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McNeil River State Game Refuge and State Game Sanctuary Management Plan

by

Janet Hall Schempf

and

Joe Meehan

May 2008

Alaska Department of Fish and Game **Divisions of Sport Fish and Wildlife Conservation**

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

fork length	FL
mideye-to-fork	MEF
mideye-to-tail-fork	METF
standard length	SL
total length	TL

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

SPECIAL PUBLICATION NO. 08-01

MCNEIL RIVER STATE GAME REFUGE AND STATE GAME SANCTUARY MANAGEMENT PLAN

Alaska Department of Fish and Game
Division of Sport Fish, Region V
333 Raspberry Road, Anchorage, Alaska, 99518-1599

May 2008

The Division of Sport Fish Special Publications series was established in 1991 for the publication of techniques and procedures manuals, informational pamphlets, special subject reports to decision-making bodies, symposia and workshop proceedings, application software documentation, in-house lectures, and other documents that do not fit in another publication series of the Division of Sport Fish. Since 2004, the Division of Commercial Fisheries has also used the same Special Publication series. Special Publications are intended for fishery and other technical professionals. Special Publications are available through the Alaska State Library and on the Internet: http://www.sf.adfg.state.ak.us/statewide/divreports/html/intersearch.cfm. This publication has undergone editorial and peer review. The Division of Sport Fish Special Area Management Plans are management plans used by the Department and other entities for management of legislatively designated refuges, critical habitat areas, and sanctuaries. The goals and policies of management plans are adopted by regulation.

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Planning team members who participated in development of the plan are Ray Burger, Alaska Department of Natural Resources (ADNR); Kent Patrick-Riley, Alaska Department of Environmental Conservation (ADEC); John Czarnezki, Kenai Peninsula Borough; and ADF&G representatives Tracy Lingnau (Division of Commercial Fisheries), and Tom Vania and Mark Fink (Division of Sport Fish).

Others who participated in planning team meetings and development of the document are Judy Alderson (National Park Service), John Hechtel (ADF&G, Division of Wildlife Conservation), and Ron Somerville (Alaska Board of Game).

Tom Brookover (ADF&G, Division of Sport Fish) provided policy direction to the planning team. Lance Nelson and Kevin Messing (Department of Law), Kerri Tonkin (ADF&G, Division of Commercial Fisheries), and Al Cain (ADF&G, Division of Sport Fish) provided technical and practical advice about implementing regulations for special area management plans. Frances Inoue and Jason Graham (ADF&G, Division of Sport Fish) provided cartographic support and Joanne MacClellan, Dean Hughes, and Nita Meierhoff (ADF&G, Division of Sport Fish) assisted document preparation. McNeil River State Game Sanctuary staff and volunteers, including Tom Griffin, Polly Hessing, Doug Hill, Josh Peirce, and Kellie Peirce, provided orientation for planning team members. Terry Thompson (ADF&G Division of Sport Fish) and the Alaska Islands and Oceans Visitors Center provided meeting space and logistical support for meetings held in Homer.

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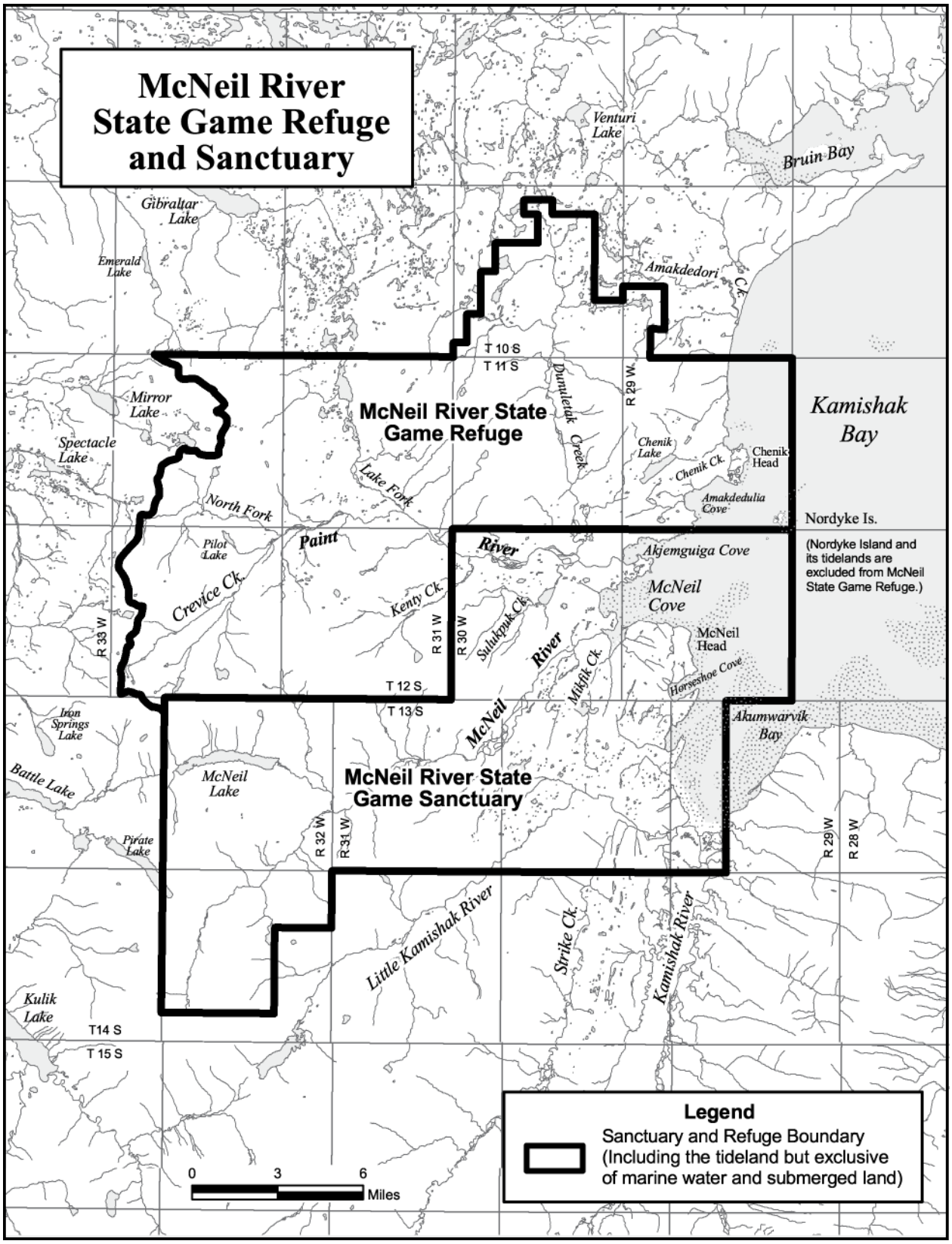

Figure 1.–Map of McNeil River State Game Refuge and State Game Sanctuary.

INTRODUCTION

The McNeil River State Game Sanctuary (sanctuary) was first established by the Alaska legislature in 1967. In 1991, the legislature expanded the sanctuary and established the McNeil River State Game Refuge (refuge). Both the sanctuary and refuge were established for these purposes:

1. The permanent protection of brown bear and other fish and wildlife populations and their habitats for scientific, aesthetic, and educational purposes;

2. To manage human use and activities in a way that is compatible with that purpose and to maintain and enhance unique bear viewing opportunities in the sanctuary;

3. To provide compatible opportunities for wildlife viewing, fisheries enhancement, fishing, temporary safe anchorage and other activities in both the sanctuary and refuge, and, in the refuge, for hunting and trapping opportunities if compatible with sanctuary management objectives.

ADF&G adopted the *McNeil River State Game Refuge and State Game Sanctuary Management Plan* (plan) for the refuge and sanctuary in 1996. In the course of implementation, department staff found four of the plan's policies (ACCESS, RECREATIONAL ACTIVITIES MENTIONED IN STATUTE, NON-COMMERCIAL CAMPING, AND COMMERCIAL FACILITIES/STRUCTURES) difficult to interpret and apply to permitting situations. In the fall of 2005, the Department decided to revise the plan so these specific policies could be clarified.

The Department began the revision process in April 2006. Public meetings were held in Anchorage and Homer to identify issues to address during the planning process, and additional comments were submitted to the department by electronic mail. As part of the revision, ADF&G staff updated the 1996 resource inventory of fish and wildlife and their habitats, public access, land use, and land ownership. A planning team, composed of state, federal, and local agency representatives with responsibilities on refuge and sanctuary lands, developed the revised management plan policies based on the issues identified at the public meetings; identified refuge and sanctuary resource values; the purposes for which the areas were established; the products of earlier planning efforts for the areas; and additional guidance provided in law.

The draft revised plan was distributed for public review. Based on comments received during the review period, appropriate changes were made and the Commissioner of Fish and Game adopted the plan for use by the department in managing the refuge and sanctuary.

The adopted plan will be implemented by ADF&G in several ways. A Special Area Permit is required for any habitat altering activity, including any construction work, in a designated state game refuge or game sanctuary (5 AAC 95). The Department will use the plan in administering the Special Area Permit program to ensure that all proposed activities are consistent with the goals and policies outlined in the plan. Activities will be approved, conditioned, or denied based on the direction provided in the plan as well as other applicable state laws and regulations. As a result, activities including research programs, public use facilities, and other projects conducted within the McNeil River State Game Refuge and State Game Sanctuary will be consistent with the goals and polices presented in this plan. The plan will be reviewed every five years, and if appropriate, updated as funding permits.

The Department anticipates that other state, federal, and local agencies having management responsibilities within the refuge and sanctuary will consult the plan when making their own planning and permitting decisions. For example, any use, lease, or disposal of resources on state land in the refuge and sanctuary requires authorization from Alaska Department of Natural Resources (ADNR). Activities affecting air or water quality require authorization from Alaska Department of Environmental Conservation (ADEC). The U.S. Army Corps of Engineers (COE) evaluates applications for discharging dredged and fill material in waters of the United States, including wetlands. Federal and state resource agencies, including the U.S. Fish and Wildlife Service, National Marine Fisheries Service, and Environmental Protection Agency, along with local governments, review proposals for COE permits, pursuant to the Fish and Wildlife Coordination Act (16 USC 661-666 et. seq.). U.S. Coast Guard approval is required for certain kinds of work in navigable waters. The Kenai Peninsula Borough reviews and comments on proposed projects within the Alaska coastal zone, including the portion of the McNeil River State Game Refuge and Sanctuary that lies within the area of coastal consistency applicability. Review of activities requiring more than one type of authorization will be coordinated through the Office of Project Management and Permitting (ADNR) for a finding of consistency with the Alaska Coastal Management Program.

STATUTES

Alaska statutes that specifically pertain to the establishment and management of the McNeil River State Game Refuge and Sanctuary are codified at AS 16.20.

The refuge statute first became law in 1991 (§ 2 ch 56 SLA 1991), and was amended in 1995 and 1999 (am § 21 ch 21 SLA 1995; am § 2 ch 59 SLA 1999).

The sanctuary statutes were first adopted in 1967 (§ 2 ch 108 SLA 1967), and were amended in 1972, 1991, 1995, and 1999 (am § 15 ch 71 SLA 1972; am § 3 and 4 ch 56 SLA 1991; am § 22 ch 21 SLA 1995; am § 3 ch 59 SLA 1999).

MCNEIL RIVER STATE GAME REFUGE

AS 16.20.041. McNeil River State Game Refuge. (a) The following state-owned land and water, including the tideland but exclusive of marine water and submerged land, lying within the parcels described in this subsection is established as the McNeil River State Game Refuge:

Township 10 South, Range 29 West, Seward Meridian
- Section 19: S1/2
- Section 20: SW1/4
- Section 29: W1/2
- Sections 30 – 31

Township 10 South, Range 30 West, Seward Meridian
- Section 3: SW1/4
- Section 4: SE1/4
- Sections 10 - 11
- Sections 14 - 16
- Section 17: E1/2
- Sections 20 - 23
- Sections 25 - 29
- Section 30: SE1/4
- Section 31: NE1/4, S1/2
- Sections 32 – 36

Township 11 South, Range 29 West, Seward Meridian
- Sections 1 – 35
- Section 36, except Nordyke Island and its tideland

Township 11 South, Range 30 West, Seward Meridian
- Sections 1 – 36

Township 11 South, Range 31 West, Seward Meridian
- Sections 1 – 36

Township 11 South, Range 32 West, Seward Meridian
- Sections 1 – 36, except land within Katmai National Park and Preserve

Township 12 South, Range 31 West, Seward Meridian
- Sections 1 – 36

Township 12 South, Range 32 West, Seward Meridian
Sections 1 – 36, except land within Katmai National Park and Preserve

Township 13 South, Range 33 West, Seward Meridian
Section 1 - except land within Katmai National Park and Preserve.

(b) The McNeil River State Game Refuge is established to:

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

(2) manage human use and activities in a way that is compatible with (1) of this subsection and to maintain and enhance the unique bear viewing opportunities in the McNeil River State Game Sanctuary established under AS 16.20.160;

(3) provide opportunities that are compatible with (1) of this subsection for wildlife viewing, fisheries enhancement, fishing, hunting, and trapping, for temporary safe anchorage, and for other activities.

(c) The Board of Game shall determine whether hunting of brown bears within the McNeil River State Game Refuge should be prohibited.

(d) The use and enjoyment of valid rights and interests in mineral claims, including the right of access, within the McNeil River State Game Refuge is protected. This subsection does not affect the power of the commissioner of natural resources to open or close land within the McNeil River State Game Refuge to new mineral entry under AS 38.05.185 - 38.05.275.

(e) The department and the Department of Natural Resources

(1) may not enter into sales of land within the McNeil River State Game Refuge;

(2) may enter into leases within the McNeil River State Game Refuge if the commissioner finds that activity conducted under the lease is compatible with the purposes for which the refuge is established;

(3) may not accept transfer of state selected land from the federal government, or conveyance of other land, within the refuge if the land is subject to

(A) a lease, easement, or other right to operate or maintain a private facility on the land or to conduct a private enterprise on the land; or

(B) a continuing trespass by an unauthorized private facility or private enterprise.

(f) The commissioner shall prepare a report and notify the legislature of its availability by January 30 of each year on

(1) the status of the brown bears and other fish and wildlife resources within the McNeil River State Game Refuge; and

(2) the effect of hunting, fishing, and trapping, fishery enhancement activity, and mineral resource development on these resources.

MCNEIL RIVER STATE GAME SANCTUARY

Sec. 16.20.160. McNeil River State Game Sanctuary. The following state-owned land and water, including the tidelands but exclusive of marine water and submerged land, lying within the parcels described in this subsection is established as the McNeil River State Game sanctuary:

Township 12 South, Range 29 West, Seward Meridian
Sections 1 - 36

Township 12 South, Range 30 West, Seward Meridian
Sections 1 - 36

Township 13 South, Range 29 West, Seward Meridian
Sections 5 - 8
Sections 17 - 20
Sections 29 - 32

Township 13 South, Range 30 West, Seward Meridian
Sections 1 - 36

Township 13 South, Range 31 West, Seward Meridian
Sections 1 - 36

Township 13 South, Range 32 West, Seward Meridian
Sections 1 - 36

Township 14 South, Range 32 West, Seward Meridian
Sections 1 - 12
Sections 15 - 22
Sections 27 - 30.

Sec. 16.20.162. Purpose; regulations. (a) The McNeil River State Game Sanctuary is established to:

(1) provide permanent protection for brown bear and other fish and wildlife populations and their habitats, so that these resources may be preserved for scientific, aesthetic, and educational purposes;
(2) manage human use and activities in a way that is compatible with (1) of this subsection and to maintain and enhance the unique bear viewing opportunities within the sanctuary; and
(3) provide opportunities that are compatible with (1) of this subsection for wildlife viewing, fisheries enhancement, and fishing, for temporary safe anchorage, and for other activities.

(b) Hunting and trapping within the McNeil River State Game Sanctuary are prohibited.

(c) The department and the Department of Natural Resources

(1) may not enter into sales of land within the McNeil River State Game Sanctuary;
(2) may enter into leases within the McNeil River State Game Sanctuary if the commissioner finds that activity conducted under the lease is compatible with the purposes for which the sanctuary is established;

(3) may not accept transfer of state selected land from the federal government, or conveyance of other land, within the sanctuary if the land is subject to:

(A) a lease, easement, or other right to operate or maintain a private facility on the land or to conduct a private enterprise on the land; or

(B) a continuing trespass by an unauthorized private facility or private enterprise.

(d) The McNeil River State Game Sanctuary is closed to mineral entry under AS 38.05.185 - 38.05.275.

(e) The State of Alaska Boards of Fish and Game may adopt regulations governing access, entry, development, construction, fishing, and other uses and activities affecting the natural habitat, fish and wildlife, and public use of the McNeil River State Game Sanctuary.

(f) The commissioner shall prepare a report and notify the legislature of its availability by January 30 of each year on

(1) the status of the brown bears and other fish and wildlife resources within the McNeil River State Game Sanctuary; and

(2) the effects of fishing and fishery enhancement activity on these resources.

STATUTORY GOALS

STATUTORY GOALS: MCNEIL RIVER STATE GAME SANCTUARY

Activities within the **McNeil River State Game Sanctuary** will reflect the following goals in accordance with the purpose for which the area was established. All department management decisions in the McNeil River State Game Sanctuary, whether affecting activities undertaken by the Department, other agencies, or the public will be in accordance with these goals.

I. **Fish and Wildlife Populations and Their Habitat** - Manage the sanctuary to provide permanent protection for brown bear and other fish and wildlife populations and their habitats for the following purposes:

   A. Scientific.

   B. Aesthetic.

   C. Educational.

II. **Public Use** - Manage human activities in the sanctuary compatible with Goal I and with maintaining and enhancing the unique bear viewing opportunities in the sanctuary including:

   A. Provide opportunities for wildlife viewing.

   B. Provide opportunities for fisheries enhancement.

   C. Provide opportunities for fishing as allowed by the Board of Fisheries.

   D. Provide opportunities for temporary safe anchorage.

STATUTORY GOALS: MCNEIL RIVER STATE GAME REFUGE

Activities within the **McNeil River State Game Refuge** will reflect the following goals in accordance with the purpose for which the area was established. All department management decisions in the McNeil River State Game Refuge, whether affecting activities undertaken by the Department, other agencies, or the public will be in accordance with these goals.

I. **Fish and Wildlife Populations and Their Habitat** - Manage the refuge to provide permanent protection for brown bear and other fish and wildlife populations and their habitats for the following purposes:

   A. Scientific.

   B. Aesthetic.

   C. Educational.

II. **Public Use** - Manage human activities in the refuge compatible with Goal I and with maintaining and enhancing the unique bear viewing opportunities in the McNeil River State Game Sanctuary including:

   A. Provide opportunities for wildlife viewing.

   B. Provide opportunities for fisheries enhancement.

   C. Provide opportunities for fishing, hunting, and trapping where allowed by the Boards of Fisheries and Game.

   D. Provide opportunities for temporary safe anchorage.

POLICIES

COMPATIBILITY POLICY

Refuge and Sanctuary Policy: Uses and activities may be allowed in the sanctuary and refuge when the uses and activities are compatible with the purposes for which the refuge and sanctuary were established and the goals and policies of the management plan. Uses and activities will be restricted as necessary to 1) prevent disturbance to or displacement of bears and other fish and wildlife, 2) prevent erosion, trampling, and other impacts to habitats; and 3) maintain public access to refuge or sanctuary resources.

