Observed 1 black oystercatcher observed toward McNeil head.
6/13/2019	MCR	Observed 1 greater yellowlegs observed in both the MCR and MCT.
6/13/2019	MCR	Observed 2 mew gulls observed in both the MCR and the MCT.
6/13/2019	MCR	Observed 1 lincoln's sparrow, 1st observation.
6/13/2019	MCR	Observed 450 sockeye salmon (red salmon), many fish finning in the MCR deep pool, heading into high tide.
6/15/2019	MCL	Observed 10 mew gulls observed in both the mcl and the MCR.

Date	Location zone ^a	Comments
6/15/2019	MCL	Observed 10 glaucous-winged gulls observed in both the mcl and the MCR.
6/15/2019	MCL	Observed 10 bald eagles.
6/15/2019	LAG	Observed 1 yellow warbler.
6/15/2019	LAG	Observed 1 savannah sparrow.
6/15/2019	MCR	Observed 1 golden-crowned sparrow.
6/17/2019	DUN	Observed 1 Meadow Jumping Mouse. Deceased, with an engorged tick on it
6/17/2019	DUN	Observed 1 Tick, type unknown. Found on a deceased meadow jumping mouse, tick was engorged
6/17/2019	LAG	Observed 1 Wood Frog. Found in puddle near group of alders before wall trail.
6/18/2019	LAG	Observed mixed flock - Pintail, Widgeon, Green-winged teal, Shoveler.
6/18/2019	LAG	Observed mixed flock - Pintail, Widgeon, Green-winged teal, Shoveler.
6/18/2019	LAG	Observed mixed flock - Pintail, Widgeon, Green-winged teal, Shoveler.
6/18/2019	LAG	Observed mixed flock - Pintail, Widgeon, Green-winged teal, Shoveler.
6/18/2019	MCR	Observed 12 bald eagles at 19:00 at Mikfik.
6/19/2019	LAG	Observed 13 American wigeon, males and females.
6/19/2019	LAG	Observed 57 glaucous-winged gulls.
6/19/2019	MCT	Observed 1 sockeye salmon (red salmon).
6/19/2019	LAG	Observed 1 common raven.
6/19/2019	LAG	Observed 15 green-winged teal.
6/20/2019	MCT	Observed 15 green-winged teal at the "s" turn of Mikfik creek down stream of riffles.
6/20/2019	MCT	Observed 2 greater yellowlegs at the "s" turn of Mikfik creek down stream of riffles.
6/21/2019	MSE	Observed 1 Wilson's snipe, winnowing.
6/21/2019	MCR	Observed 2 green-winged teal, observed an adult female and a male.
6/21/2019	MCR	Observed 1 greater yellowlegs wading around bears.
6/21/2019	MCR	Observed 1 golden-crowned sparrow, calling.
6/21/2019	MCR	Observed 4 common merganser, 1 male and 3 females flew overhead.
6/21/2019	LAG	Observed many bumblebee, yellow and black with orange on the back.
6/22/2019	CMP	Observed 10 green-winged teal, mother duck with 9 ducklings in sauna pond.
6/22/2019	CMP	Observed 1 red fox. First heard under back cabin at 0430, then throughout camp rest of morning.

Date	Location zone ^a	Comments
6/24/2019	LAG	Observed 1 gray wolf, male (from pictures) crossing lagoon sedges toward Mikfik.
6/25/2019	MCR	Observed many sockeye salmon (red salmon) made a run at 14:15.
6/25/2019	MCR	Observed 16 bald eagles at the riffles.
6/28/2019	LAG	Observed 7 double-crested cormorant.
6/28/2019	MRF	Observed 1 northern harrier.
6/28/2019	CMP	Observed 1 red fox, muddy went through camp, no sign of den use in camp or near outhouses.
6/30/2019	CMP	Observed 1 common fireweed, first bloom observed around camp and McNeil trail.
6/30/2019	MRF	Observed 10 bald eagles.
6/30/2019	MRF	Observed 1 common raven.
6/30/2019	MCR	Observed 1 American dipper.
6/30/2019	MRF	Observed 6 unknown mergansers below the lower falls.
6/30/2019	MRF	Observed 35 glaucous-winged gulls at 16:50.
7/2/2019	MRF	Observed 2 common raven.
7/2/2019	MRF	Observed 10 bald eagles.
7/2/2019	MRF	Observed many chum salmon (dog salmon).
7/2/2019	MRF	Observed 25 glaucous-winged gulls.
7/3/2019	LAG	Observed 8 brant in the lagoon.
7/4/2019	NBL	Observed 3 gray wolves observed together on the north bluff at 9:15 am.
7/4/2019	CMP	Observed 1 northern shrike.
7/4/2019	CMP	Observed many common redpolls.
7/4/2019	CMP	Observed 6 bank swallows.
7/5/2019	MRF	Observed 9 glaucous-winged gulls (juvenile and adult).
7/5/2019	MRF	Observed 9 bald eagles (juvenile and adult).
7/6/2019	LAG	Observed 14 double-crested cormorants.
7/7/2019	CMP	Observed many common redpolls.
7/7/2019	LAG	Observed 7 double-crested cormorants, flying.
7/7/2019	CMP	Observed 8 bank swallows, flying.
7/7/2019	MRF	Observed 1 dolly varden (arctic char), jumping in near falls.
7/7/2019	MRF	Observed 30 glaucous-winged gulls.
7/7/2019	MRF	Observed 5 mew gulls.
7/7/2019	LAG	Observed 200 black scoters.
7/7/2019	CMP	Observed 12 dragonflies.
7/8/2019	MRT	Observed 2 Sitka burnet.
7/8/2019	MSE	Observed many beach rye grass.
7/8/2019	TDF	Observed 42 white-winged scoters in flight over the tidal flats.
7/9/2019	CMP	Observed 1 short-eared owl, observed by Tony Newlin late night.
7/9/2019	CMP	Observed 2 pine grosbeak, male and female pair seen in camp near cook cabin
7/10/2019	MRF	Observed 1 Wilson's snipe.
7/10/2019	MRF	Observed 6 common mergansers below the lower falls.

