Fishery Management Report No. 18-26

Fishery Management Report for Sport Fisheries in the Northwest/North Slope Management Area, 2017

by

Brendan Scanlon

December 2018

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

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)

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

FISHERY MANAGEMENT REPORT NO. 18-26

FISHERY MANAGEMENT REPORT FOR SPORT FISHERIES IN THE NORTHWEST/NORTH SLOPE MANAGEMENT AREA, 2017

By
Brendan Scanlon
Division of Sport Fish, Fairbanks

Alaska Department of Fish and Game
Division of Sport Fish, Research and Technical Services
333 Raspberry Road, Anchorage, Alaska, 99518-1565

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The Fishery Management Reports series was established in 1989 by the Division of Sport Fish for the publication of an overview of management activities and goals in a specific geographic area, and became a joint divisional series in 2004 with the Division of Commercial Fisheries. Fishery Management Reports are intended for fishery and other technical professionals, as well as lay persons. Fishery Management Reports are available through the Alaska State Library and on the Internet: http://www.adfg.alaska.gov/sf/publications/. This publication has undergone regional peer review.

Brendan Scanlon,
Alaska Department of Fish and Game, Division of Sport Fish,
1300 College Road, Fairbanks, AK 99701-1599, USA

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ABSTRACT

This report presents sport fisheries season summaries for 2017 and preliminary information for 2018 in the Northwest/North Slope Management Area. The Northwest/North Slope Management Area (NW/NSMA) consists of all waters north of the Yukon River drainage in Norton Sound, the Seward Peninsula, Kotzebue Sound (including the major drainages of the Kobuk and Noatak rivers), and all north-draining waters of the Brooks Range east to the Canadian border. Sport and subsistence fisheries target king, coho, chum, and pink salmon, Dolly Varden, sheefish, Arctic grayling, and northern pike. In 2017, angler-days totaled 12,245 with the largest proportion (0.67) coming from the Seward Peninsula/Norton Sound fisheries. Coho salmon was the predominant sport species harvested in 2017 with 5,944 fish taken followed by Dolly Varden/Arctic char (1,559) and pink salmon (962). Summaries of major sport, commercial, and subsistence fisheries within the NW/NSMA are detailed, including descriptions of recent performances, Alaska Board of Fisheries regulatory actions, social and biological issues, and descriptions of ongoing research and management activities.

Key Words: Northwest Alaska, Norton Sound, Kotzebue, Unalakleet, North Slope, sport fisheries, subsistence, king salmon, coho salmon, pink salmon, chum salmon, sockeye salmon, Arctic grayling, Dolly Varden, sheefish

INTRODUCTION

This area management report provides information regarding the Northwest/North Slope Management Area (NW/NSMA) and is the first in a series of reports annually updating fisheries management information within Region III. The report is provided for the Alaska Board of Fisheries (BOF) and Fish and Game Advisory Committees (ACs), as well as the public and other interested parties. It presents fisheries assessment information and the management strategies that are developed from that information. In addition, this report includes a description of a wide variety of information concerning Division of Sport Fish management programs within the area, including the fisheries regulatory process; the geographic, administrative, and regulatory boundaries; and funding sources.

The goals of the Division of Sport Fish of the Alaska Department of Fish and Game (ADF&G) are to protect and improve the state's recreational fisheries resources by managing for sustainable yield of wild stocks of sport fish, providing diverse recreational fishing opportunities, and providing information to assist the BOF in optimizing social and economic benefits from recreational fisheries. In order to implement these goals, the division has established a fisheries management process.

A regional review is conducted annually, during which the status of important area fisheries is considered, and research needs are identified. Fisheries stock assessment projects are developed, scheduled, and implemented to meet information needs identified by fisheries managers. Projects are planned within a formal operational planning process. Biological information gathered from these research projects is combined with effort information and input from user groups to assess the need for and development of fisheries management plans and to propose regulatory strategies.