ACCESS

Refuge and Sanctuary Policy: Maintain public access for research and public use in the sanctuary and refuge. Except for helicopter landings, no permit is necessary for access to the refuge. Access to the sanctuary generally requires a Sanctuary Access Permit. Development of access sites, including airstrips, is not allowed in the sanctuary and refuge. Helicopter landings in the sanctuary and refuge require a Special Area Permit and may be authorized only for activities for which there is a demonstrable need and for which there is no feasible alternative.

OFF ROAD USE OF MOTORIZED VEHICLES

Refuge Policy: The off-road use of wheeled, tracked, or ground-effect motorized vehicles for recreational use will not be allowed, except the use of snowmachines in support of trapping activities may be authorized by Special Area Permit under conditions identified by the Department. These conditions will include: adequate snow and ground frost conditions exist to protect soils and vegetation from damage, and timing and location of the activity will not cause disturbance to wildlife, particularly denning bears.

The off-road use of wheeled, tracked, or ground-effect motorized vehicles for non-recreational activities will generally not be allowed. However, the Department may, in its discretion, issue a Special Area Permit allowing the off-road use of these vehicles for authorized non-recreational activities only when the use of these vehicles fulfills a demonstrable need for which there is no feasible alternative.

Sanctuary Policy: To ensure the protection of sensitive habitats and avoid harmful disturbance to fish and wildlife, do not allow the off-road use of wheeled, tracked, or ground-effect motorized vehicles in the sanctuary, except for management or research purposes only when the use of these vehicles fulfills a demonstrable need for which there is no feasible alternative.

INFORMATION/EDUCATION

Refuge and Sanctuary Policy: Provide information to refuge and sanctuary users regarding resource values and rules, especially information about avoiding impacts to natural brown bear behavior, and uses and activities occurring in the refuge and sanctuary.

SCIENTIFIC RESEARCH

Refuge and Sanctuary Policy: Encourage scientific research of fish, wildlife, habitats, and other resources when compatible with the Research Policy maintained by the Division of Wildlife Conservation.

RECREATIONAL ACTIVITIES MENTIONED IN STATUTE

Refuge Policy: Low intensity recreational activities, including wildlife viewing, hunting, trapping, and fishing, are allowed. Use levels may be managed through Special Area Permits if necessary to avoid adverse impacts to fish and wildlife populations and their habitats. For the purposes of this policy, "low-intensity" means "insignificant, inconsequential, or inconspicuous."

Sanctuary Policy: Low intensity recreational activities, including wildlife viewing and sport fishing, may be allowed in the sanctuary through Sanctuary Access Permits. Use levels on the Kamishak River may be managed through Sanctuary Access Permits and Special Area Permits if necessary to avoid adverse impacts to fish and wildlife populations and their habitats. For the purposes of this policy, "low-intensity" means "insignificant, inconsequential, or inconspicuous."

ARCHÆOLOGICAL AND HISTORICAL RESOURCES

Refuge and Sanctuary Policy: Protect archæological and historical resources located within the refuge and sanctuary. Where appropriate, allow legal investigation of archæological and historical resources through a Special Area Permit (in the refuge and sanctuary) and a Sanctuary Access Permit (in the sanctuary).

HABITAT AND POPULATION ENHANCEMENT

Refuge and Sanctuary Policy: As appropriate, allow enhancement of fish and wildlife populations and their habitats if it is compatible with statutory goals of the area, especially the permanent protection of brown bears and the unique brown bear viewing opportunities of the sanctuary, is not at the expense of refuge and sanctuary resource values (including diversity and abundance), and does not interfere with public use and enjoyment.

CAMPING

Refuge and Sanctuary Policy: Camping will be managed in the refuge and sanctuary to afford parties camping opportunities of up to 2 weeks in duration, with certain exceptions. Restrictions to camping may include provisions for location of camps and associated activities, types of structures, number of camp occupants, access points, period(s) of use, and number of authorized camps within a particular area.

Camping (commercial and non-commercial) in the refuge and sanctuary for more than 14 consecutive days at any one location, or relocating a camp within a two-mile radius of the original campsites, will generally not be allowed.

Camping (commercial and non-commercial) in the sanctuary will be allowed only under the terms, including designated locations, of a Sanctuary Access Permit.

Non-commercial camping will be allowed within the refuge and sanctuary for up to 14 days in a calendar year without a Special Area Permit. Non-commercial camping in the refuge and sanctuary for more than 14 days in a calendar year will require a Special Area Permit.

Commercial camping in the refuge and sanctuary may be allowed under terms of a Special Area Permit. In the Chenik area, only two commercial camps will be permitted at any one time and the

aggregate number of campers shall number twenty or fewer individuals at any one time. Commercial camping in the Chenik area will be restricted to 14 days per operator in a calendar year.

Special Area Permit applications for commercial camping in the Chenik Area will be accepted by the Department after November 1 for the following calendar year. Permits authorizing commercial camps will include a requirement to report activity.

For all camping in the refuge and sanctuary, solid waste disposal is not allowed; solid waste, including garbage, must be removed from the refuge and sanctuary. Human waste disposal must be done accordance with Department of Environmental Conservation requirements (18 AAC 60). Food and garbage must be isolated from bears by using bear-proof containers, electric fences, and/or enclosed food caches located at least 15 feet above ground, or within a hard sided building, or within a lockable and hard-sided section of a vehicle, vessel, or aircraft.

Camping Policy Definitions: For the purposes of implementing the refuge and sanctuary Camping policies, "Bear-proof container" means a securable container constructed of a solid non-pliable material capable of withstanding the stress and compacting forces of an adult grizzly bear. When secured and under stress, the container will not have any cracks, openings, or hinges that would allow a bear to gain entry by biting or pulling with its claws. Wood containers are not considered bear resistant unless the containers are reinforced with metal. Ice chests and/or coolers are not considered to be bear-proof containers. The "Chenik Area" means the area within 1 mile of Chenik Creek, Chenik Head, and the outlet of Chenik Lake.

STRUCTURES

Refuge and Sanctuary Policy: Permanent recreation related structures are prohibited, except as allowed under the SANCTUARY AND REFUGE MANAGEMENT FACILITIES policy.

Temporary structures, including tent platforms, elevated food caches, latrines, and other hardened structures may be allowed by Special Area Permit only when:

a) the allowance does not reduce bear viewing opportunities; and

b) the proposed use requires the structure, or impacts to fish and wildlife and their habitat would be lessened by allowing the temporary structure; and

c) the structure does not adversely impact the public's ability to access and use an area.

For any permitted structure, all materials must be removed from the refuge and sanctuary at the end of permitted operations. Off-season or over winter storage of materials will not be authorized.

"Temporary" means is used for the term of the permit or the authorized duration of activity or use.

BOAT STORAGE

Refuge and Sanctuary Policy: Small boat storage may be allowed by Special Area Permit. Storage will be authorized only for boats less than or equal to twenty feet in length. Storage of motors, fuel, fuel containers, and other accessories will generally not be allowed. The number of boats and storage locations may be limited.

OIL AND GAS

Refuge and Sanctuary Policy: To avoid damage to fish and wildlife habitats, disturbance to fish and wildlife populations (especially impacts to brown bears), and displacement of public use in a high quality environment, surface entry for oil and gas development and transportation, including supplies and equipment storage for offshore exploration or development, will not be allowed in the refuge or sanctuary. Exploration may be allowed under terms and conditions compatible with statutory goals, including appropriate restrictions.

MINING

Refuge and Sanctuary Policy: Mining of valid mineral claims may occur within the refuge under Special Area Permit. The sanctuary is closed to mineral entry under AS 38.05.185 - 38.05.275 in accordance with AS 16.20.162(d).

MATERIAL EXTRACTION

Refuge and Sanctuary Policy: Avoid material extraction within the refuge or sanctuary unless for purposes of maintenance, enhancement, restoration, or management of the refuge or sanctuary. Material extraction may be allowed for other authorized activities in the refuge where there is a public need and no feasible alternatives. Impacts of material extraction activities within the refuge or sanctuary will be fully mitigated including, if appropriate, rehabilitation and restoration.

HAZARDOUS SUBSTANCES AND PETROLEUM-BASED FUEL

Refuge and Sanctuary Policy: Hazardous substances (as defined by AS 46.09.900) and petroleum-based fuels may not be disposed in the refuge or sanctuary. Fuel storage is prohibited unless required to conduct an activity authorized by Special Area Permit, under conditions identified by the department. Authorized fuel storage will only be permitted for the period of operation during which the fuel is required to conduct the activity. Fuel authorized for storage must be contained in a structure that holds 110% of the combined volume of all fuel containers, and the containment structure or fuel containers must not be susceptible to damage by bears. This policy does not apply to fuel on board vessels, vehicles or aircraft; or for fuel actively used in a camp; or for fuel contained within authorized structures.

ROADS/TRAILS/DOCKS/PIPELINES/UTILITY LINES

Refuge and Sanctuary Policy: To prevent damage to fish and wildlife habitats and disturbance to fish and wildlife populations, especially brown bears that seasonally use the refuge or sanctuary, construction of new permanent roads in the refuge or sanctuary is not allowed. A temporary (life of the project) road may be allowed in the refuge if the road fulfills a public need for which there is no feasible alternative. Construction of new pipelines, utility lines, or docks is not allowed unless the facilities are a necessary component of an authorized project in the sanctuary or refuge. Impacts will be fully mitigated including, if appropriate, rehabilitation and restoration. New trails shall be constructed only where needed to protect habitats or as necessary to sustain public use. For the purposes of this policy, “temporary” means is used for the term of the permit or the authorized duration of activity or use.

SANCTUARY AND REFUGE MANAGEMENT ACTIVITIES

Refuge and Sanctuary Policy: To facilitate management of the refuge and sanctuary, including administration of the McNeil River brown bear viewing program, the construction, maintenance, and upgrade of cabins, campgrounds, associated facilities, and brown bear viewing areas may be permitted. Facilities should be sited and constructed consistent with the primitive character of the area.

GRAZING

Refuge and Sanctuary Policy: With the exception of incidental grazing of pack animals, the grazing of domestic or feral animals within the refuge or sanctuary is prohibited.

TIMBER HARVEST

Refuge and Sanctuary Policy: Timber harvest is prohibited in the refuge or sanctuary. Dead and down wood may be used for personal use within the refuge or sanctuary.

ECOSYSTEM INTEGRITY

Refuge and Sanctuary Policy: Allow only those uses and activities that will not compromise the integrity of the refuge and sanctuary ecosystem. Do not allow the introduction of exotic plant or animal species, whether wild or feral, unless for purposes described in the Habitat and Population Enhancement Policy.

REGULATIONS

Title 5. Fish and Game.

Chapter 95. Fish and Game Habitat.

Article 5. State Game Refuges.

5 AAC 95.540. McNeil River State Game Refuge and State Game Sanctuary Management Plan. The McNeil River State Game Refuge and State Game Sanctuary goals and policies stated in the McNeil River State Game Refuge and State Game Sanctuary Management Plan dated May 2008 are adopted by reference. The plan presents management goals and policies for the refuge and sanctuary and their resources that the department will use in determining whether proposed activities in the refuge and sanctuary are compatible with the protection of fish and wildlife, their habitats, and public use of the refuge and sanctuary. Under 5 AAC 95.420, a special area permit is required for certain activities occurring in a designated state game refuge or state game sanctuary. The department will review each special area permit application for consistency with the goals and policies of the management plan adopted by reference in this section. A special area permit for an activity in the McNeil River State Game Refuge or the McNeil River State Game Sanctuary will be approved, conditioned, or denied based on the criteria set out in the goals and policies stated in the McNeil River State Game Refuge and State Game Sanctuary Management Plan and on the standards contained elsewhere in this chapter. (Eff. 8/23/96, Register 139; am 6/29/2008, Register 186)

Authority:	AS 16.05.020	AS 16.20.041	AS 16.20.160
	AS 16.05.050	AS 16.20.050	AS 16.20.162
	AS 16.20.020	AS 16.20.060	

5 AAC 95.542. McNeil River State Game Refuge and McNeil River State Game Sanctuary. (a) The following conditions apply to activities in the McNeil River State Game Refuge (refuge) and the McNeil River State Game Sanctuary (sanctuary):

(1) **Helicopter access:** a person must obtain a special area permit before landing a helicopter within the refuge or sanctuary;

(2) **Off-road use of wheeled, tracked, or other ground-effect motorized vehicles:** the off-road use of wheeled, tracked, or other ground-effect motorized vehicles is prohibited within the refuge and sanctuary, except that

(A) the off-road use of a snowmachine in support of lawful trapping activities within the refuge may be conducted only under the terms of a special area permit;

(B) the commissioner may issue an individual special area permit, on a case-by-case basis, for the off-road use of a wheeled, tracked, or other ground-effect motorized vehicle within the refuge or sanctuary if the applicant shows that the use of the applicable vehicle is

(i) a demonstrable need for which there is no feasible alternative;

(ii) consistent with the goals and policies of the management plan under this section; and

(iii) consistent with the purpose for which the refuge or sanctuary was established;

(3) **Camping:** the following restrictions apply to camping activities within the refuge and sanctuary:

(A) a person may not engage in noncommercial camping within the refuge or sanctuary for more than 14 days per calendar year unless authorized by a special area permit issued before the camping activity begins;

(B) a person may not provide commercial camping services within the refuge or sanctuary unless authorized by a special area permit issued before providing the services;

(C) the following requirements apply to all camping activity within the refuge or sanctuary:

(i) a person may not place, deposit, or leave any solid waste, including garbage and litter, within the refuge or sanctuary; all waste must be removed at the time the camping activity ends;

(ii) a person may not store food and garbage at the campsite within the refuge or sanctuary unless the food and garbage is isolated from bears by using a bear-proof container, an electric fence, an enclosed food cache located at least 15 feet above ground, or stored within a hard-sided building or a lockable and hard-sided section of a vehicle, vessel, or aircraft;

(4) **Structures**: a person may not construct a structure, including a tent platform, elevated food cache, latrine, or other hardened structure, within the refuge or sanctuary unless authorized by a special area permit issued before the construction begins;

(5) **Boat storage**: the following restrictions apply to boat storage within the refuge or sanctuary:

(A) a person may not store a boat more than 20 feet in overall length within the refuge or sanctuary;

(B) a person may not store a boat 20 feet or less in overall length within the refuge or sanctuary unless authorized by a special area permit issued before the boat is stored;

(6) **Mining**: a person may not engage in mining activities within the refuge unless authorized by a special area permit issued before the mining activity begins;

(7) **Fuel storage and hazardous substances**: the following restrictions apply to fuel storage and the handling of hazardous substances within the refuge or sanctuary:

(A) a person may not release or dispose of a hazardous substance, as defined in AS 46.09.900, or petroleum-based fuel in the refuge or sanctuary;

(B) a person may not store fuel in the refuge or sanctuary unless authorized by a special area permit issued before the activity begins; this prohibition does not apply to

(i) fuel contained in fuel tanks on board vessels, vehicles, or aircraft;

(ii) fuel actively used in a camp; and

(iii) fuel contained within permitted structures;

(8) **Timber harvest**: a person may not harvest live or standing timber within the refuge or sanctuary; the harvest of dead and down wood for personal use within the refuge or sanctuary is allowed.

(b) In this section,

(1) "bear-proof container"

(A) means a securable container constructed of a solid non-pliable material capable of withstanding the stress and compacting forces of an adult grizzly bear, and when secured and under stress, the container will not have any cracks, openings, or hinges that would allow a bear to gain entry by biting or pulling with its claws;

(B) does not include

(i) a wood container unless the container is reinforced with metal; and

(ii) ice chests and coolers;

(2) "commercial camping service" means the provision of assistance for compensation, or with the intent to receive compensation, to persons who camp in the refuge or sanctuary;

(3) "overall length" means the straight line length between the extremities of the boat, excluding any part of the boat's motor;

(4) "solid waste" means garbage, refuse, abandoned, or other discarded solid or semisolid material, regardless of whether subject to decomposition, originating from any source. (Eff. 6/29/2008, Register 186)

Authority: AS 16.05.020 AS 16.20.041 AS 16.20.160
AS 16.05.050 AS 16.20.050 AS 16.20.162
AS 16.20.020 AS 16.20.060

IMPLEMENTATION

The McNeil River State Game Refuge and Sanctuary Management Plan will be implemented by the ADF&G through its day-to-day, on-the-ground management activities, through its annual budgetary process, through Special Area Permits issued for land use activities, and through Sanctuary Access Permits.

Special Area Permits: A Special Area Permit is required for any habitat-altering activity, including construction work, in the McNeil River State Game Refuge and Sanctuary. A Special Area Permit application form can be obtained from any ADF&G office and should be submitted to the Sport Fish Division office in Anchorage (5 AAC 95).

Implementing Regulations: In addition to applicable statutes and other laws and the goals and policies of this management plan codified at 5 AAC 95.540, management direction is provided by activity specific regulations codified at 5 AAC 95.542.

Sanctuary Access Permits: A Sanctuary Access Permit is required for access to McNeil River State Game Sanctuary. A Sanctuary Access Permit application can be obtained from the Department, and the completed application should be submitted to the Division of Wildlife Conservation (5 AAC 92.065).

Information/Education: Work with government agencies and private groups to develop an information/education program for the refuge and sanctuary that will inform the public about resource values, rules, and recreational opportunities. Work with air charter operators and the Federal Aviation Administration to explain aircraft access limitations.

Mining Claims and Leasehold Locations: Work with the Department of Natural Resources to review the status of mining claims, close out all lapsed claims, and prepare mineral closing orders and leasehold location orders for the refuge.

Bureau of Land Management: Work with the Bureau of Land Management to acquire BLM lands in the McNeil River State Game Refuge.

Paint River Fish Ladder: For the purposes of implementing this plan, the Paint River Fish Ladder is not considered a commercial facility/structure.

Developed Access: Where feasible, the Department should ensure that developed public access can accommodate disabled visitors, consistent with safety and the wilderness character of the area.

Archæological and Historic Resources: Support archæological investigations to document and protect these resources, and to better understand the prehistoric and historic use of the sanctuary and refuge.

Activities of Other Agencies: This plan will also be used by other state, federal, and local decision makers in making management decisions for the refuge and sanctuary under their respective statutory authorities.

Special Publication No. 08-01 Appendix A

McNeil River State Game Refuge and State Game Sanctuary Management Plan

RESOURCE INVENTORY

by

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Alaska Department of Fish and Game **Divisions of Sport Fish and Wildlife Conservation**

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INTRODUCTION

The McNeil River State Game Sanctuary was created in 1967. Legislation to expand the sanctuary and create the McNeil River State Game Refuge was passed in 1991 and became effective in 1993, when the Paint River Fish Ladder was declared operational by the Commissioner of Fish and Game. The expanded sanctuary and refuge encompass state owned lands and waters, including tidelands. Marine waters and submerged lands are not included.

This Resource Inventory presents an overview of the resources and uses of the sanctuary and refuge; it is an update of the Resource Inventory prepared in 1995 (Clausen and Aumiller).