Date	Location zone ^a	Comments
7/12/2019	MRF	Observed 8 common mergansers below the lower falls, 6 females and 2 males.
7/12/2019	LAG	Observed 1 northern harrier.
7/13/2019	MRL	Observed 1 gray wolf at the mouth of McNeil river at 6:30 am.
7/13/2019	UMR	Observed 20 double-crested cormorants down the coast about 0.75 miles.
7/13/2019	UMR	Observed 6 pigeon guillemot.
7/13/2019	LAG	Observed 1 northern harrier.
7/15/2019	BCB	Observed 1 short-eared owl, flying at 21:30 behind camp.
7/15/2019	MRF	Observed 1 Wilson's snipe.
7/16/2019	UMR	1 caribou observed at Chenik Lake by Dave Bachrach.
7/23/2019	CMP	Observed 1 gray wolf observed on NBL, heard two howling back and forth in the morning.
7/23/2019	UMR	Observed 6 American pipets, flying, perched along beach and conglomerate wall, observed on beach walk to McNeil head.
7/23/2019	UMR	Observed 2 gray-crowned rosy-finch observed along beach, conglomerate wall near McNeil head.
7/23/2019	CMP	Observed 12 common redpoll observed flying around the camp area.
7/23/2019	UMR	Observed 100 double-crested cormorants observed in nesting colony about 0.75 miles down the beach from camp toward McNeil head.
7/23/2019	UMR	Observed 25 glaucous-winged gulls nesting below the cormorant colony about 0.75 miles down the beach toward McNeil head.
7/23/2019	UMR	Observed 2 pigeon guillemot observed flying just offshore.
7/23/2019	UMR	Observed 1 peregrine falcon flying close to the dcco/gwgu colony 0.75 miles down the beach from camp.
7/23/2019	UMR	Observed 4 bald eagles (male, female and 2 eaglets) nesting on conglomerate islet off McNeil head about 2.5 miles from camp.
7/24/2019	TDF	Observed 2 black oystercatcher observed on the tidal flats at low tide.
7/24/2019	TDF	Observed 25 unidentified sandpipers, possibly western or least.
7/24/2019	UMR	Observed 15 unidentified mergansers possibly red-breasted or common.
7/24/2019	LAG	Observed 2 greater yellowlegs observed in the lagoon/wall.
7/24/2019	MRL	Observed 1 greater yellowlegs observed in the slough at lower.
7/25/2019	MRF	Observed 13 common mergansers.
7/25/2019	MRF	Observed 2 common ravens.
7/25/2019	MRF	Observed 2 bald eagles.
7/25/2019	LAG	Observed 11 semipalmated plovers.
7/26/2019	LAG	Observed 1 short-eared owl.
7/26/2019	LAG	Observed 1 northern harrier.
7/29/2019	MRL	Observed 10 common mergansers.
7/29/2019	MRL	Observed 1 pink (humpback) salmon caught at MRL.