THE SETTING

McNeil River State Game Sanctuary (MRSGS) and McNeil River State Game Refuge (MRSR) are located on the west side of lower Cook Inlet, on the shores of Kamishak Bay.

The sanctuary encompasses the area draining into McNeil Cove, including Mikfik Creek and McNeil River, the lower six miles of the Paint River, and the lower one and one-half miles of the Kamishak River.

The refuge lies immediately to the north of the sanctuary. The primary drainages in the refuge are Chenik Creek system and Paint River, including the northern tributary known as Dunuletak Creek and minor tributaries Sulukpuk, Kenty, and Crevice creeks.

The sanctuary and refuge lie approximately 100 miles directly west of Homer across Cook Inlet and 210 miles southwest of Anchorage. The sanctuary and refuge are immediately north and east of the Katmai National Park and Preserve (KNPP). The sanctuary is about 200 square miles in size (128,000 acres) and the refuge is about 188 square miles (120,120 acres). When combined, the two areas protect approximately 388 square miles (248,120 acres) of bear habitat.

Kamishak Bay is characterized by extreme tidal fluctuations and navigational hazards. In a typical year, the tide heights range from over 23 feet and to below -5 feet. Numerous reefs and shoals are scattered throughout Kamishak Bay; many are exposed at low tide. The south shore of Kamishak Bay has extensive reefs, ledges, and adjoining mudflats (National Ocean Service 1995). Sea currents generally run counterclockwise in Cook Inlet; thus sea currents into are primarily from the north into Kamishak Bay (Burbank 1977).

The uplands are characterized by rolling foothills of the Aleutian Range. Mountains in the sanctuary and refuge are less than 4,700 feet elevation. Vegetation is predominantly dense thickets of willow (*Salix spp*.) and alder (*Alnus spp.*) interspersed with grassy patches. Woody vegetation extends to about the 1,000-foot level. A few balsam poplars (*Populus balsamifera*) are spread throughout the lower riparian areas. Extensive tidal flats with large areas of sedge (*Carex* spp.) have formed in McNeil Cove and at the mouth of Kamishak River. The area has been well described elsewhere (Bledsoe 1987, Walker & Aumiller 1993).

HISTORY AND PREHISTORY

The name *Kamishak Bay* has a number of historical variations, including Bourdiens Bay, Bourdieus Bay, Kamieshatskia Bay, Kamiischatskaja Bay, Kamiskuk Bay, Kamychatskoi Bay, Kamyshak Bay, and Kamyshatskaya Bay (Orth 1967:491).

The earliest and only reference to Russian entry into Kamishak Bay was a description of a damaged Russian ship making an unplanned landing in 1796 (Tornfelt and Burwell 1992). The ship *Tri Sviatitelia* ("three sisters") commanded by Medvednikov was caught in a storm and blown ashore in Kamishak Bay. Four crew members were lost. Alexander Baranov sent a crew of carpenters to the site in the spring of 1797 to repair the ship, but the ship was beyond repair and was abandoned (*ibid*.).

Captain George Vancouver's map drawn from his 1794 explorations in Cook Inlet recorded the area now known as Kamishak Bay as "Bourdieus Bay" (Vancouver 1798). However, since Vancouver does not mention giving the name Bourdieus Bay in his journals, Wagner (1937) speculates that Captain George Dixon actually bestowed the name during his visit to Cook Inlet in 1787.

The native name published by the early Russians was "Guba Kamyshatskaya," meaning "Kamyshatskaya Bay" (Sarychev 1969). Though no translation was recorded, Boraas and Petersen (1988) speculate the name is probably a Russianized version of an Alutiiq Eskimo name for the bay that was later anglicized to Kamishak.

No permanent settlements are noted as existing in Kamishak Bay in the 1890 Department of Interior Census (Porter 1893). Some seasonal use, however, is described:

> *Along the shores of Kamishak Bay, between St. Augustine Island on the north and Cape Douglas on the south, numerous camps of sea otter hunters can be found every season from early spring until late in autumn. These camps are occupied by Kiatagmint, Aglemiut, and Togiagmiut Eskimo, who, under instigation of traders, undertake long, tedious journeys, transporting their household goods and skin canoes on sledges over tundra, rivers, lakes, and mountain ranges, before the snow melts in the spring, to return only when the first storms of autumn make sleighing possible again. The Togiagmiut, whose villages are located far to the westward of Bristol Bay, must cover between 200 and 300 miles in their journeys to this hunting ground. All through the winter the shores of the Kamishak are deserted and desolate, a wilderness of barren rock and drifting snow, the battlefield of furious gales, and trembling before the unceasing onslaught of a raging sea, kept in a state of turmoil by the joint action of wind and tide.*

The Alaska Heritage Resource Survey has cataloged two historic sites in the planning area:

A–Site ILI-007: The Eskimo village of Chenik located about 8 miles north of Paint River. The site was reported as the location of an Eskimo village in 1925 (Brooks 1925) but has since been abandoned.

A–Site ILI-045: Kamishak, or McNeil Ranch, the site consists of a log cabin occupied by Charlie McNeil in 1923 and located on the north bank at the mouth of McNeil River.

McNeil River was named for (or by) Charles McNeil, an adventurer and entrepreneur who first came to Alaska in 1898 from Colorado (Peterson 2002). He visited the McNeil River area as

early as April 1904, when he traveled by dog sled from Hallo Bay. He built a log cabin near his copper claim and a large storage cellar on the bluff above a cave on the north side of McNeil Lagoon (McNeil 1924). There is no record of what McNeil River was called prior to this, except for one letter which mentions "my abode situated at McNeill Creek, Kamashak Bay, Alaska" (McNeil 1924). Mikfik Creek is apparently a local Eskimo name, as is *Chenik Creek* (Brooks 1925).

The origin of the name for *Paint River* is less clear. It is also first reported in Brooks and others (1925). Paint River was also called Ach-check River by Charles McNeil in his certification of location for his mining claims on Paint River.

An archæological survey was conducted at the mouth of Paint River in 1988 as a permit requirement for the construction of the salmon ladder. No prehistoric or historic sites were identified in an on-site inspection of the approximately one-quarter by one-quarter mile project area (Boraas and Petersen 1988). During June 2005, six prehistoric sites were found and mapped by Doug Reger, Jeanne Schaaf, and Judy Alderson in McNeil Lagoon, and additional radiocarbon samples were collected from the sites in June 2006 by Dr. Reger[1].

ILI-163 is a large prehistoric site of unknown age with 48 house and cache features strung over 500 linear meters along the second ridge west of the modern beach, from the current ADF&G campground to the junction of the water trail with the Mikfik and McNeil Falls main trails. The house depressions include circular single-roomed forms and Thule-like rectangular houses with main rooms having entry rooms and side rooms off of the entryway.

ILI-164 is a prehistoric settlement northeast of camp of unknown age with 8 houses represented by large shallow rectangular depressions. A single radiocarbon date on wood charcoal collected from a small test in one of the house depressions is 1,560 +/- 50 years before present (BP, Besta-221551). Small shallow depressions near the houses are probably caches. Entry openings in the house walls could be seen in two of the houses. The house depressions are infilled with a 30 cm thick deposit of 1912 ash. This site is probably older than ILI-163 based on the position of prominent ashes in the sediments relative to the house floors. The house forms are similar to Norton tradition houses dated to 2200-1300 BP in the region, and the single radiocarbon date collected falls within this range.

ILI-165, ILI-166, ILI-167 and ILI-168 are spectacular late prehistoric settlements located on the bluff at the head of McNeil Lagoon, between the Mikfik Creek mouth and the McNeil River mouth. These settlements contain from 2 to 6 large rectangular houses with from 2 to 8 side rooms each. Large sod borrow areas and cache pits are also present near the houses. The main rooms are 5 to 6 meters across and the satellite rooms are 2 by 3 meters on the average. Two to 4 meter-long entry tunnels are indicated.

A single small test placed in the center of the main room of House 4 at ILI-167 found a clay-lined pit in the house floor, charcoal and a quartz crystal among other things. Wood charcoal collected from this test has a radiocarbon age of 290 +/1 40 years BP (Beta-221553). A small test was placed in House 16 at ILI-166 in June 2006 and wood charcoal recover3d yielded a radiocarbon age of 430 +/- 40 BP (Beta-221552). Large multi-roomed houses, with clay lined

[1] Jeanne Schaaf, Cultural Resources Program Manager, Lake Clark/Katmai National Parks and Preserves, National Park Service, Anchorage, provided the information about the 2005 sampling and the additional radiocarbon samples collected from the sites in June 2006 by Dr. Reger.

pits and quartz crystals in the artifact assemblages appear in Kodiak as early as 650 years ago and along the Brooks River around 550 years ago. Multi-roomed houses excavated at Leader Creek near the mouth of the Naknek River are around 300 years old.

It is thought that after a volcanic eruption around 1300 AD, people affiliated with Kodiak (but not necessarily from Kodiak) moved into the Naknek drainage. This also coincides with the beginning of the Little Ice age, a period of colder temperatures that lasted for about 300 years. These large structures may have been adapted to these colder temperatures and would have housed large extended families, 15 or more people. The settlements in McNeil Lagoon would have had 40 to 100 people if only one site were occupied at a time and if not all houses in each settlement were occupied at the same time. It is possible that the sites represent the same group of people, occupying one site for a generation or two, then the descendants moving to another location on the same promontory, and so on.

The sites (ILI-165, -166, -167, and -168) could collectively represent as much as a 300-year long sequence of relatively continuous occupation. It will be important to conduct more testing at these sites to collect charcoal for radiocarbon dating and to better understand this unique group of sites. The conglomerate bluff that supports these sites is eroding and some of the houses are being eroded away. It was reported that a sea mammal rib artifact with drilled holes, possibly a sled runner, was collected from below these sites about 20 years ago.

At least three possible house depressions were noted near the bear viewing points along the west side of Mikfik Creek. Many more prehistoric sites are likely to exist in this resource-rich and protected estuary; these sites are likely to span a much greater temporal range than is documented at this time. A complete report of the 2005 archaeological survey and the 2006 testing is being prepared by Dr. Reger, and is expected to be completed in June 2007.

PHYSICAL ENVIRONMENT

CLIMATE AND WEATHER

The sanctuary and refuge stretch inland approximately 25 miles; elevations range from sea level to about 4,000 feet. Although the primary influence is a moderate maritime climate, the area is large enough that other factors, such as elevation and topography, are important. The summers are generally cool and wet, and the winters have moderate temperatures, wind, and 40-60 inches of snow (Selkregg 1974).

Climate and weather have never been systematically recorded nor described in Kamishak Bay, except for informal summer weather observations in McNeil River Cove made by ADF&G staff. These observations show that in the summers of 1975 and 1976, 56% of the days at McNeil Cove were at least partly cloud-free, had winds less than 15 mph, and had no rain. Twenty-five percent of the days had at least some rain or winds in excess of 15 mph and total cloud cover, and 14% of the days had total cloud cover, at least some rain, and winds in excess of 15 mph. The highest recorded summertime wind velocity was 80 mph in August of 1985.

Other visitors have reported their observations in a variety of publications:

- "All next day the wind blew unabated, driving white spray 60 feet or more into the air off the cliffs." Cecil Rhode, National Geographic Magazine, August 1954, pp. 195-205.
- "Since the Alaska Peninsula is exposed to storms blowing across the Gulf of Alaska, driving rain, gale force winds and low clouds are common." John Ibbotson, Adventure Travel Magazine, August 1980, pp 28-33.
- "The weather out there on the Alaska Peninsula is thick enough to swim in." Jose deCreeft reported in *Wild Alaska* by Erwin Bauer.

Kamishak Bay is reported as having an average of 40 inches of annual snowfall. Summer temperatures of between 45 and 60°F and typical winter temperatures of 10 to 25°F are also reported. There is no permafrost in the area (Selkregg 1974).

GEOLOGY

The sanctuary and refuge consist of two primary geological formations separated by the Bruin Bay Fault (Detterman and Reed 1980). The Bruin Bay Fault bisects the sanctuary and refuge running generally northeast to southwest. This fault has its origins at Mt. Susitna on the west side of Cook Inlet across from Anchorage and runs about 300 miles southwest to Lake Becharof on the Alaska Peninsula. The fault emerges from under the sea at about the northern border of the refuge, near the southern end of Amakdedori Beach. It generally runs southwest splitting the distance between McNeil River and Little Kamishak River. The Bruin Bay Fault and other minor faults are closely associated with waterfalls on Kirschner Creek, Chenik Creek, Paint River, McNeil River, Mikfik Creek and Strike Creek (Detterman and Reed 1980).

On the eastern side of the fault exists the Naknek Formation consisting mainly of sedimentary arkosic arenite; arkosic and lithic wacke; conglomerate; and sandy siltstone (Detterman and Reed 1980). The base of the formation is a massive cobble boulder conglomerate (Chisik conglomerate) that was formed under pressure and high temperature. The western shore of Kamishak Bay from a point two miles north of Chenik southward to the mouth of the Kamishak River is formed of comparatively flat-lying beds of Chisik conglomerate. This formation extends up the Little Kamishak River and then reappears along upper Strike Creek (Mather 1924). McNeil Head, which rises from the sea several hundred feet, is an excellent example of the Chisik conglomerate. Also, spread throughout the area east of the fault are boulders of various types of granite and metamorphic rocks, which form the mountains west of Kamishak Bay. These are called glacial erratics and were deposited by glaciers during the last ice age, the Cretaceous, about 10,000 years ago (Richter and Herreid 1965).

Other geologic features in the sanctuary and refuge east of the Bruin Bay Fault are floodplain deposits, beach sand and gravel, and glacial outwash of the coastal and riparian areas (Mather 1924).

Igneous quartz diorite formations lie west of the Bruin Bay fault; these formations include biotite and hornblende, and locally small areas of diorite and granodiorite (Detterman and Reed 1980). In descending size of area, there are also examples of surficial deposits (weathered by alluvial, colluvial, glaciofluvial, lacustrine, marine, and eolian actions), the Talkeetna formation (andesite flows, agglomerate, tuff, and volcanic breccia), and lastly the Kamishak formation (gray and black limestone, gray and black chert, and gray ruff). Very small areas of intrusive rock (granodiorite, quartz monzonite, and quartz diorite) exist in the headwaters of the Paint River.

BIOLOGICAL RESOURCES

MARINE VEGETATION

No formal surveys of marine vegetation, phytoplankton or macrophytes (seaweeds) have been conducted in either the sanctuary or refuge. Nearshore marine vegetation is presumed to be dominated by various species of marine algae, including species of *Fucus, Laminaria, Porphyra, Alaria,* and *Ulva* (Viereck et. al. 1992). Eelgrass (*Zostera sp.*) beds occur in limited areas including in the vicinity of Chenik Head[2].

TERRESTRIAL VEGETATION

More than 100 flowering plants have been catalogued in the sanctuary and refuge by ADF&G sanctuary staff (Table A1). In elevations below approximately 1,000 feet, the sanctuary and refuge are predominantly covered by open tall alder-willow vegetation communities (Viereck et al. 1992). Open alder-willow communities consist of 25-75% alder and willows less than 5 feet tall. Grasses (*Calamagrostis* spp.) are abundant. The notable exception is an area near the mouth of the Kamishak River, which is classified as closed broadleaf forest canopy, which consists of over 60% balsam poplars. Small stands or single examples of balsam poplar are spread throughout the area. Very rare single examples of spruce trees, thought to be *Picea sitchensis,* also exist in both the sanctuary and refuge. Above 1,000 feet, the plant community changes to alpine tundra, which continues generally upland to about the 1,500 foot level, where most vegetation gives way to lichens or rocks.

MARINE INVERTEBRATES

The southern shore of Kamishak Bay does not support a large number or much diversity of marine invertebrates. Amakdedulia Cove, Akjemguiga Cove, McNeil Lagoon, Horseshoe Cove, Pinkidulia Cove, and Akumwarvik Bay all have extensive areas of mudflats (with a few boulders and rock reefs) (N.O.A.A. 1989). This type of substrate provides limited habitat for marine invertebrates, primarily because of exposure, freezing, and seasonal ice scour; however, some marine invertebrates were located in McNeil Lagoon.

ADF&G staff identified the following marine invertebrates in McNeil Lagoon:

Jellyfish:	*Staurophora* spp.
Limpets:	*Notoacmea* spp.
Mussels:	*Mytilus edulis*
Cockles:	*Clinocardium* spp.
Clams:	*Siliqua patula, Mya* spp.
Barnacles:	*Balanus glandula*, *Lepas pacifica*
Amphipods:	*Anonyx* spp.
Hermit crabs:	Species unknown

Other marine invertebrates are washed onto beaches after severe storms, suggesting that suitable habitat for other species exist seaward of the mud flats. On Amakdedori beach, immediately north

[2] E. O. Otis, Commercial Fisheries Biologist, ADF&G, Homer; personal communication.

of Chenik Lagoon, over 60 species of marine life have washed ashore and been identified (Cunning 1977, Table A2). The majority of these organisms were sea squirts (*Halosynthra aurantium*), Goose barnacles (*Lepas* spp.), or mussels (*Mytilus edulis*).

TERRESTRIAL AND AQUATIC INVERTEBRATES

Insects and other invertebrates have not been scientifically surveyed in either the sanctuary or refuge, but the following orders of invertebrates have been noted: Odonata (dragonflies), Lepidoptera (butterflies), Coleoptera (beetles), Lepidoptera (moths), Diptera (flies), Hymenoptera (wasps and bees), Trichoptera (caddisflies), Mallophaga (chewing lice [bird lice]), Hemiptera (water bugs), and Siphonaptera (fleas [parasites on bears]). The following orders have not been noted in either the sanctuary or refuge: Orthoptera (grasshoppers, crickets or cockroaches), Dermaptera (earwigs), Mecoptera (scorpion flies), and Isoptera (termites).

FRESHWATER AND ANADROMOUS FISH

Anadromous fish for all of the major freshwater rivers and creeks in the sanctuary and refuge have been catalogued by the ADF&G (ADF&G 2008). Chenik Creek and Lake contain sockeye salmon (*Oncorhynchus nerka*), and Arctic char (*Salvelinus alpinus*). Prior to the 1940s, the Chenik system was historically an excellent sockeye salmon producer. Stocks declined dramatically after this time, however, and by the mid-70s annual returns to this system numbered less than 500 fish. An enhancement project initiated by ADF&G in the early 1980s resulted in annual runs of over 100,000 sockeyes in the mid- to late 1980s, but an outbreak of Infectious Hematopoietic Necrosis Virus (IHNV) in the system during the early 1990s caused increased mortality to juvenile salmon, precipitating another crash in the stocks. The enhancement project was discontinued after 1996, and sockeye salmon production in recent seasons has come entirely from naturally spawning adults. Total annual runs to Chenik Lake during the years 2003 through 2006 averaged nearly 38,000 sockeyes.

Paint River, including its tributaries Sulukpuk and Dunuletak creeks, at one time contained sockeye and pink salmon (*O. gorbuscha*) as a result of stocking by Cook Inlet Aquaculture Association. The Paint River fish ladder, constructed in 1991 and declared officially operational in 1993, has never been opened to migrating adult salmon due to low numbers of returning fish; thus no freshwater escapement into the system has ever occurred.

McNeil River contains Arctic char, chum salmon (*O. keta*), some coho salmon (*O. kisutch*), pink salmon, and small numbers of Chinook salmon (*O. tshawytscha*). McNeil River hosts one of the major chum salmon runs in the Lower Cook Inlet area. Though relatively few chums currently utilize the upstream areas of the system, the river provides approximately 14 miles of chum salmon spawning habitat from the intertidal lagoon upstream to the outlet of McNeil Lake. Fish are unable to move beyond this point due to a series of small but steep falls. Past observations indicate the McNeil River chum salmon run historically peaked in late July. However, similar to Mikfik Creek, the run timing appears to have shifted, with significant numbers of fish returning in early July. Changes in run timing from year to year appear to be influenced by the age composition of a given year's return. Runs dominated by five or six year old fish tend to return in late June or early July, while in those years when the run is dominated by four year old fish, the run peaks in mid- to late July. Generally all three age classes are present in any given year’s return, but there is often a slight delay or "lull" in the run between the arrival of early and late components of the return in early July. Other factors can and do affect the timing of fish

movement into McNeil River. These include water temperature of the river from melting snow, local weather conditions, magnitude of tidal exchange, and changes in water discharge rates from rain and melting snow.

Mikfik Creek and Lake has sockeye salmon and Arctic char. The Mikfik system supports a natural run of sockeye salmon which spawn and rear in a small 120-acre lake located approximately two miles upstream of McNeil Lagoon. The number of salmon returning to this system can be extremely variable, with a twenty-year annual average escapement of 10,000 sockeyes. Although details are erratic, historic records from the first half of the previous century suggest that the sockeye salmon run to Mikfik Creek occurred somewhat later than now, from mid/late June to mid-July. In recent times however, run timing has shifted, with fish beginning to return in early June, up to a full month earlier than the earlier observations. Nearby Kamishak River, Little Kamishak River, and Strike Creek contain all five species of Pacific salmon as well as Arctic char. Kamishak and Little Kamishak Rivers support a twenty-year average annual escapement of approximately 20,000 and 15,000 chum salmon, respectively, while these systems support a twenty-year combined average annual escapement of 2,300 sockeye salmon.

Although not formally keyed, fish identified as Arctic char (*Salvelinus alpinus*) in these systems are probably Dolly Varden (*Salvelinus malma*) based on known distribution of both species and physical descriptions[3].

In addition to the above information, lake trout (*Salvelinus namaycush*) are known to occur in Chenik Lake, while rainbow trout (*Oncorhynchus mykiss*), Arctic grayling (*Thymallus arcticus*) and lake trout are known to occur in the upper Paint River[4]. Rainbow trout have been reported in Mikfik Creek. Unidentified sculpins (Cottidae) and three-spined sticklebacks (*Gasterosteus aculeatus*) have been observed in several freshwater locations in both the sanctuary and refuge.

BIRDS

At least 130 species of birds have been documented in or within one-half mile of McNeil Lagoon, including nearby marine waters (Table A3). MRSGS staff have kept bird sighting records in and near McNeil Lagoon since 1976. In some of those years, abundance, nesting, and migration timing records were also kept.

The U.S. Fish and Wildlife Service (USFWS) has catalogued seven seabird colonies in the sanctuary and refuge, and islands offshore of the sanctuary or refuge. In the summer of 1978, a boat survey of birds was conducted by the ADF&G at several areas on the west side of Cook Inlet including Kamishak Bay (Arneson 1980). This survey included the seven seabird colonies in or just off shore from the sanctuary or refuge. In 1992, ADF&G sanctuary staff were contracted by the USFWS to once again survey these seven sites (USFWS 1994). Seven species were noted to be nesting on at least one of these sites in each of these surveys (Table A4).

Aircraft based aerial surveys for selected bird species were conducted during all four seasons of 1978 by Arneson (1980). Arneson's comprehensive account reports types of birds (by group), bird seasonal abundance, and identifies habitat and habitat usage. The following seasonal comments were included in that report:

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[3] F. DeCicco, personal interview with L. Aumiller.

[4] L.F. Hammarstrom, Div. of Commercial Fisheries Biologist, ADF&G, Homer; personal interview with L. Aumiller.

Spring: "High densities of divers were observed in Akumwarvik Bay. Also, a large raft of scoters and eiders (487 birds/mi^2) was observed at Chenik Head. High densities of gulls, not associated directly with colonies were on the western shore of Kamishak Bay, where a density of 148 gulls/mi^2 were found."

Summer: "Kamishak Bay with a density of 526 birds/mi^2 had mostly sea ducks (272 birds/mi^2) and gulls (176 birds/mi^2) with some alcids (29 birds/mi^2) and a relatively high cormorant density (18 birds/mi^2)."

Fall: "A fall density of 324 birds/mi^2 in ... the McNeil cove/Akumwarvik Bay area was the second highest in lower Cook Inlet." "Nearly half of the birds were shorebirds (141 birds/mi^2)." "Sea ducks (83 birds/mi^2) and dabbling ducks (75 birds/mi^2) made up most of the remainder." "Only 21 gulls/mi^2 were found in that region."

The sanctuary and refuge are not known to support large numbers of nesting waterfowl. There are, however, records of green-winged teal, mallards, and northern pintails nesting around McNeil Lagoon. In the spring and, to a lesser degree, the fall, migrating waterfowl stage in McNeil Lagoon. Canada goose (*Branta canadensis*) and Brant (*Branta bernicla*) stop to feed on eelgrass (*Zostera sp.*) on the south side of Chenik Head in early-May before continuing their northward migration to summer nesting grounds, and large numbers of scoters (*Melanitta sp*.) frequent the area in April and May to feed on Pacific herring eggs (*Clupea pallasi*) that have been spawned on the eelgrass and rock weed (*Fucus gardneri)* common to the area[5].

Bald eagles are seasonally common on McNeil River and Mikfik Creek. As many as thirty-seven eagles have been seen at one time in McNeil Lagoon. Three to four active bald eagle nests have been located in the sanctuary each summer; with the exception of a nest near the Kamishak River; these nests are ground nests constructed on coastal bluffs or islets. Other avian predators, such as short-eared owls and rough-legged hawks, that rely on small mammals for food are relatively numerous in certain locales in the sanctuary and refuge. In summer, the most common birds in the sanctuary and refuge are glaucous-winged gulls and the various warblers and sparrows that nest in open alder-willow plant communities.

MARINE MAMMALS

Marine mammals are not often observed near the shoreline in either the sanctuary or refuge, perhaps because of the shallow, muddy nature of Kamishak Bay and the extreme tidal fluctuation of lower Cook Inlet. The one exception is harbor seals (*Phoca vitulina*) that commonly follow the migrating salmon on the high tide into McNeil River (Miller 1963, Walker and Aumiller 1993). These seals are in the river through high tide, and move seaward as the tide recedes. At low tide, the water's edge can be up to 1/2 mile from McNeil Lagoon, eliminating marine mammal access.

Beluga whales (*Delphinapterus leucas*) have been observed in the bay once[6]. Sea otters (*Enhydra lutris*) and Steller sea lions (*Eumetopias jubatus*) have been seen twice near the McNeil Lagoon gravel spit at high tide. Sea otters are more common in deeper nearshore waters extending from McNeil Head eastward toward an area offshore of the Douglas River mouth and rafts of 20-30 sea otters have been observed around Nordyk Island. Steller sea lions (*Eumetopias*

[5] E. O. Otis, Commercial Fisheries Biologist, ADF&G, Homer; personal communication.
[6] D. Stonorov. Homer resident. Personal interview by L. Aumiller.

jubatus) and harbor seals are seasonally abundant in the nearshore waters of Chenik Head and Amakdedulia Cove when Pacific herring spawn there in April and May[7].

TERRESTRIAL MAMMALS

No terrestrial mammal surveys have been systematically conducted, although biologists from various agencies have visited the general area and reported their observations (Cahalane 1959; Murie 1959; Miller 1963, 1965, 1966, 1967, and 1968). Since 1975, ADF&G staff have observed 24 terrestrial mammal species in the sanctuary and refuge (Table A5).

Moose are present in small numbers in both the sanctuary and refuge. Brown bears are seasonally abundant in the sanctuary, but less so in the refuge (Miller 1991). Caribou have been observed in both the sanctuary and refuge but are considered rare.

The sanctuary and refuge are beyond the normal ranges of many familiar large Alaskan mammals: Sitka black-tailed deer, mountain goat, Dall sheep, black bear, muskox, bison, wapiti (elk), and polar bears have not been seen in the sanctuary or refuge.

Medium-sized mammals are not well represented in either the sanctuary or refuge. Red foxes and beaver sightings are fairly common, but wolf, river otter, wolverine, mink, porcupine, snowshoe hare and hoary marmot sightings are rare. Tundra hare, arctic fox, coyote, lynx, and marten have not been noted in the area.

Systematic sampling of small mammals has not been done in either the sanctuary or refuge; however, sanctuary staff have identified two species of shrew, a lemming, three species of voles, and a jumping mouse (Table A5).

Brown Bears

Brown bears are seasonally abundant at McNeil River falls, lower Mikfik Creek, and McNeil Lagoon (Bledsoe 1987, Walker and Aumiller 1993, Sellers and Aumiller 1994). Elsewhere in the sanctuary and refuge, bear densities are considerably less (Miller 1991). Nearby Katmai National Park has a bear density of approximately one bear/mi^2, which is the highest of any censused area in the state (Miller 1993).

McNeil River first gained wide public attention over 50 years ago because of the high density of bears found in such a small area. In 1967 when the Alaska State Legislature created the sanctuary, protection of this unique concentration was the impetus[8]. During the peak of the chum salmon run, brown bear density within the core four square miles around the falls was over 28 bears per square mile (Sellers and Aumiller 1994). Over 100 individual bears have been observed in this core area on several different days. This represents a minimum number of bears using the area, as a bear is not counted unless it is one that staff is confident of recognizing a second time; further, the number does not include less tolerant bears that fish at McNeil falls during hours when humans are not present.

The number of recognizable brown bears (excluding cubs) using the sanctuary more than doubled between 1976 and 1997 (from 38 to 101 individuals), and then declined over the next eight years (Table A6, Aumiller 2005). A number of factors may be responsible for the initial increase, including the unintentional effects of an ADF&G bear research program in the

[7] E. O. Otis, Commercial Fisheries Biologist, ADF&G, Homer; personal communication.
[8] C. Tillion. Halibut Cove resident. Personal interview by L. Aumiller.

sanctuary between 1962 and 1972. The project experienced some bear mortality and due to the nature of ground darting and handling of bears, the study acted as an aversive conditioning program that discouraged bear use at McNeil River (Sellers and Aumiller 1994). During the same time period, increasing and unregulated public use may have also contributed to reduced bear numbers by displacing bears from the area (Sellers and Aumiller 1994).

Once the research project was terminated and public use controlled through a permit program starting in the 1970s, bear numbers at McNeil began to rise; however, the primary reason for the increase may have been the increased protection from hunting mortality afforded bears in adjacent protected areas (Sellers and Aumiller 1994). Katmai National Monument was expanded by presidential proclamation in December 1978 (and renamed Katmai National Park and Preserve in 1980) to encompass more than 6,000 mi^2 just south and west of the sanctuary. An additional 161 mi^2 of state land between the sanctuary and KNPP was closed to brown bear hunting in 1986 by the Alaska Board of Game and the area was later designated as the Kamishak Special Use Area by the Alaska Department of Natural Resources in 1990. The 188 mi^2 McNeil River State Game Refuge (located immediately north of the sanctuary) was created by the Alaska State Legislature in 1991 (implemented in 1993) and closed to brown bear hunting by the Alaska Board of Game in 1995. Of the eight bears tagged by the ADF&G at McNeil River, seven had been harvested by hunters in these areas prior to their closure to bear hunting (three in KNPP, three in the Kamishak Special Use Area and one in the McNeil River State Game Refuge).

With the closure of these areas to bear hunting, cessation of the bear tagging project, and increase restrictions on public use (which strictly limited the number of visitors and their activities while in the sanctuary (Aumiller and Matt 1994)), the number of bears using McNeil River increased until 1997 when a peak number of bears (101, not including cubs) was observed. This increase was also likely influenced by the growth in brown bear populations throughout most areas of the Alaska Peninsula during this period (Miller and Sellers 1990) and the generally strong salmon runs at McNeil River and the region throughout the 1980s.

After 1997, the number of bears using McNeil River decreased to 63 individuals in 2004 and 69 in 2005. These trends are also reflected in two other brown bear monitoring programs at McNeil River and include an annual number of "bear-use days" wherein each identifiable bear is tallied daily (Table 7). The third monitoring method is conducted by hourly tallies of all bears observed at McNeil River falls during the peak of the summer. The mean of the seven highest hourly counts provides an annual index used to monitor annual trends (Table A8).

The reasons for the decline observed in all three monitoring programs starting in 1998 is not well understood and without undertaking an intensive research project, any theories would be simply speculation. However, if food resources are a primary factor in wildlife abundance, it is worthy to note that McNeil River has failed to achieve established chum salmon escapement goals for 12 years during the period of 1990 to 2006 (Meehan 2006). Compounding the low escapements in McNeil River, the surrounding systems have experienced strong salmon returns, particularly drainages in the Katmai National Preserve (immediately west of the sanctuary), which have experienced escapements of sockeye salmon that were several magnitudes higher than their escapement goals. This abundance of salmon in the nearby systems may have drawn bears away from McNeil River where salmon was not as abundant.

Also not well understood is how the harvest of brown bears during legal hunts in areas adjacent to the sanctuary affects bear abundance at McNeil River. The areas near the sanctuary open to

brown bear hunting have experienced increased harvest levels since 1998, when hunting regulations were liberalized in Units 9B and 9C because harvest levels were considered too conservative for the growing bear population.

While the recent increases in harvests correspond with a decline in bears at McNeil River (Meehan 2006), no cause and effect relationship between harvest pressure and the current decline in bear-use indices at McNeil River has been established. Statistical analysis indicates that historic harvests were not a significant factor in the bear-use indices observed at McNeil River and that salmon escapement in surrounding systems explained much of the variation. However, decreases in bear-use indices are primarily the result of decreased use of the area by maternal females and sub-adults. Historic harvests have been shown to dampen changes in composition indices at McNeil River (Sellers and Aumiller 1994), but have not been shown to significantly alter trends in bear composition or to reduce the number of maternal females or sub-adults. In addition, the number of male bears at McNeil River has remained stable since the late-1990s in spite of increases in the predominately male harvests in surrounding areas. High male sex ratios (67% male) observed at McNeil between 2000 and 2005 are indicative of a lightly harvested bear population*, but also suggest that the spatial scale of McNeil indices is limited; preventing broad-scale application of this data to the bear population as a whole. These observations argue against a cause and effect relationship between bear-use of McNeil River and bear harvest, and support traditional population assessments made through the age and sex structure of hunter-harvested bears, which indicate the regional bear population remains healthy[9].

The geographic area from which brown bears are attracted to the sanctuary is not fully known (Sellers and Aumiller 1994). There have been, however, several bears marked in the sanctuary from 1962-72 that were subsequently shot or sighted in areas outside the sanctuary (ADF&G unpublished). Prior to 1989, the greatest distance a known McNeil bear was killed or observed from McNeil Falls was about 32 miles. In July of 1989, two adult males appeared at McNeil River Falls with ear tags applied two months earlier, one 48 miles and the other 73 miles straight line distance south of the falls on the coast of Katmai National Park (Sellers and Aumiller 1994).

As part of a study to determine the effects of effects of bear viewing on bear behavior along salmon streams, 16 brown bears from the Douglas River area (in the Kamishak Special Use Area) were outfitted with Global Positioning System (GPS) collars in 2003 and 2004. Douglas River is approximately 23 miles from McNeil River Falls. Two collared adult males from this study were subsequently observed at McNeil River Falls. Location data from the collars showed that these two bears, as well as a female with 2 yearling cubs, ranged through the McNeil River sanctuary and refuge, the Kamishak Special Use Area, Katmai National Park, and Katmai National Preserve. All collared bears returned to the Douglas River area in the fall for denning (Farley 2005).

HUMAN USE

ACCESS

No developed roads, airstrips or other public access facilities exist in either the refuge or sanctuary. The only maintained trails extend from the McNeil River camp to the bear viewing

[9] Lem Butler, personal interview with Joe Meehan.

sites at McNeil River Falls and Mikfik Creek, and an un-maintained trail connects Chenik Lake with the Chenik Head area. The refuge and sanctuary are generally accessible by boat or small plane and floatplanes are known to land in McNeil Cove and Lagoon, Chenik Lagoon, Chenik Lake, Kamishak River, Paint River Lakes, the lower section of Paint River, and occasionally on Mikfik Lake. Wheeled-planes including herring spotters in the spring and private bear viewers are known to land near Chenik Head. Airspace over McNeil River Falls is controlled by the Federal Aviation Administration and they publish an advisory requesting pilots avoid flights below 1,000 feet within two nautical miles of McNeil River Falls from June 1 through September 15 because of heavy concentrations of bears and people.

Access to the sanctuary is restricted to those possessing permits issued under the Division of Wildlife Conservation's access permit program (5 AAC 92.065), although a permit is not required for access to the McNeil Lagoon spit and tidelands seaward of the spit. An access permit is also not required for access to other sanctuary tidelands open to commercial fishing by emergency order and commercial fishermen visit coastal areas of the sanctuary in spring and summer. General public use (hiking, short-term camping, hunting, fishing, wildlife viewing, etc.) and access to the refuge is unrestricted provided the activities do not impact fish and wildlife populations or their habitats, in which case the activity would require a Special Area Permit (5 AAC 95.420).

SANCTUARY ACCESS

Five sites are generally utilized to access the refuge and sanctuary. These include McNeil Cove/Lagoon and the lower Kamishak River in the sanctuary. Access to McNeil Cove/Lagoon is limited to those possessing access permits for the ADF&G operated bear viewing program at McNeil River, which allows up to 257 people access to the McNeil River area for the purpose of watching and photographing bears. These permits are issued through a lottery program and are valid for 4 days. Department staff accompanies all permit holders when they venture from the campground at the mouth of McNeil Lagoon and their activities are tightly controlled.

The lower 1½ miles of the Kamishak River is located in the southern portion of the sanctuary, while most of the drainage lies within the adjacent Katmai National Park. Commercial guides, air taxis, and lodges owners (primarily from the Bristol Bay region) obtain access permits to enter this portion of the sanctuary where they guide paying clients on sport fishing excursions on the Kamishak River and to a lesser degree, the Little Kamishak River and Strike Creek. Brown bear viewing and photography are also popular activities in this area. As many as ten lodges have obtained permits to store jet boats and/or establish guide camps near the mouth of the Kamishak River. These permits contain restrictions intended to protect fish and wildlife habitat, prevent impacts to bears and minimize disturbance to the region. Clients are prohibited from remaining overnight in the camp and most fishing activity and bear-viewing occurs upstream from the sanctuary boundary inside Katmai National Park. For the years 2001 to 2005, the annual average of the number of to the Kamishak River was about 600.