Date	Location zone ^a	Comments
7/29/2019	MRL	Observed 4 greater yellowlegs in the back slough near enders.
7/29/2019	CMP	Observed 1 arctic ground squirrel, observed running underneath cook shack, then observed near back cabin.
7/30/2019	MRL	Observed 9 common mergansers.
7/30/2019	MRL	Observed 1 northern shoveler.
7/30/2019	MRL	Observed 7 double-crested cormorants.
7/30/2019	SPT	Observed 40 semipalmated plovers.
7/30/2019	MRL	Observed 3 greater yellowlegs.
7/30/2019	LAG	Observed 6 spotted sandpipers.
7/30/2019	TDF	Observed 30 least sandpiper
7/30/2019	LAG	Observed 50 glaucous-winged gulls.
7/30/2019	LAG	Observed 25 mew gulls.
7/31/2019	MRL	Observed 2 harbor seals opposite ender's island at high tide.
7/31/2019	TDF	Observed 1 whimbrel on the tidal flats in the a.m. (got pictures).
7/31/2019	MRL	Observed 2 common mergansers observed in the MRL and the lag.
7/31/2019	MRL	Observed 4 harlequin ducks.
7/31/2019	LAG	Observed 2 gray wolves observed together by the trailhead in the lagoon.
7/31/2019	CMP	Observed 3 hawk moth in green caterpillar stage, seen crawling on trail in camp
7/31/2019	CMP	Observed 1 carrion beetle, Found on path near back cabin.
8/3/2019	UMR	Observed 1 rough-legged hawk, observed between the cormorant colony and McNeil head.
8/3/2019	MRL	Observed 1 belted kingfisher.
8/3/2019	MRL	Observed 4 greater yellowlegs.
8/3/2019	MRF	Observed 2 mallards.
8/3/2019	MRF	Observed 18 common mergansers.
8/4/2019	MRF	Observed 3 pink (humpback) salmon caught.
8/4/2019	MRF	Observed 1 coho (silver) salmon caught.
8/4/2019	SPT	Observed 1 spotted sandpiper at the end of the spit.
8/4/2019	LAG	Observed 1 red-throated loon.
8/4/2019	SPT	Observed 5 semipalmated plovers.
8/7/2019	MRL	Observed 5 greater yellowlegs in the back slough.
8/7/2019	MRL	Observed 4 mallards.
8/8/2019	MSE	Observed 6 arctic daisies.
8/10/2019	MRL	Observed 10 mallards.
8/10/2019	MRL	Observed 5 greater yellowlegs in the back slough.
8/11/2019	UMR	Observed 1 short-eared owl.
8/11/2019	LAG	Observed 1 osprey observed and photographed by Ruth Wood/John Strassenburgh, confirmed by John Pearce USGS.
8/11/2019	UMR	Observed 1 wandering tattler observed on the beach near creek prior to McNeil head.
8/11/2019	UMR	Observed 1 peregrine falcon flying just beyond the dcco/gwgu colony 0.75 miles down the beach from camp.

Date	Location zone ^a	Comments
8/11/2019	UMR	Observed 100 double-crested cormorants observed in nesting colony about 0.75 miles down the beach from camp toward McNeil head.
8/11/2019	UMR	Observed 25 glaucous-winged gulls observed just below the cormorant colony.
8/12/2019	MSE	Observed 1 short-eared owl observed in MSE along the east bluff at 10:30 am.
8/12/2019	BCB	Observed 2 short-eared owl observed in flight and vocalizing at 22:30 in BCB/MSE.
8/12/2019	MSE	Observed 1 northern harrier observed in MSE and east wall in the am.
8/13/2019	CMP	Observed 1 short-tailed weasel observed in camp by the mushroom stools at 8:00 am.
8/13/2019	MSE	Observed 1 Wilson's snipe, flushed.
8/13/2019	TDF	Observed 2 double-crested cormorants, flying.
8/13/2019	WBL	Observed 3 common raven flying in a group.
8/16/2019	CMP	Observed 1 short-eared owl observed in the p.m.
8/17/2019	CMP	Observed 1 short-eared owl.
8/17/2019	TDF	Observed hundreds moon jelly fish, many small clear, round jelly fish observed all throughout the tidal flats and the lower tide-line of the beach.
8/17/2019	LAG	Observed 5 greater yellowlegs observed near the lagoon wall.
8/17/2019	LAG	Observed 8 common mergansers.
8/18/2019	LAG	Observed 2 unidentified swans.
8/18/2019	MSE	Observed 2 short-eared owl flying over MSE at 11:00 a.m.
8/18/2019	LAG	Observed 1 merlin, flying.
8/18/2019	MRL	Observed 3 greater yellowlegs, flying.
8/18/2019	BCB	Observed 1 northern harrier flying.
8/18/2019	CMP	Observed 1 northern shrike flying over sauna pond.
8/18/2019	MRL	Observed 5 mallards.
8/19/2019	MRL	Observed 15 green-winged teal.
8/19/2019	MRL	Observed 1 merlin going for a dragon fly.
8/19/2019	MRL	Observed 1 northern harrier in the back slough of the lower river.
8/19/2019	MRL	Observed 3 greater yellowlegs.
8/20/2019	MSE	Observed 3 short-eared owls flying around MSE in the morning.
8/20/2019	LAG	Observed 12 mallards.
8/20/2019	MRF	Observed 4 green-winged teal, swimming in river.
8/20/2019	MRL	Observed 4 greater yellowlegs.
8/22/2019	MRL	Observed 40 unidentified mergansers flocking up in MRL. Observed 20 common ravens by the sport fish sign at the mouth of river in a group.
8/22/2019	MRL	
8/23/2019	SPT	Observed 3 peregrine falcons on the spit.
8/24/2019	MRL	Observed 40 unidentified mergansers flocking up in MRL.

Date	Location zone ^a	Comments
8/24/2019	CMP	Observed 3 short-eared owls flying around cabins and the camp area late in the evening.
8/25/2019	MRT	Observed 1 northern harrier.
8/25/2019	LAG	Observed many yellow monkey flowers near the trailhead.
8/25/2019	LAG	Observed 1 American pipit on conglomerate near the trailhead.

^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; UMR = McNeil River Refuge General; UMS = McNeil River Sanctuary General.