REFUGE ACCESS

Public visitors and commercial operators primarily use three access sites in the refuge including Chenik Lake, the Chenik Lagoon area, and the Paint River Lakes. The Chenik Lagoon, Chenik Creek and Chenik Lake area experienced a relatively high level of use in the past when an unauthorized wilderness lodge was in operation near the lagoon; however, this lodge has since

been removed. This area now experiences occasional use by sport anglers pursuing lake trout in Chenik Lake and by bear viewers along the creek and at the lagoon. Both private and commercial bear viewers use this area for day trips or overnight camping and the ADF&G does not generally monitor use levels at this site.

In 2004, one commercial bear-viewing guide obtained a permit for a long-term (more than 2-week) camp at Chenik Lake but did not establish the camp or host clients at this site. Two commercial operators obtained permits for camps in the Chenik area (at the lake and/or lagoon area) in 2005. One of these operators hosted 20 clients for 116 visitor days at a camp established near the outlet of Chenik Lake while the second guide again did not establish a camp at this site.

While the ADF&G does not generally monitor visitor use numbers in the refuge, there is some use of the Paint River Lakes area and some visitors likely access the northern part of the refuge by hiking from the Amakdedori Creek area, located outside the refuge boundary. During the period of 2001-2005, an average of 2.8 people per year hunted moose in the refuge; of those, an average of 1.8 are successful.

REFUGE AND SANCTUARY MANAGEMENT

Management of the refuge and sanctuary is guided by Alaska State Statutes, including the enabling legislation (AS 16.20.041 and AS 16.20.160-162, respectively); regulations adopted by the Alaska Board of Fish, Alaska Board of Game, and the Commissioner of the ADF&G under their respective authorities; and department policy.

In 1973, the ADF&G, Division of Wildlife Conservation (formerly the Division of Game) began to actively manage the bear-viewing program at McNeil River Falls through regulations adopted by the Alaska Board of Game. Prior to this time, visitors arrived by plane or boat, camped wherever they desired (including at McNeil River Falls), disposed of food or garbage in ways that sometimes attracted bears, and generally had no established guidelines on where to go or how to behave around bears. The number of bears observed at the falls declined in the late 1960s and early 1970s, and one of the primary reasons was thought to be unregulated visitor use. In 1970, results of ADF&G brown bear studies supported restraint of public uses to protect the purposes for which the sanctuary was created:

> *The McNeil River State Game Sanctuary was established to maintain a high number of bears for the public to observe and photograph. Unrestricted public use of the McNeil River Brown Bear Sanctuary has reached a point where it endangers those values, which attract observers and photographers. The Department should therefore manage public use in an effort to perpetuate those intrinsic values which make the Sanctuary unique for public enjoyment* (Glenn 1971).

Problems associated with food storage and garbage disposal intensified in 1972. Bears destroyed at least four tents that year (J. Faro ADF&G monthly report - July 1972). At least five bears (two females, three cubs) were killed directly by visitors or died as a result of human activities prior to 1972 (Miller 1963, Faro 1970). Safety, not only for people but also for bears, had become a management issue.

Management of the sanctuary has concentrated on the McNeil River area, but in the 1980s, concern developed over visitor activities outside the sanctuary, along the Kamishak River and in the Douglas River area (south and east of the sanctuary, respectively). Participants in the commercially guided sport fishing activity on the Kamishak River and users of guide camps at

the mouth of the river were reportedly interacting with bears in an inappropriate manner, including allowing bears to obtain fish and food from people.

Because bears move freely between the Douglas River area and McNeil River, inappropriate activities have the potential to undermine the ADF&G's management of the McNeil River bear-viewing program. While some of these activities were occurring on lands within the designated boundary of Katmai National Park, the lands were owned by the State of Alaska and therefore not under National Park jurisdiction. To better manage activities occurring on state land, the Alaska Department of Natural Resources designated the 102,846 aces of state-owned land and waters in the Douglas River area as the Kamishak Special Use Area (ADNR 1990). The management plan for this Special Use Area includes restrictions to avoid bear-human conflicts. In 1993, the Alaska Legislature added the portion of the Special Use Area along the Kamishak River to the sanctuary, and the ADF&G began to actively manage visitor use in this area.

While the refuge was created in 1993, the lands receiving the highest visitor use around Chenik Lagoon and Chenik Lake did not come into state ownership (and hence, ADF&G management) until 2003; ADF&G has since managed these areas consistent with the purposes of the refuge and the goals and policies of the management plan.

A policy concerning management of the sanctuary was drafted in 1976 and was formalized in 1981 (ADF&G 1981). In 1991, responding to concerns over the construction of the Paint River fish ladder (and its potential impacts to bears and the bear-viewing program in the sanctuary), the Alaska Board of Game directed the ADF&G to create a citizens' advisory group for the purpose of making recommendations to the Department on sanctuary and refuge management issues. The ADF&G Commissioner appointed 10 individuals to this group with broad interests, including hunting, commercial fishing, bear viewing, conservation, commercial uses, mining, and other topics and activities.

The advisory group made recommendations to the Department that the Department used to develop an Operational Management Plan for the refuge and sanctuary in 1995; this plan includes management objectives and guidelines addressing wildlife research and management; bear viewing and education; bear threshold criteria; hunting, sport fishing, and other recreational activities; fisheries enhancement; commercial fisheries management; funding; visitor permits and fees; staffing; and reporting (ADF&G 1995). This document was to be used as guidance when developing regulations and management plans (including the 1996 management plan and subsequent revisions).

Certain activities in either the refuge or sanctuary, and all activities that will potentially impact fish and wildlife populations, or their habitats, require authorization from the ADF&G in the form of a Special Area Permit (5 AAC 95.420).

BEAR VIEWING, HABITATION, AND SAFETY

Humans have visited McNeil River Falls specifically to view brown bears since at least the mid-to-late 1940s[10] more than 6,000 people have visited McNeil River since 1973, when the number of sanctuary visitors became limited by Alaska Board of Game-adopted regulation.

[10] Effler, G. Homer. Personal interview by L. Aumiller.

In June, sockeye salmon migrate into Mikfik Creek, which drains into McNeil Cove. Visitors observe bears from a variety of sites on or near the creek with bears catching fish and grazing on tidal vegetation. Mikfik Creek is small and typically attracts only a couple dozen bears. In July and August, chum salmon enter McNeil River and bear activity shifts to McNeil River Falls. McNeil River is a large river, accommodating more bears.

The success of the visitor program at McNeil River is largely due to the habituation of bears to people (Aumiller and Matt 1994). Habituation is defined as the reduction in the frequency or strength of response following repeated exposure to inconsequential stimulus (Jope 1985, Gilbert 1989). One type of response by bears toward people is aggression. Eliminating or diminishing this response creates a safer environment for interaction. Human actions that encourage habituation in bears also, by virtue of lowering stress levels in bears, encourages them to be comfortable around humans which in turn enhances the viewing program (Aumiller and Matt 1994).

Most of the bears in the sanctuary are neutrally habituated. This means that while they are comfortable around people, they do not seek or receive human food or garbage. A few bears remain wary of humans and none in recent years were conditioned to perceive humans as a source of food (Aumiller and Matt 1994).

By ensuring that humans don't provide food on one hand, nor do they harass or discourage natural behavior in bears on the other, bears are encouraged to use the sanctuary in close proximity to humans in a relatively safe environment. Since access to the sanctuary was restricted in 1973, no bears have been killed by staff or visitors and no humans have been harmed by bears.

At the sanctuary, managers found that the objectives of bear protection, quality of viewing and safety (for humans and bears), were compatible (Aumiller and Matt 1994). Managing for the maximum number of bears required limiting the number of visitors and their activities in the sanctuary. Limited visitation required less development and crowding and thus enhanced the visitors' wilderness experience. Most of the actions taken at the sanctuary to encourage more bear use also encouraged habituation.

SANCTUARY ACCESS PERMIT SYSTEM

In 1973, a program to limit visitors to ten per day at the viewing pad at McNeil Falls was initiated (ADF&G 1981). Perhaps as important, this management program also regulated the activities of the visitors. Activities such as where to camp, what to do with garbage, how to store food, where to fish, how to behave in the presence of bears, and what trails to use, were all addressed in this management plan.

Currently, ten people per day are allowed every four days during the peak viewing period from June 7th through August 25th. Due to the high interest in visiting the sanctuary during summer, access permits are issued through a lottery. The peak number of applicants was 2,150 in 1993 and over the past 10 years (1996 to 2005) the annual number of applicants averaged approximately 1,300.

The permit system has been modified several times throughout the 1970s and 1980s to accommodate a growing public demand. In 1983, an application fee of five dollars was required to participate in the permit drawing. In 1987, the application fee was raised to ten dollars and a use fee of $40.00 was required of all permit holders. In 1992, the Board of Game substantially revised sanctuary access regulations, and as part of the revision, increased the application and

user fees (the application fee was raised to $20.00; access permits were raised to $100.00 for Alaskan residents and $250.00 for non-Alaskan residents). In 2000, the application fee was raised to $25.00 while access permits were raised to $150.00 for Alaskan residents and $350.00 for non-residents. The permits are issued by lottery for four-day visits scheduled from June 7 through August 25.

A standby system provides opportunities for as many visitors as is possible to visit the bear viewing areas. Until recently, the department had an informal method for issuing standby permits. Under this system, the sanctuary manager was contacted by radio or by visiting the sanctuary and, if any vacancies were available, standby permits were issued on a first-come-first-served basis. The demand for these permits, particularly during the peak viewing period, eventually outgrew this simple system. In 1991, standby permits were issued on a first-come-first-served basis to people who telephoned in at a scheduled time. Managing this system was very labor-intensive and therefore costly. However, this method was very efficient at keeping the number of bear viewers near the maximum of ten people per day. A new procedure for issuing standby permits went into effect in 1993. Standby permits were issued by lottery at the same time as regular bear viewing permits. This is a much less costly and more efficient method. Standby permits originally had a user fee of fifty dollars for Alaskan residents and one hundred twenty-five dollars for non-Alaskan residents (ADF&G 1993). These standby user fees were increased in 2000 to $75.00 for residents and $175.00 for non-residents. In addition, the Commissioner has authority to issue up to 15 permits per year for scientific or educational purposes.

Permits are also required to visit the sanctuary outside the summer viewing period, but the demand for these is very low.

FISH PASSAGE IMPROVEMENTS

Charles McNeil, for whom McNeil River is named, lived seasonally in McNeil Cove for some years between 1911 and about 1923 (McNeil 1924). Although his primary interest was prospecting, he also trapped fur animals, hunted seals, and worked as a salmon stream watchman on local salmon streams. Among McNeil's papers is a photocopy of his log of stream watchman activities during one July. Highlights include:

- July 8 – 9: With partner named Studdert, installed "a box for salmon to ascend the falls" on Mikfik Creek.
- July 12: "Put in log sod and rock wing dam to divert stream enabling salmon to make the grade" up Chenik Creek. "Salmon enter the stream at a rate of 175 per hour during about 5 hours each high tide."
- July 26: Returned to Chenik, "rearranged dam there."

The crude "fish ladder" on Mikfik Creek was still working in the early 1930s.

Mikfik Creek/McNeil River

Agents working for the U.S. Bureau of Fisheries apparently altered the configuration of the falls on "McNeil Creek" in 1932 to improve salmon passage (Bower, 1933). However, some confusion exists as to whether the actual work occurred at McNeil River Falls to improve chum salmon migration or at Mikfik Creek Falls to improve sockeye salmon migration. Commercial

fishermen who historically used the area believe the modification work was performed at McNeil Falls[11]. The relevant passage from the stream improvement section of the Alaska fishery and fur-seal industries in 1932 reads "At the upper falls in McNeil Creek, Kamishak Bay, a fishway was blasted out of the solid rock, through which the fish can pass without difficulty into the creek above. A temporary dam was constructed at the crest of the lower falls in this stream, diverting the water to a side channel of comparatively easy ascent." Additional information is available from ADF&G commercial fishery salmon survey files of Kamishak Bay District, McNeil River (ADF&G Homer files). Under the 1932 entry is written, "stream improvement: fishway blasted out of solid conglomerate rock, cut made in rock 3½ foot wide, averaging 30" deep by 15' in length with drop of 20%." It then mentioned an aerial survey done for sockeye salmon that year. In 1936, the same record mentions "fish climbed falls into lake" and another aerial survey was done for sockeye salmon.

The description of the blast site could describe an area on the north side of the upper McNeil River Falls or an area on the north side of lower Mikfik Falls, or even the upper Mikfik Falls, considering the area has been through at least one earthquake since 1932. The fact that the site is referred to as "McNeil Creek" does not help support either view because "McNeil" has always referred to a river and "Mikfik" to a creek in other early publications (Mather 1923, Orth 1967). Mikfik Creek joins McNeil River in McNeil Lagoon, and becomes a tributary to McNeil River at low tide.

The position that alteration was actually done on Mikfik Creek to improve passage of sockeye salmon is supported by several points. First, in the Bureau of Sport Fishery notation it mentions two falls (an upper and a lower), which best describes Mikfik Creek. McNeil River contains a series of riffles before dropping over a 100-yard stretch, and only the upper extreme of this area impedes fish passage or would be considered a falls (Walker and Aumiller 1993). The lower riffles on McNeil are not conducive to a "temporary dam on its crest" primarily because of the size and volume of the river. Also there is no "side channel at the lower falls" on McNeil River, but an area on Mikfik Creek at its lower falls perfectly fits this description.

Secondly, the major species in McNeil River, chum salmon, were not a species that were held in high regard in the early twentieth century. Sockeye salmon catches reported for central Alaska were eight times what chum catches were in 1932 (Bower 1933). No aerial surveys were conducted for chum salmon in the McNeil system until 1950 (including 1932, the year of alteration) but they were conducted for sockeye salmon several times prior to 1950 (ADF&G files, Homer).

Third, the 1936 aerial survey record for sockeye salmon mentions that the "fish climbed into (the) lake." Mikfik Creek has a lake accessible to salmon, while it is suspected salmon are unable to migrate into the lake on upper McNeil River.

A proposal to introduce an artificial sockeye salmon run into McNeil River and fertilize McNeil Lake was considered and rejected by the ADF&G in 1988. After careful consideration ADF&G Commissioner Don Collinsworth (1988) wrote:

> *. . . an enhancement project at McNeil carries with it too many risks which could adversely affect the highly successful bear-viewing program ... the projected benefits are not worth the costs and unknown impacts . . .*

[11] Cabana, L. Homer resident. Personal interview by L. Aumiller.

Chenik Creek and Lake

Chenik Creek drains into marine waters of Chenik Lagoon. A fishery enhancement project was attempted at the mouth of Chenik Creek two decades after the 1964 earthquake partially blocked the stream mouth. The stream mouth was modified in 1981-82 and again in 1986 by Cook Inlet Aquaculture Association.

As mentioned previously, hatchery-raised sockeye salmon fry (*Oncorhyncus nerka*) were stocked into the lake annually between 1986 and 1996 (except for 1994), and Chenik Lake was also fertilized in an effort to increase sockeye numbers. Unfortunately, due to an outbreak of the IHN 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 have rebounded considerably. In fact, commercial fishing effort directed at this stock was allowed each year from 2004 through 2007, the first time for such activity in over a decade. Additionally, the established sockeye salmon sustainable escapement goal (SEG) for Chenik Lake was met or exceeded each year between 2003 and 2007, also a first for this system in over a decade.

Paint River

The most ambitious fish passage improvement project in either the sanctuary or refuge is the Paint River fish ladder. A forty-foot waterfall at the outlet of Paint River has historically acted as a barrier to salmon passage. In 1991, Cook Inlet Aquaculture Association built a fish ladder to bypass these falls. The Paint River Lakes system, which drains into Paint River, was stocked with hatchery-raised sockeye salmon fry between 1986 and 1995, and experimentally again in 2002. Although these plantings were expected to produce significant numbers of returning adult sockeye salmon, the largest documented run occurred in 2005 when 2,000 fish were estimated by aerial surveys[12]. The historical lack of success with the sockeye salmon enhancement program at Paint River led to the cessation of stocking, and at this time there are no active plans to resume stocking this system. Informal observations from aerial survey overflights suggest that the Paint River fish ladder has sustained some amount of damage in the years since its completion and would likely require significant repairs in order to return it to a fully functional condition.

SPORT FISHING

McNeil River has never been a high use area for sport anglers, perhaps because fishing activity has always been incidental to bear watching in the sanctuary.

In the late 1970s concern was expressed by sanctuary managers that some sport fishing was occurring at McNeil Falls after the summer bear viewing season, and the fishermen, who were not accustomed to being around habituated bears, posed a risk to these bears that would not likely move out of their way[13]. A second concern of sanctuary staff was that during the summer, sport fishing in McNeil River itself was displacing some bears from gaining access to this very valuable food resource. There were also safety concerns for both bears and people that would be in close proximity and competing for the same fish.

The legislation creating the sanctuary was clear in its intent. It was to be a true sanctuary for bears and all human use was secondary. Hence, in 1979 the Board of Fisheries closed McNeil

[12] L.F. Hammarstrom, Div. of Commercial Fisheries Biologist, ADF&G, Homer; personal communication.
[13] Faro, J. ADF&G, retired. Personal interview by L. Aumiller.

River to sport fishing within one-half mile of McNeil Falls. This essentially closed the lower river.

Sport fishing still takes place in the sanctuary, although access permit stipulations allow sport fishing only from the gravel spit near the campground. Sport fishermen and bears are thus separated. Fishermen are allowed to keep fish caught from the gravel spit for immediate consumption in camp.

A small but increasing number of anglers visit Chenik Lake in pursuit of lake trout, while the Kamishak River has been an important sport fishery since the early 1980s. Seven to ten sport fishing lodges annually obtain land use permits from the ADF&G for establishing guide camps and/or storing jet boats near the river's mouth (the lower 1½ miles of the Kamishak River is in the sanctuary). Most sport fishing activity occurs upstream from the sanctuary in Katmai National Park. There was an annual average of approximately 600 visitors to the Kamishak River between 2001 and 2005. During this period, guides reported their clients annually harvested an average of approximately 800 salmon (primarily coho) and landed approximately 6,000 Dolly Varden (most of which were released). Sport Fish harvest and catch data for the refuge and sanctuary area from 1990 to 2004 are shown in Table 9.

COMMERCIAL FISHING

Numerous streams in the Kamishak Bay drainage have historically produced salmon in sufficient quantities to support commercial fishing activities. Today salmon returns to rivers within the sanctuary and refuge form an important component of the commercial purse seine fisheries in Lower Cook Inlet. These rivers and the commercial fisheries associated with them fall within the Kamishak Bay District management unit. Marine waters adjacent to the sanctuary and refuge have been further divided into four separate subdistricts in order to facilitate time and area restrictions on the fleet's activities. The various subdistricts can be opened or closed individually or in combination to target the harvest of surplus stocks, while still protecting the runs to achieve adequate spawning escapements.

Salmon runs in the Kamishak Bay area are managed by ADF&G's Division of Commercial Fisheries from the Homer area office. Commercial fisheries biologists frequently conduct low-level aerial surveys throughout the season to estimate the number of spawning fish returning to the various systems. ADF&G additionally has employed relatively new remote video technology to monitor sockeye salmon escapements at Mikfik Lake (since 1998) and at Chenik Lake (since 2005).

Results from these assessments and harvest information contribute to management strategies used in these fisheries. The overall objective is to achieve sustainable escapement goals while identifying harvestable surpluses on individual stocks within the district.

Mikfik Creek

A commercial purse seine fishery targeting the Mikfik sockeye stock dates back to the early 1900s. As in many streams and rivers throughout Alaska in the early 1900s, Mikfik Creek sockeye salmon were managed by the Federal Bureau of Commercial Fisheries, which frequently posted "stream guards" at the mouth of the lagoon near tidewater to protect against "creek robbing". After statehood, the ADF&G's Division of Commercial Fisheries became responsible for management of these stocks.

Until 1988, the fishery was managed using an escapement goal of 5,000 fish. The return was gauged from aerial escapement estimates, and limited commercial fishing was permitted in the bay outside the lagoon. In some years however, large groups of fish returning over short periods of time resulted in large buildups of fish in McNeil Lagoon and Mikfik Creek during early stages of the run. As a result, special emergency fishery openings inside McNeil Lagoon were commonly utilized to harvest fish excess to escapement needs.

In an attempt to minimize fishing activities inside McNeil Lagoon, ADF&G implemented a new non-regulatory management plan beginning in 1988. This plan revised the Mikfik Creek sockeye salmon escapement goal to a range of 5,000-7,000 fish, and set stricter guidelines on commercial fishing inside McNeil Lagoon. The most recent special opening inside McNeil Lagoon, to target sockeye salmon bound for Mikfik Lake, occurred in 1999 when an estimated 6,000 sockeyes were taken in a single two-hour opening.

The relatively small size of Mikfik Lake limits its capacity to produce a large, commercial surplus of sockeye salmon. When combined with the downturn in the Alaska salmon market, this has resulted in very little targeted commercial fishing effort and only negligible harvests in recent years. In addition, after a careful escapement goal review conducted by ADF&G's Division of Commercial Fisheries in 2001, a new sustainable escapement goal (SEG) range of 6,300 to 12,150 sockeye salmon was established and implemented for the Mikfik Creek system beginning in 2002, based on the Policy for the Management of Sustainable Salmon Fisheries (5 AAC 39.222).

McNeil River

Commercial purse seining on McNeil River chum stock dates back to the early 1900s and, like Mikfik Creek, was managed by the Federal Bureau of Commercial Fisheries prior to statehood. Commercial harvests historically occurred in McNeil Cove and occasionally inside McNeil Lagoon, which is a traditional safe anchorage for fishing boats.

Management of the McNeil River chum salmon return to McNeil River seeks to maintain a healthy salmon population at a sustained yield by endeavoring to achieve the escapement goal. Surpluses beyond the escapement goal are targeted for harvest by the Lower Cook Inlet commercial purse seine fishery. A wide variety of factors can affect run size and timing to produce unexpected results.

Activity of the commercial fishery in the bay just seaward of the intertidal lagoon can affect timing of fish moving into McNeil River. The commercial fishing fleet is managed with a tightly regulated fishing schedule. Harsh weather conditions also play a major role, frequently preventing fishing activities even during open fishing periods.

The commercial fisheries management staff recognized that bear viewing opportunities in McNeil Sanctuary may be influenced by commercial fishing activities occurring within or in close proximity to the Sanctuary. The Mikfik Creek - McNeil Lagoon Salmon Fishery Management Plan approved by the ADF&G Commissioner in 1988 and the McNeil River Chum Salmon Fishery Management Plan (1993) addressed this. These plans were non-regulatory and have since been superseded by the Lower Cook Inlet Management plan (5 AAC 21.369) and the Policy for the Management of Sustainable Salmon Fisheries (5 AAC 39.222).

Because chum salmon runs to McNeil River have been considered generally weak since 1988, very little directed commercial fishing activity targeting this stock has been allowed since then

and only minor harvests, cumulatively totaling less than 3,000 fish, have resulted. Marine waters of McNeil Cove have been closed to commercial salmon fishing for the duration of the chum salmon return to that system between the years 2000 and 2007.

Chenik Lake

Chenik Lake was historically an excellent sockeye salmon producer prior to the 1940s when annual runs approached 150,000 fish. After that time, however, sockeye salmon runs declined dramatically, forcing complete closure of the Chenik area fishery beginning in 1952. By the mid-70s the annual return to this system was less than 500 fish. In 1978, ADF&G initiated a program to re-establish sockeye salmon returns and subsequently increase commercial fishing opportunities in the Kamishak Bay area. Sockeye salmon fry were annually stocked in Chenik Lake from 1986 and 1996 (except for 1994 when no fry were available), and a partial migrational barrier at the intertidal mouth of Chenik Creek was modified to allow easier fish passage.

Beginning in 1987, and from 1989 through 1991, lake enrichment occurred through the application of liquid fertilizer. Increased escapements in the early 1980s augmented production, and the Chenik area was re-opened to commercial fishing. Returns in the late 1980s accounted for nearly 50% of the total Lower Cook Inlet commercial sockeye salmon harvest in some years, approaching the historical record high runs of the 1930s.

A steady decline in Chenik sockeye runs beginning in 1989 was attributed to an outbreak of the IHN virus in the system. This condition appeared to suppress juvenile sockeye salmon survival in the lake, and the stocking program was consequently discontinued after the 1996 season. Marine waters of the Chenik Subdistrict were closed beginning with the 1994 season to protect returning adult fish for escapement purposes. Runs remained low for the rest of the 1990s and early 2000s, but in 2003 the sockeye run to Chenik Lake was unexpectedly strong, totaling almost 14,000 fish, all of which were allowed to enter the system as escapement. During the ensuing four seasons, runs to Chenik Lake exhibited sufficient strength to allow commercial exploitation while still achieving the established escapement goal. In 2004, commercial fishing was allowed in Chenik Subdistrict for the first time in over a decade, resulting in a harvest totaling approximately 33,000 sockeyes, followed by catches of 47,000, 12,000, and 162,000 sockeyes over the next three seasons, respectively. It should be noted that all runs of sockeye salmon to the Chenik Lake system in recent years are the result of natural production.

Kamishak River

The lower 1/2 mile of the Kamishak River and several miles of the lower Little Kamishak River fall within the boundaries of the sanctuary. These drainages support all five species of salmon, and at times have contributed significant numbers of sockeye, chum, and coho salmon to the commercial purse seine fishery. Catches of salmon bound for these rivers occur in nearby Akumwarvik Bay as well as farther to the east in the Douglas River Subdistrict. The lower Kamishak River also offers one of the few safe anchorages on the west side of Lower Cook Inlet.

MINING, MINERAL EXPLORATION, AND MINING CLAIMS

On the headwaters of Paint River on Crevice Creek, in an area where the Kamishak formation is found, Charles McNeil had his mining claim. It was first filed in 1911 and was called the Reward Group (Walker and Aumiller 1993). By 1923, when Mather visited the site E.H. Holly, McNeil, and others had pending applications for patent on five claims (Mather 1925). Mather noted a number of prospect pits and one tunnel about sixty feet long from which some ore had

been extracted – "most of the workings had caved in and many were mere pits in the gossan" (Mather 1925). This mining claim was seventeen miles from the shore of Kamishak Bay. For access, a camp was established in McNeil Lagoon and from there a primitive wagon road stretched six miles to the mouth of Kenty Creek and at that point a horse trail led to the site a short distance below the mouth of Crevice Creek on Paint River. McNeil let his claims lapse sometime after the 1920s.

Interest was revived in the McNeil claims in 1959 when E. Sargent and Associates relocated the claims in the Crevice Creek area and initiated a vigorous prospecting program. The claims and workings were examined by the Alaska Territorial Department of Mines in 1953 and 1955 (Jasper 1953 and 1956). The claims were apparently abandoned around 1970, and there are no current claims near Crevice Creek.

In the summer of 1963, a team of geologists from the State of Alaska, Department of Natural Resources visited the Crevice Creek area to conduct geologic, geochemical, and magnetic studies (Richter and Herried 1965). Approximately twenty-five square miles were surveyed and the principal mineral showings were mapped. In 1991, American Copper and Nickel Company, Inc., and Cominco Mining Company staked several mining claims around the Paint River Lakes system.

OIL AND GAS EXPLORATION

In 1921, Charles McNeil applied to the United States Land Office for a permit to prospect for oil and gas on about four square miles of land located on the south shore of Kamishak Bay, and prepared a "Notice of Oil Land Location." The prospecting would occur on a claim called the Douglas Dome Oil Claim. The application was to secure "a permit to prospect for oil and gas, and thereafter a lease upon said lands for the purposes of extracting oil and gas therefrom" (McNeil 1921). The necessary permit was subsequently granted "to prospect for oil and gas" (U.S. Department of the Interior 1921).

As of 1994, offshore oil and gas exploration was just beginning. A lease sale is scheduled in the near future for lower Cook Inlet waters and may include areas offshore of the refuge and sanctuary.

BROWN BEAR RESEARCH AND PUBLICATIONS

Two books (Bledsoe 1987, Walker and Aumiller 1993) and two videos (*A Gathering of Bears,* Alaska Video Postcards, 1993; *Showdown at Grizzly River*, WNET–for PBS Nature series, 2000) have been produced about the bears that use McNeil River. Numerous scientific papers have been written about research conducted in the sanctuary including papers on bear life history (Glenn et al., 1976; Modafferi 1984; Sellers and Aumiller 1994); social behavior (Stonorov 1970, Stonorov and Stokes 1972, Egbert and Stokes 1976, Egbert 1978); fishing behavior (Luque and Stokes 1976, Luque 1978, Aumiller 1995); non-consumptive use programs (Faro and Eide 1974, Aumiller and Matt 1994, Titus et al., 1994); other bear activities including adoption and cub mortality (Erikson 1963, Hessing and Aumiller 1995); and the economic value of the sanctuary (Clayton and Mendelsohn 1993).

Over 60 articles about the bears that seasonally use McNeil River have been published in U.S. magazines (Table 10), and at least another ten articles have been published in foreign magazines.

Tabulating the thousands of published photographs that have been taken in the sanctuary is an impossible task, as available photographic opportunities are well utilized. For example,

professional photographer Boyd Norton[14] estimated that he had over two million photographs in various books and articles of a particular individual bear.

LAND STATUS

The Bureau of Land Management owns and manages approximately ¼ of Sec 1, T33S, R13W, which lies within the refuge boundary and adjacent to Katmai National Park (Appendix B: Map Section). All other land in the sanctuary and refuge is state-patented or tentatively approved state land.

A final decision has been reached regarding acquisition of the 14 sections encompassing Chenik Lake and Chenik Head that were jointly selected by the state and Seldovia Native Corporation. The land and mineral rights of these 14 sections were tentatively approved for conveyance to the State of Alaska on September 30, 2003 via the Bureau of Land Managements case file AA-38411 and state case file FG-25. This land is now managed by the Department as refuge land.

LAND USE ACTIVITIES

Certain land uses and other activities conducted within the refuge or sanctuary require authorization from the ADF&G in the form of a Special Area Permit. To date, these activities have included:

Sanctuary

- Facilities, campground, and trails to support ADF&G's bear-viewing program at McNeil River.
- Remote satellite/internet bear camera at McNeil River Falls.
- Archaeological survey at McNeil River, McNeil Lagoon, and McNeil River camp.
- Boat storage at Kamishak River (up to 10 permits annually).
- Guide camp at Kamishak River (up to 10 permits annually).
- Remote video camera/recorder to determine sockeye salmon escapement at Mikfik Lake.

Refuge

- Fisheries weir on Chenik Creek.
- Fisheries research cabin at Chenik Lake.
- Temporary commercial bear-viewing camp at Chenik Lake (up to 2 annually).
- Remote video camera/recorder to determine sockeye salmon escapement at Chenik Lake.
- Permanent geological GPS research station.

RECOGNITIONS

The McNeil River State Game Sanctuary was designated a National Natural Landmark in 1967. National Natural Landmarks are areas representing the best examples of the ecological and geographical features comprising our nation's natural history. The National Natural Landmarks Program was established by the National Park Service to help identify and encourage the preservation of these significant areas. The objectives of the program are to encourage the preservation of sites illustrating the geological and ecological character of the United States, to enhance the scientific and educational value of sites thus preserved, to strengthen public

[14] Norton, B. Personal interview with L. Aumiller.

appreciation of natural history, and to foster a greater concern in the conservation of the nation's natural heritage.

The National Registry of Natural Landmarks thus provides an important complement to the National Park System for many natural areas of national significance that cannot or need not be acquired by the federal government and managed by the National Park Service. Sites determined to be one of the best examples of a natural region's characteristic biotic or geologic features are considered nationally significant. Department of the Interior standards used to make that determination include primary criteria which consider the illustrative character and present condition of a site and secondary criteria which consider the diversity and rarity of additional features within a site, as well as its value for science and education.

National Natural Landmark designation may be conferred upon sites under any land ownership. Designation does not change the ownership or management of a site, nor does it carry with it any regulations or restrictions regarding its use or future development.

INFORMATION NEEDS

The Department has identified a number of information needs relevant to management of the refuge and sanctuary. The following list is not presented in any order of need or priority:

- Conduct periodic brown bear surveys/monitoring of Paint River for baseline data should the fish ladder ever become functional, including periodic monitoring of the Paint River Fish Ladder for bear use.
- Conduct a comprehensive inventory and status of sanctuary/refuge birds, mammals, and plants, including plant communities.
- Conduct vegetative survey; develop and print plant checklists.
- Conduct research to better understand the movements of brown bears in and around the sanctuary and the importance of regional factors (including brown bear harvest) that may influence bear use of McNeil River.
- Conduct research to better understand the dynamics of fish runs and bear use of fish within the McNeil River State Game Sanctuary. Evaluate these data in terms of the relationships between the brown bears that seasonally use the McNeil River area and commercial fishing operations.
- Continue to conduct surveys of brown bears in the sanctuary to determine bear use trends.
- Conduct an eagle nest survey of the refuge and sanctuary.
- Continue to document commercial fishing activity as it relates to the refuge and sanctuary.
- Monitor levels of public use in the refuge and sanctuary and document resource impacts (if any).

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TABLES

Table A1.–Flowering plants noted in the sanctuary and refuge.

SPECIES

Family *Cyperaceae* (Sedge Family)
- Cottongrass *Eriophorum*

Family *Liliaceae* (Lily Family)
- Chocolate Lily *Fritillaria camschatcensis*
- False Hellebore *Veratrum viride eschscholtzii*
- False Asphodel *Tofieldia* spp.

Family *Iridaceae* (Iris Family)
- Wild Iris *Iris setosa*

Family *Orchidaceae* (Orchis Family)
- Lady's Slipper *Cypripedium guttatum*
- Orchis *Coeloglossum viride bracteatum*

Family *Urticaceae* (Nettle Family)
- Nettles *Urtica gracilis*

Family *Polygonaceae* (Buckwheat Family)
- Sourdock *Rumex arcticus*
- Mountain Sorrel *Oxyria digyna*
- Bistort *Polygonum bistorta*
- Polygonum *Polygonum viviparum*

Family *Caryophyllaceae* (Pink Family)
- Moss Campion *Silene acaulis*
- Minuartia *Minuartia macrocarpa*
- Chickweed *Stellaria sitchana*
- Beach Greens *Honckenya peploides major*

Family *Ranunculaceae* (Crowfoot Family)
- Narcissus flowered Anenome *Anenome narcissiflora*
- Marsh Marigold *Caltha palustris*
- Meadow Rue *Thalictrum sparsiflorum*
- Monkshood *Aconitum delphinifolium*

Family *Papaveraceae* (Poppy Family)
- Poppy *Papaver alaskanum*

Family *Cruciferae* (Mustard Family)
- Kamchatka Rockcress *Arabis lyrata kamchatica*
- Winter Cress *Barbarea orthoceras*
- Draba *Draba borealis*
- Scurvy Grass *Cochlearia officinalis oblongifolia*

Family *Crassulaceae* (Stonecrop Family)
- Roseroot *Sédum rósea integrifólium*

Family *Saxifragaceae* (Saxifrage Family)
- Spotted Saxifrage *Saxifraga bronchialis*
- Saxifrage *Saxifraga punctata pacifica*
- Northern Water Carpet *Chrysosplemium tetrandrum*
- Bog Saxifrage *Saxifraga hirculus*
- Saxifrage *Saxifraga rivularis flexuosa*
- Grass of Parnassus *Parnassia palustris*
- Alpine Heuchera *Heuchera glabra*

Family *Rosaceae* (Rose Family)
- Cloudberry *Rubus chamaemorus*
- Nagoonberry *Rubus arcticus*
- Cinquefoil *Potentilla villosa*
- Shrubby Cinquefoil *Potentilla fruticosa*
- Cinquefoil *Potentilla hyparctica*
- Geum *Geum macrophyllum*
- Pacific Silverweed *Potentilla egedii grandis*
- Salmonberry *Rubus spectabilis*
- Burnet *Sanguisorba menziesii*
- Dryas *Dryas octopetala*
- Two-flowered Cinquefoil *Potentilla biflora*
- Alaska Spiraea *Spiraea Beauverdiana*

Family *Leguminosae* (Pea Family)
- Blackish Oxytrope *Oxytropis nigrescens*
- Lupine *Lupinus nootkensis*
- Wild Sweetpea *Lathyrus palustris* (Vetchling)
- Eskimo Potato *Hedysarum lanatum*
- Yellow Oxytrope *Oxytropis maydelliana*
- Oxytrope *Oxytropis viscida*
- Oxytrope *Oxytropis deflexa*

Family *Geraniaceae* (Geranium Family)
- Wild Geranium *Geranium erianthum* (Cranesbill)

Family *Violaceae* (Violet Family)
- Yellow violet *Viola glabella*
- Yellow violet *Viola biflora*
- Alaska violet *Viola langsdorffii*
- Marsh violet *Viola epipsila*

Family *Onagraceae* (Evening Primrose Family)
- Fireweed *Epilobeum latifolium* (River beauty)
- Epilobeum *Epilobeum sertulatum*
- Fireweed *Epilobeum angustifolium*

Family *Araliaceae* (Ginseng Family)
- Devil's Club *Echinopanax horridum*

Family *Umbelliferae* (Parsley Family)
Angelica *Angelica lucida*
Cow Parsnip *Heracleum lanatum*
Beach Lovage *Ligusticum scoticum Hultenii*
Hemlock Parsley *Conioselinum chinense*

Family *Cornaceae* (Dogwood Family)
Dogwood *Cornus canadensis*

Family *Pyrolaceae* (Wintergreen Family)
Wintergreen *Pyrola asarifolia* (Pink Pyrola)

Family *Ericaeae* (Heath Family)
Labrador Tea *Ledum palustre decumbens*
Bog Rosemary *Andromeda polifolia*
Lingonberry *Vaccinium vitis-idaea*
Alpine Azalea *Loiseleuria procumbens* A–
Alpine Blueberry *Vaccinium uliginosum*
Kamchatka Rhododendron *Rhododendron camtschaticum*
Bearberry *Arctostaphylos uva-ursi*

Family *Diapensiaceae* (Diapensia Family)
Diapensia *Diapensia lapponica*

Family *Primulaceae* (Primrose Family)
Pixie Eyes *Primula cuneifolia*
Starflower *Trientalis europaea*
Rock Jasmine *Androsace chamaejasme*
Greenland Primrose *Primula egaliksensis*

Family *Gentianaeae* (Gentian Family)
Swertia *Swertia perennis*
Whitish Gentian *Gentiana algida*

Family *Polemoniaceae* (Polemonium Family)
Jacob's Ladder *Polemonium boreale*
Tall Jacob's Ladder *Polemonium acutiflorum*

Family *Boraginaceae* (Borage Family)
Oysterleaf *Mertensia maritima*
Forget-me-not *Myosotis alpestris*

Family *Scrophulariaceae* (Figwort Family)
Wooly Lousewort *Pedicularis kanei*
Weasel Snout *Lagotis glauca*
Coastal Paintbrush *Castilleja unalaschcensis*
Lousewort *Pedicularis langsdorffi arctica*
Lousewort *Pedicularis verticillata*
Yellow Monkey Flower *Mimulus guttatus*
Yellow Rattle *Rhinanthus minor borealis*

Family *Orobanchaceae* (Broomrape Family)
Broomrape *Boschniakia rossica*

Family *Lentibulariaceae* (Bladderwort Family)
Bog Violet *Pinguicula vulgaris* (Butterwort)

Family *Plantaginaceae* (Plantain Family)
Goosetongue *Plantago maritima*

Family *Rubiaceae* (Madder Family)
Northern Bedstraw *Galium boreale*

Family *Caprifoliaceae* (Honeysuckle Family)
High Bush Cranberry *Viburnum edule*
Elderberry *Sambucus racemosa pubens*
Twinflower *Linnaea borealis*

Family *Campanulaceae* (Bluebell Family)
Harebell *Campanula lasiocarpa* (Bluebell)

Family *Compositae* (Composite Family)
Pussy Toe *Antennaria rosea*
Dandelion *Taraxacum trigonolobum*
Yarrow *Achillea borealis*
Arnica *Arnica frigida*
Senecio *Senecio lugens*
Senecio *Senecio resedifolius*
Goldenrod *Solidago multiradiata*
Arnica *Arnica lessingii*
Wormwood *Artemesia arctica arctica*
Arctic Daisy *Chrysanthemum arcticum*
Senecio *Senecio hyperborealis*
Beach Senecio *Senecio psuedo-Arnica*
Saussurea *Saussurea angustifolia*
Pineapple Weed *Matricaria matricarioides*

Table A2.–Species found on Amakdedori Beach (Cunning 1977).

- EUCARDIA (crabs)
  - A–*Oregonia gracilis*
  - *A–Telmessus cheiragonus*
  - A–
- OPHIUROIDEA (brittle stars)
  - A–*Ophiopholis aculeata*
- HOLOTHUROIDEA (sea cucumbers)
  - A–*Parastichopus californicus*
- ECHINOIDEA (sea urchins)
  - A–*Strongylocentrotus drobachiensis*
- CIRRIPEDIA (barnacles)
  - A–*Balanus sp*.
  - *A–Chthamalus sp*.
  - *A–Lepas sp*.
  - *A–Lepas fascicularis*
- POLYPLACOPHORA (gumboots)
  - A–*Chryptochiton stelleri*
- ASTEROIDEA (sea star)
  - A–*Crossaster papposus*
- FISH
  - A–*Gadus macrocephalus*
- ALGAE
  - A–*Agarum sp*.
  - *A–Alaris sp*.
  - *A–Constantinia sp*.
  - *A–Desmarestia sp*.
  - *A–Fucus sp*.
  - *A–Halosaccion sp*.
  - *A–Laminaria sp*.
  - *A–Nereocystis leutkeana*
- GASTROPODA
  - A–(Limpets)
  - A–*Collisella sp*.
  - *A–Punctarella multistriata*
  - A–(snails and whelks)
  - A–*Beringius kennicottii*
  - *A–Fusitriton oregonensis*
  - *A–Thais sp*.
  - *A–Thais emarginata*
  - *A–Trichotropis insignis*
  - *A–Velutina sp*.
- BRYOZOA (moss animals)
  - A–*Caulibugula sp*.
  - *A–Dendrobeania murropana*
  - *A–Dendrobeania multiseriata*
  - *A–Flustrella gigantea*
  - *A–Terminoflustra membranaceo-truncata*
- HYDROID
  - A–*Abietinaria sp*.
  - *A–Eucrata loricata*
  - *A–Thuiaria sp*.
- BIVALVIA (clams, mussels, cockles)
  - A–*Clinocardium nuttalli*
  - *A–Hiatella sp*.
  - *A–Hiatella arctica*
  - *A–Macoma sp*.
  - *A–Macoma balthica*
  - *A–Modiolus modiolus*
  - *A–Musculus discors*
  - *A–Mya truncata*
  - *A–Mytilus edulis*
  - *A–Pododesmus macroschisma*
  - *A–Saxidomus giganteus*
  - *A–Siliqua alta*
  - *A–Siliqua patula*
  - *A–Siliqua sp*.
  - A–*Tellina lutea*
- PORIFERA (sponges)
  - A–*Esperiopsis laxa*
  - *A–Halichondria panicea*
  - *A–Suberites ficus*
- UROCHORDATA (tunicates)
  - A–*Halosynthia aurantiam*

Table A3.– Birds Observed at McNeil River State Game Sanctuary and Adjacent Marine Waters.

SPECIES

Family *Gaviidae*
- red-throated loon *Gavia stellata**
- Pacific loon *G. pacifica*
- common loon *G. immer*

Family *Falconidae*
- American kestrel *Falco sparverius*
- Merlin *F. columbarius*
- peregrine falcon *F. peregrinus**
- gyrfalcon *F. rusticolus*

Family *Scolopacidae*
- greater yellowlegs *Tringa melanoleuca**
- solitary sandpiper *T. solitaria*
- wandering tattler *Heteroscelus incanus*
- spotted sandpiper *Actitis macularia*
- whimbrel *Numerius phaeopus*
- bar-tailed godwit *Limosa lapponica*
- ruddy turnstone *Arenaria interpres*
- black turnstone *A. melanocephala*
- surfbird *Aphriza virgata*
- red knot *Calidris canutus*
- western sandpiper *C. mauri*
- least sandpiper *C. minutilla*
- pectoral sandpiper *C. melanotos*
- rock sandpiper *C. ptilocnemis*
- dunlin *C. alpina*
- short-billed dowitcher *Limnodromus griseus*
- common snipe *Gallinago gallinago**
- red-necked phalarope *Phalaropus lobatus*
- red phalarope *P. fulicaria*

Family *Podicipedidae*
- horned grebe *Podiceps auritus*
- red-necked grebe *P. grisegena*

Family *Phasianidae*
- willow ptarmigan *Lagopus lagopus**
- rock ptarmigan *L. mutus*

Family *Procellariidae*
- northern fulmar *Fulmarus glaciali*

Family *Gruidae*
- sandhill crane *Grus canadensis*

Family *Hydrobatidae*
- fork-tailed storm-petrel *Oceanodroma furcata*

Family *Charadriidae*
- black-bellied plover *Pluvialis squatarola*
- lesser golden plover *P. dominica*
- semi-palmated plover *Charadrius semipalmatus**

Family *Phalacrocoracidae*
- double-crested cormorant *Phalacrocorax auritus**
- pelagic cormorant *P. pelagicus**

Family *Haematopodidae*
- black oystercatcher *Haematopus bachmani**

Family *Anatidae*
- tundra swan *Cygnus columbianus*
- greater white-fronted goose *Anser albifrons*
- snow goose *Chen caerulescens*
- emperor goose *C. canagica*
- brant *Branta bernicla*
- Canada goose *B. canadensis*
- green-winged teal *Anas crecca**
- mallard *A. platyrhynchos**
- northern pintail *A. acuta**
- northern shoveler *A. clypeata*
- Eurasian wigeon *A. penelope*
- American wigeon *A. americana*
- greater scaup *Aythya marila*
- common eider *Somateria mollissima*
- king eider *S. spectabilis*
- Steller's eider *Polysticta stell*eri
- harlequin duck *Histrionicus histrionicus**
- oldsquaw *Clangula hyemalis*
- black scoter *Melanitta nigra*
- surf scoter *M. perspicillata*
- white-winged scoter *M. fusca**
- common goldeneye *Bucephala clangula*
- Barrow's goldeneye *B. islandica*
- common merganser *Mergus merganser*
- red-breasted merganser *M. serrator**

Family *Laridae*
- parasitic jaeger *Stercorarius parasiticus*
- Bonaparte's gull *Larus philadelphia**
- mew gull *L. canus**
- herring gull *L. argentatus**
- glaucous-winged gull *L. glaucescens**
- black-legged kittiwake *Rissa tridactyla**
- Sabine's gull *Xema sabini*
- Arctic tern *Sterna paradisaea*
- Aleutian tern *S. aleutica*

Family *Accipitridae*
- osprey *Pandion haliaetus*
- bald eagle *Haliaeetus leucocephalus**
- golden eagle *Aquila chrysaetos*
- northern harrier *Circus cyaneus**
- sharp-shinned hawk *Accipter striatus*
- rough-legged hawk *Buteo lagopus**

Family *Motacillidae*
- American pipit *Anthus rubenscens**

Family *Alcidae*
- common murre *Uria aalge**
- pigeon guillemot *Cepphus columba**
- marbled murrelet *Brachyramphus marmoratus*
- parakeet auklet *Cyclorrhynchus psittacula*
- crested auklet *Aethia cristatella*
- tufted puffin *Fratercula cirrhata**
- horned puffin *F. corniculata**

Family *Bombycillidae*
- Bohemian waxwing *Bombycilla garrulus*

Table 3A.-Page 2 of 2.

Family *Laniidae*
northern shrike *Lanius excubia*

Family *Columbidae*
domestic pigeon (banded)

Family *Strigidae*
northern hawk owl *Surnia ulula*
short-eared owl *Asio flammeus**

Family *Alcedinidae*
belted kingfisher *Ceryle alcyon*

Family *Picidae*
northern flicker *Colaptes auratus*

Family *Hirundinidae*
tree swallow *Tachycineta bicolor**
violet-green swallow *T. thalassina*
bank swallow *Riparia riparia**
cliff swallow *Hirundo pyrrhonota**

Family *Cinclidae*
American dipper *Cinclus mesicanus**

Family E*mberzidae*
orange-crowned warbler Vermi*vora celatay**
yellow warbler *Dendroica petechia**
yellow-rumped warbler *D. coronata**
blackpole warbler *D. striata*
northern waterthrush *Seiurus noveboracensis**
Wilson's warbler *Wilsonia pusilla**
American tree sparrow Spize*lla arborea**
Savannah sparrow *Passereulus sandwichensis**
fox sparrow *Passerella iliaca**
song sparrow *Melospiza melodia*
golden-crowned sparrow *Zonotrichia atricapilla**
white-crowned sparrow *Z. leucophyrus*
dark-eyed junco *Junco hyemalis*
Lapland longspur *Calcarius lapponicus*
snow bunting *Plectrophenax nivalis*
McKay's bunting *Plectrophenax nivalis*

rusty blackbird *Euphagus carolinus*

Family *Fringillidae*
rosy finch *Leucosticte arctoa*
pine grosbeak *Pinicola enucleator*
common redpoll *carduelis flammea*

Family *Corvidae*
gray jay *Perisoreus canadensis*
black-billed magpie *Pica Pica**
northwestern crow *Corvus caurinus*
common raven *C. corax**

Family Paridae
black-capped chickadee *Parus atricapillus*
boreal chickadee *P. hudsonicus*

Family *Muscicapidae*
ruby-crowned kinglet *Regulus calendula*
gray-cheeked thrush *Catharus minimus**
hermit thrush *C. guttatus**
American robin *Turdus migratorius**
varied thrush *Ixoreus naevius*

OTHER BIRDS EXPECTED
red-faced cormorant *Phalacrocorax urile*
Kittlitz's murrelet *Brachyramphus brevirostris*+
thick-billed murre *Uria lomvia*+

Source: A–Bird species were compiled by Larry Aumiller, Polly Hessing, and Colleen Matt from 1976 to 1994. Observations were A–made as early as May 1 and as late as October 30, but were generally made between early-June and late-August.

* = Nesting

+ = Observed near Chenik Head - (L. Johnson, ADF&G retired. Personal interview with L. Aumiller).

Table A4.–Seabird Nesting Colonies within or offshore from McNeil River State Game Sanctuary or State Game Refuge.

1. Nordyke Island (FWS colony No. 51-001)

A–Glaucous-winged gull
A–Tufted puffin
A–Pigeon guillemot
A–Black oystercatcher
A–Double-crested cormorant

2. Akumwarvik Bay (FWS colony No. 51-005)

A–Glaucous-winged gull
A–Pigeon guillemot

3. McNeil Islet (FWS colony No. 51-007)

A–Common murres

4. McNeil Cove (FWS colony No. 51-008)

A–Double-crested cormorant
A–Pigeon guillemot
A–Horned puffin
A–Glaucous-winged gull

5. Amakdedulia Cove (FWS colony No. 51-009)

A–Double-crested cormorant
A–Tufted puffin
A–Glaucous-winged gull

6. Amakdedulia Island (FWS colony No. 51-010)

A–Black oystercatcher
A–Glaucous-winged gull

7. McNeil Head (FWS colony No. 51-034)

A–Double-crested cormorant
A–Glaucous-winged gull

8. Paint River (FWS colony No. 51-035)

A–Glaucous-winged gull

Table A5.–Mammals Observed at McNeil River State Game Sanctuary, 1976 – 2005*.

Common Name	*A–Scientific Name*
Masked Shrew	*A–Sorex cinereus*
Dusky shrew	*A–Sorex monticolus*
Little brown bat	*A–Myotis lucifuga*★
Snowshoe hare	*A–Lepus americanus*★
Hoary marmot	*A–Marmota caligata*
Arctic ground squirrel	*A–Spermophilus parryii*
Beaver	*A–Castor canadensis*
Brown lemming	*A–Lemmus trimucronatus*
Northern red backed vole	*A–Clethrionomys rutilus*
Meadow vole	*A–Microtus pennsylvanicus*
Tundra vole	*A–Microtus oeconomus*
Muskrat	*A–Ondatra zibethicus*★
Meadow jumping mouse	*A–Zapus hudsonius*
Porcupine	*A–Erethizon dorsatum*★
Short-tailed weasel/ermine	*A–Mustela erminea*★
Mink	*A–Mustela vison*★
River otter	*A–Lutra canadensis*
Red fox	*A–Vulpes vulpes*
Wolverine	*A–Gulo gulo*★
Coyote	A–*Canis latrans*★
Gray wolf	*A–Canis lupus*★
Brown bear	*A–Ursus arctos*
Moose	*A–Alces alces*
Caribou	*A–Rangifer tarandus*★
Sea otter	*A–Enhydra lutris*+
Harbor seal	*A–Phoca vitulina*+
Steller sea lion	A–*Eumetopias jubatus*★
Beluga	*A–Delphinapterus leucas*+

***** Mammal sightings were generally made from late May through early September.

★ Rare or unusual sightings.

\+ Seen in McNeil Lagoon or nearby marine waters.

Table A6.–Sex and Age Composition of Brown Bears at McNeil River State Game Sanctuary: 1976-2005[1] .

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

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

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

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

Table A7.–McNeil River State Game Sanctuary bear use figures by area.

McNeil River State Game Sanctuary
Bear Use Figures by Area
(Bear use is the total number of bears seen, added daily, throughout the season)

Year	McNeil Falls			Lower McNeil River			Mikfik Creek			All Other Areas (Flats, bluffs, etc.)			* Total Bears		
	Adult Sub-Adult	All cubs	Total	Adult Sub-Adult	All cubs	Total	Adult Sub-Adult	All cubs	Total	Adult Sub-Adult	All cubs	Total	Adult Sub-Adult	All cubs	Total
1980	709	140	849	14	15	29	46	21	67	162	56	218	924	218	1142
1981	878	224	1102	-	-	-	18	21	39	77	63	140	973	308	1281
1982	925	142	1067	21	9	30	28	2	30	83	33	116	1054	186	1240
1983	926	172	1098	-	-	-	8	0	8	100	41	141	1032	213	1245
1984	1218	274	1492	50	9	59	43	0	43	123	39	162	1432	322	1754
1985	1514	451	1965	37	31	68	150	56	206	195	100	295	1888	642	2530
1986	1649	494	2143	34	42	76	192	126	318	214	172	386	2061	825	2886
1987	1723	465	2188	9	12	21	235	86	321	161	152	313	2126	715	2841
1988	1515	471	1986	30	40	70	201	28	229	142	48	190	1873	524	2397
1989	1863	699	2562	119	80	199	156	71	227	174	189	363	2300	1032	3332
1990	1606	551	2157	76	57	133	229	159	388	264	251	515	2089	936	3025
1991	1393	388	1781	1	0	1	428	120	548	246	138	384	2039	631	2670
1992	1510	480	1990	3	6	9	385	115	500	178	139	317	2075	738	2813
1993	1240	86	1326	94	57	151	234	26	260	358	164	522	1921	227	2148
1994	1165	125	1290	95	59	154	212	29	241	208	103	311	1661	307	1968
1995	1137	147	1284	113	64	177	229	6	235	298	120	418	1741	329	2070
1996	1301	229	1530	90	40	130	419	105	524	153	75	228	1957	449	2406
1997	1510	454	1964	151	52	203	207	62	269	162	147	309	2030	715	2745
1998	1396	235	1631	147	61	208	459	205	664	179	179	358	2181	680	2861
1999	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2002	1144	175	1319	86	70	156	407	213	620	143	111	254	1780	569	2349
2003	938	233	1171	226	123	349	477	234	711	62	44	106	1713	643	2356
2004	825	100	925	175	98	273	273	74	347	128	37	165	1401	307	1708
2005	782	82	864	268	100	368	413	128	541	156	119	275	1619	429	2048

Notes: * = Total Bears may be less than the sum of the first four columns if a bear is counted using more than one area in the same day. Total for June, July and August ONLY! (Does not include May or September)

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- Each time a recognizable bear is seen in an area of the sanctuary, it is counted as one bear use day for that area. Hence, if 10 different bears are seen at McNeil Falls 10 days in a row, that equals 100 bear use days for McNeil Falls. The total bears column may be less than the sum of the first four columns if a bear is counted using more than one area in the same day. Bears are noted opportunistically and figures reflect not only actual bear use but to some degree the amount of time spent viewing.
- McNeil Falls sightings are made from the viewing pad and include any recognizable bear no matter where it is or how far down stream it is.
- Lower McNeil River sightings are made from the mouth of McNeil River, generally from Enders Island. Viewing occurs here in mid to late July after bear activity ceases at McNeil Falls. Little or no time was spent viewing here from 1980-1983.
- Mikfik Creek is defined as the area up creek from the last area of tidal influence, including the area referred to as the "riffles".
- All other areas includes anywhere in McNeil Cove that is not included in the first three categories. This includes the sedge flats, beach, by camp, or on any of the bluff areas. Through the years notations of bear use in these areas has been very casual as very little time comparatively is spent systematically bear watching away from the first three areas.

Table A8.–One-sided Shewhart control chart for the seven highest daily and hourly bear counts at McNeil River Falls, McNeil River State Sanctuary, Alaska, 1983 - 2005 ($\alpha = 0.01$).

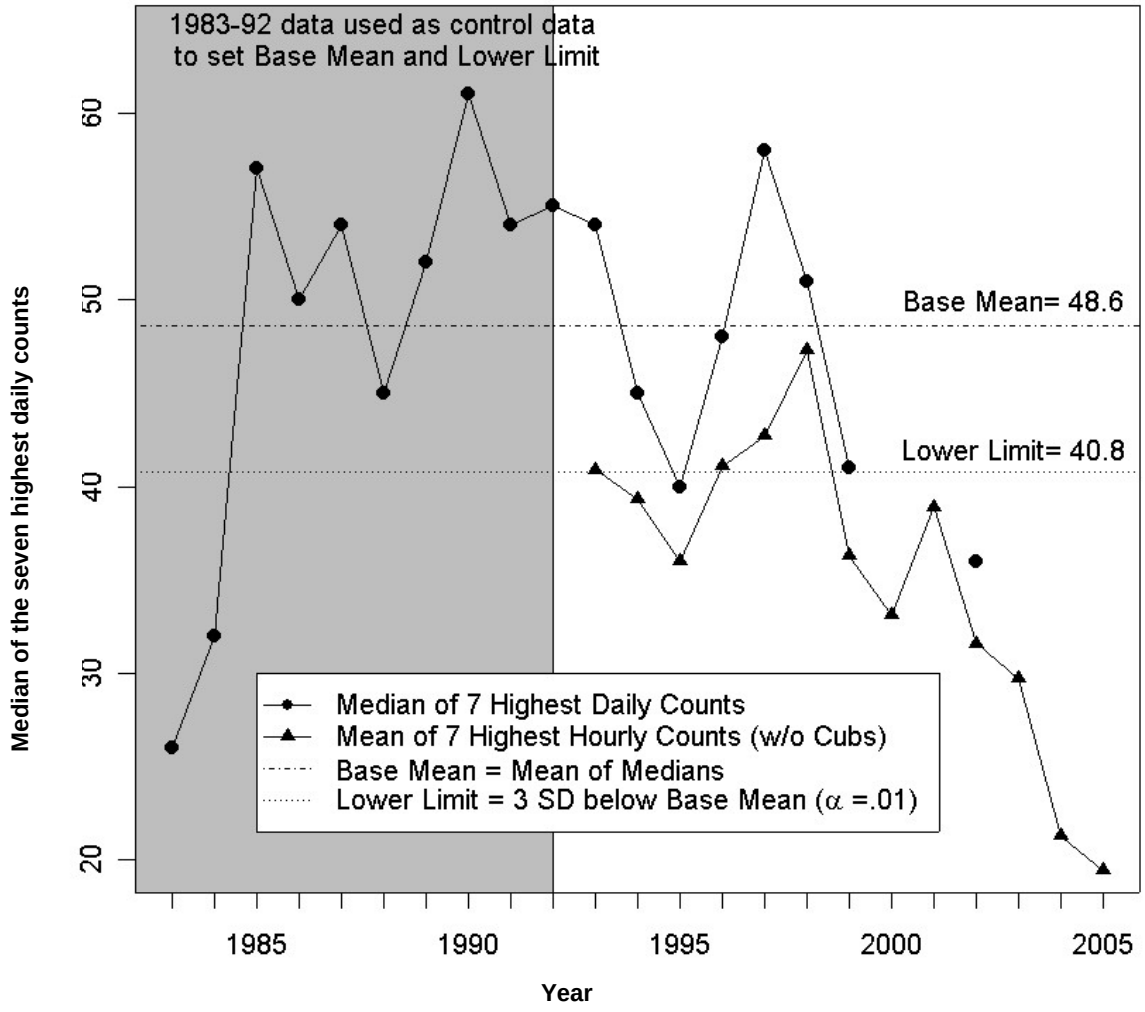

Table A9.–Statewide harvest and catch data from Statewide Harvest Survey 1990-2004, Kamishak Bay combined (updated 2006).

Please Note: Only numbers in bold are useful, and indicate relative orders of magnitude for assessing long term trends (<30 responses received). For all other locations and years, angler response rates were limited (<12 responses) and these numbers should only be used only to indicate that sportfishing occurred, and that specific species are present (Mills and Howe 1992).[a]

Kamishak Bay

Year	Effort[b]	Pink salmon		Chum salmon		Sockeye salmon		Silver salmon		Rainbow trout		Lake trout		Dolly Varden		Arctic grayling		Halibut		Lingcod	
		Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch
1990	151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	198	674	0	0
1991	218	33	33	17	17	0	0	0	0	0	0	0	0	0	0	0	0	245	548	14	14
1992	112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	125	292	0	56
1993	**596**	**9**	**216**	**8**	**8**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**26**	**26**	**0**	**0**	**608**	**1987**	**27**	**45**
1994	**565**	**0**	**0**	**0**	**0**	**0**	**11**	**0**	**20**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**475**	**741**	**0**	**65**
1995	**651**	**0**	**0**	**0**	**11**	**0**	**0**	**59**	**59**	**0**	**0**	**0**	**0**	**0**	**67**	**0**	**0**	**608**	**1148**	**9**	**9**
1996	116	0	0	0	0	0	0	109	201	0	0	0	0	0	25	0	0	76	164	11	33
1997	**495**	**0**	**0**	**0**	**59**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**642**	**1374**	**27**	**27**
1998	229	0	0	0	0	46	46	0	457	0	0	0	0	0	0	0	0	158	504	27	27
1999	255	66	395	0	0	0	214	135	756	0	0	0	0	0	0	0	0	235	494	0	0
2000	446			0	0	0	0	0	0	0	0	0	0	0	0	0	0	337	602	0	0
2001	116	0	0	0	0	0	0	11	297	0	0	0	0	0	0	0	0	95	266	0	0
2002	262	0	598	0	608	0	0	153	869	0	0	0	0	0	296	0	0	160	166	0	16
2003				0	9																
2004	95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43	43	0	0

Amakdedori Creek

Year	Effort[b]	Pink salmon		Chum salmon		Sockeye salmon		Silver salmon		Rainbow trout		Lake trout		Dolly Varden		Arctic grayling		Halibut		Lingcod	
		Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch
1990	51	0	0	0	0	0	0	55	55	0	0	0	0	51	51	0	0	0	0	0	0
1991	24	11	11	0	0	29	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1992																					
1993	80	0	43	0	0	0	0	129	542	0	18	0	0	18	175	0	0	0	0	0	0
1994	13	0	0	0	0	0	0	30	100	0	0	0	0	0	0	0	0	0	0	0	0
1995	14	0	0	0	0	0	0	0	69	0	0	0	0	0	48	0	0	0	0	0	0
1996																					
1997	45	0	32	0	0	0	0	11	123	0	0	0	213	0	0	0	0	0	0	0	0
1998	9	0	41	0	0	0	0	0	19	0	0	0	0	0	0	0	0	0	0	0	0
1999	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000																					
2001																					
2002	17	0	0	0	0	0	0	0	94	0	42	0	0	0	0	0	0	0	0	0	0
2003	225	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004																					

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Table A9.- **Page 2 of 3.**

Kamishak River

Year	Effort[b]	Pink salmon		Chum salmon		Sockeye salmon		Silver salmon		Rainbow trout		Lake trout		Dolly Varden		Arctic grayling		Halibut		Lingcod	
		Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch
1990	44	0	0	0	0	0	0	0	220	0	0	0	0	67	674	0	0	0	0	0	0
1991																					
1992	117	0	0	0	68	0	0	57	202	0	119	0	0	0	369	0	225	0	0	0	0
1993	704	0	96	8	704	0	67	76	535	40	603	0	0	38	2142	0	0	0	0	0	0
1994	272	8	24	0	221	0	0	54	134	0	0	0	0	0	142	0	0	0	0	0	0
1995	204	0	66	0	98	0	0	216	1040	0	12	0	0	29	442	0	0	0	0	0	0
1996	83	0	10	0	33	0	0	109	317	0	0	0	0	3	590	0	0	0	0	0	0
1997	171	0	0	0	297	0	0	177	975	0	0	0	0	0	255	0	0	0	0	0	0
1998	305	0	27	0	15	0	0	201	413	0	0	0	0	27	670	0	38	0	0	0	0
1999	177	0	200	0	63	0	0	288	575	0	0	0	0	34	296	0	777	0	0	0	0
2000	220	0	605	0	1228	0	0	220	1323	0	0	0	0	0	817	0	0	0	0	0	0
2001	185	0	344	0	541	0	0	183	721	0	0	0	0	0	585	0	260	0	0	0	0
2002	**956**	**0**	**335**	**0**	**223**	**0**	**0**	**277**	**2258**	**0**	**0**	**0**	**0**	**0**	**785**	**0**	**7**	**0**	**0**	**0**	0
2003	**427**	**0**	**0**	**12**	**624**	**0**	**0**	**127**	**1488**	**0**	**0**	**0**	**0**	**20**	**1275**	**0**	**0**	**0**	**0**	**0**	0
2004	**416**	**0**	**81**	**0**	**504**	**0**	**68**	**836**	**3564**	**0**	**0**	**0**	**0**	**45**	**986**	**0**	**65**	**0**	**0**	**0**	0

McNeil River

Year	Effort[b]	Pink salmon		Chum salmon		Sockeye salmon		Silver salmon		Rainbow trout		Lake trout		Dolly Varden		Arctic grayling		Halibut		Lingcod	
		Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch
1990	76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1991																					
1992																		0	0	0	0
1993	74	0	0	0	134	0	0	0	0	0	0	0	0	0	48	0	0	0	0	0	0
1994	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	143	0	0	0	45	0	0	9	9	0	0	0	0	0	0	0	0	0	0	0	0
1996	51	0	0	0	44	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0
1997																					
1998																					
1999																					
2000	110	0	0	0	0	0	117	0	0	0	0	0	0	0	59	0	0	0	0	0	0
2001																					
2002	8	0	0	0	0	0	185	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2003																					
2004																					

-continued-

Table A9.-**Page 3 of 3.**

Little Kamishak River																					
Year	Effort[b]	Pink salmon		Chum salmon		Sockeye salmon		Silver salmon		Rainbow trout		Lake trout		Dolly Varden		Arctic grayling		Halibut		Lingcod	
		Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch	Harvest	Catch
1990																					
1991	53	0	0	0	114	0	0	0	0	0	0	0	0	0	301	0	0	0	0	0	0
1992																					
1993																					
1994																					
1995																					
1996																					
1997																					
1998																					
1999																					
2000																					
2001																					
2002																					
2003	15	0	10	0	208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2004																					
2005																					

Note: The sites listed in this table are not queried in the Statewide Harvest Survey. The values in this table are derived from incidental "write-ins" by respondents. Generally, the survey forms ask the angler to specify site names under the general catagories "Boat sites North of Chinitna Point", "Boat sites South of Chinitna Point" and "Shoreline Sites." Freshwater sites listed in the survey instruments for waters south of North Forelands are "Kustatan River", "Silver Salmon Creek", "Polly Creek" and in recent years "Big River Lakes" and "Wolverine Creek."

Note: Missing values indicate that no responses were received for this location and year .

[a] Mills and Howe (1992) evaluates the precision of estimates generated from Statewide Harvest Survey data. When there are less than 12 responses, sites are usually aggregated into a larger fishery, because other than to document that sportfishing occurred, estimates based on < 12 responses should not be used. Esimates based on 12-29 responses can be useful in indicating relative orders of magniture and for assuming long-term trends, and estimates from >30 responses are generally useable. See Mills, M. J., and A. L. Howe. 1992. An evaluation of estimates of sport fish harvest from the Alaska statewide mail survey. Alaska Department of Fish and Game, Special Publication No. 92-2, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/sp92-02.pdf

[b] Effort is defined as number of angler days fished; with all or part of a day counted as a whole day.

Table A10.–Magazine and other articles related to the McNeil River State Game Sanctuary and State Game Refuge.

1954 Aug. The National Geographic Magazine. When giant Alaskan bears go fishing. Cecil R. Rhode.

1955 Sep. Outdoor Life. I lived with the bears. Cecil E. Rhode.

1963 Jan. Natural History. Solitary carnivore. Milton B. Trautman.

1971 Oct. Alaska. The brown bears of McNeil River. James B. Faro.

1971 Nov/Dec. Alaska Fish and Game Trails. McNeil River Bear Search. Jim Faro.

1972 Nov. Natural History. Protocol at the annual brown bear fish feast. Derek Stonorov.

1974 Mar/Apr. Alaska Fish and Game Trails. McNeil River, it's for the bears. Jim Faro.

1975 May. Audubon The social life of an unsociable giant. Wade T. Bledsoe, Jr.

1975 Sep. The National Geographic Magazine. Alaska's big brown bears. A. Egbert and M. Luque.

1975 Sep. National Geographic Magazine. Might makes right: among Alaska's brown bears. Allan L. Egbert.

1977 Spring. The Beaver. The fishing bears. Fred Bruemmer.

1979 Mar/Apr. Alaska Fish and Game Trails. The bears of McNeil River. Chris Smith.

1980 Jun. Take Me Away. (AK Airlines) Patches, the McNeil River legend. Linda Billington.

1980 Aug. Adventure Travel. Bear encounters of a very close kind. John Ibbotson.

1984 May. Alaska. Alaska's best bear show. Larry Aumiller.

1984 Jul/Aug. Flight Time. (Wien Airlines) Bear sanctuary on the McNeil River. Cynthia K. Berry.

1985 Jun. Ranger Rick. Bears go fishing. David C. Fritts.

1985 Aug. Alaska Magazine. Chasing a belly full of salmon can also be a social occasion for the brown bears at the McNeil River Sanctuary on the Alaska Peninsula.

1986 Jan/Feb. Alaska Fish and Game. It's for the bears - Dick Sellers

1986 Jul. Connoisseur. Kingdom of the bear. John Hemingway.

1987 May/Jun. Alaska Fish and Game. Alaskan brown bear safari; a McNeil River diary. Andrew E. Elko.

1987 May/Jun. Nissan Discovery. Bear watching in Alaska. Robin Dunitz.

1988 Mar/Apr. Hometown Press. Grizzlies. Hethalyn Godwin.

1988 May. Alaska. The man who says no to bears. Jim Rearden.

1988 Summer. Alaska Outdoors. Monarchs of McNeil. James McCann.

1989 Jan/Feb. Alaska Fish & Game. Alaska special areas.

1989 Apr. Smithsonian. It's a good thing McNeil's big bears get plenty to eat. Boyd Norton.

1989 Alaska Geographic. Katmai Country. McNeil River: where the Bears Come First. Bill Sherwonit.

1989 Nov/Dec. Defenders. Visiting a world of giants. Douglas H. Chadwick.Tble A10–Page 2 of 3.

1990 Mar. Alaska Airlines Magazine. The quiet hunters. Christopher M. Batin.

1990 Dec. National Wildlife. Photo contest winners.

1991 Mar/Apr. Alaska's Wildlife. McNeil River: managing for wildlife viewing. Larry Aumiller and John Schoen.

1991 June. National Fisherman. Bears vs. fish. Doug Loshbaugh.

1991 June. Alaska Magazine. Bear of a controversy. David Hulen.

1992 Alaska Contractor. Can a good project go bad? Anonymous.

1992 Jan/Feb. Sierra. One paw over the line: should Alaska's favorite bears be shot by hunters or by photographers? Reed McManus.

1992 May. Alaska Magazine. Will bears leave sanctuary? Bill Sherwonit.

1992 Sep. We Alaskans *in* Anchorage Daily News. Charlie McNeil: explorer, miner, businessman. Tom Walker.

1992 Sep. We Alaskans *in* Anchorage Daily News. Battle of the bears. Bill Sherwonit.

1993 Alaska Geographic. Bear viewing. Bill Sherwonit.

1993 Alaska Contractor. McNeil River bears revisited. Sean Reid.

1993 June. Alaska Business Monthly. Celebrating the bears of McNeil River. "Bill" William R. Hunt.

1993 Aug/Sep. Alaska Outdoor Council News. McNeil River update. Dick Bishop.

1993 Oct. Journal Environmental Management. The Value of Watchable Wildlife: a Case Study of McNeil River. Creed Clayton and Robert Mendelsohn.

1993 Nov. Alaska. Editors' choice -- River of Bears. Tom Walker with photos by Larry Aumiller.

1993 Nov/Dec. Nature Photographer. McNeil River bears. Bob Lindholm.

1993 Dec/ 1994 Jan. Alaska Outdoor Council News. McNeil River update. Rod Arno.

1994 In: 9th International Conference on Bear Research and Management. Bears - Their Biology and Management. Brown bear population characteristics at McNeil River, Alaska. Richard A. Sellers and Larry D.Aumiller.

1994 In: 9th International Conference on Bear Research and Management. Bears - Their Biology and Management. Management of McNeil River State Game Sanctuary for viewing of brown bears. Larry D. Aumiller and Colleen A. Matt.

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1994 Jan. Country Living. The brown bears of summer -- River of Bears. Tom Walker with photographs by Larry Aumiller

1994 Feb. Alaska Magazine. Bear viewing, hunting declared compatible.

1994 Apr. Alaska Airlines Magazine. Bear necessities. Byron Ricks.

1994 Jul. Sports Afield. Confronting the grizzly dilemma. Ted Kerasote.

1994 Jul/Sep. Canadian Field Naturalist. Observations of conspecific predation by brown bears, Ursus-Arctos, in Alaska. Pauline Hessing and Larry Aumiller.

1994 Aug. Men's Journal. The bear maximum. Chip Brown.

1995 Dec/Jan. Alaska Magazine. Bogus hunters rally to protect McNeil bears.

1996 Jan/Feb. Wildlife Conservation. Barely sporting. Erwin Bauer and Peggy Bauer.

1996 Feb. Alaska Airlines Magazine. Bear essentials. Jon K. Tillinghast.

1996 Feb. Backpacker. Face your fears. Jeff Rennicke.

1996 Mar. Men's Health. When Smokey gets in your eyes. Jeff Rennicke.

1996 Apr. Field & Stream. Bullets, binoculars, and bears. Rich Landers. 1996 Aug/Sep. National Wildlife. Bear man of McNeil River. Bill Sherwonit.

1996 Sep/Oct. Wildlife Conservation. One of the bears. Nancy Simmons.

1997 Feb. Alaska Magazine. Among titans: pay a visit to Alaska's bears on their own turf. Bill Sherwonit.

1997 Feb. People Weekly. Wild style. Anonymous.

1997 Aug. We Alaskans *in* Anchorage Daily News. Lying down with bears. Bill Sherwonit.

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1998 Sep/Oct. Wildlife Conservation. Grizzlies. Henry H Holdsworth,

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McNeil River State Game Refuge and State Game Sanctuary Management Plan

MAPS

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Land Status

Base land status for this project comes from the DNR[1]. This coverage has been edited to reflect the land status information on DNR's status plats[2] ,BLM's MTP's[2,] the states recorders office[3], and documented case reports[4]. Because Alaska is a non-recordation state, there is no guarantee that additional undocumented land transfers have occurred that could potentially alter the data we have compiled. Land ownership is not static, consequently, even in the time it took to compile this information, some parcels may have changed ownership.

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