Division of Sport Fish management and research activities are funded by ADF&G and Federal Aid in Fisheries Restoration funds. ADF&G funds are derived from the sale of state fishing licenses. Federal aid funds are derived from federal taxes on fishing tackle and equipment that were established by the Federal Aid in Sport Fish Restoration Act (also referred to as the Dingell-Johnson Act or D-J Act). The D-J funds are provided to states at a match of up to 3-to-1 with the ADF&G funds. Additional funding specified for providing, protecting, and managing access to fish and game is provided through a tax on boat gas and equipment established by the Wallop-

Breaux (W-B) Act. Other peripheral funding sources may include contracts with various government agencies and the private sector.

This area management report provides information regarding the NW/NSMA and its fisheries for 2017, with preliminary information from the 2018 season. This report is organized into 2 primary sections. The first is a management area overview, including a description of the NW/NSMA and a summary of effort, harvest, and catch for the area. The second section discusses significant area fisheries, including specific harvest and catch by species and drainage.

The BOF divides the state into 18 regulatory areas to organize the sport fishing regulatory system by drainage and fishery. These areas (different from regional management areas) are described in Title 5 of the Alaska Administrative Code Chapters 47–74. The Division of Sport Fish of ADF&G divides the state into 3 administrative regions with boundaries roughly corresponding to groups of the BOF regulatory areas. Region I covers Southeast Alaska (the Southeast Alaska regulatory area). Region II covers portions of Southcentral and Southwest Alaska (including the Prince William Sound, Kenai Peninsula, Kenai River Drainage, Cook Inlet-Resurrection Bay Saltwater, Anchorage Bowl Drainages, Knik Arm Drainages, Susitna River Drainage, West Cook Inlet, Kodiak, Bristol Bay, and the Alaska Peninsula and Aleutian Islands regulatory areas). Region III includes Upper Copper River and Upper Susitna River area and the Arctic-Yukon-Kuskokwim Region (including the North Slope, Northwestern, Yukon River, Tanana River, and Kuskokwim-Goodnews regulatory areas).

Region III is the largest geographic region, encompassing the majority of the landmass of the state of Alaska (Figure 1). The region contains over 442,500 mi^2 (1,146,000 km^2) of land, some of the state's largest river systems (Yukon, Kuskokwim, Colville, Noatak, Upper Copper, and Upper Susitna River drainages), thousands of lakes, thousands of miles of coastline, and streams. Regional coastline boundaries extend from Cape Newenham in the southwest, around all of western, northwestern, and northern Alaska to the Canadian border on the Arctic Ocean. Region III as a whole is very sparsely populated, with the most densely populated area located in the Tanana River Valley. Fairbanks is the largest community with a population of about 35,000; the population of the greater Fairbanks North Star Borough is about 99,000.

For administrative purposes, the Division of Sport Fish has divided Region III into 5 fisheries management areas (Figure 1):

- Northwestern/North Slope Management Area (Norton Sound, Seward Peninsula, Kotzebue Sound, and North Slope drainages)
- Yukon Management Area (the Yukon River drainage except for the Tanana River drainage)
- Upper Copper/Upper Susitna Management Area (the Copper River drainage upstream of Canyon Creek and Haley Creek, and the Susitna River drainage above the Oshetna River)
- Tanana River Management Area (the Tanana River drainage)
- Kuskokwim Management Area (the entire Kuskokwim River drainage and Kuskokwim Bay drainages)

Area management biologists for the 5 areas are located in Nome/Fairbanks, Fairbanks, Glennallen, Fairbanks/Delta Junction, and Bethel/Fairbanks, respectively.

ALASKA BOARD OF FISHERIES

The BOF is a 7-member board that sets fishery regulations and harvest levels, allocates fishery resources, and approves or mandates fishery conservation plans for the State of Alaska. BOF members are appointed by the governor for 3-year terms and must be confirmed by the legislature.

Under the current operating schedule, the BOF considers fishery issues for regulatory areas or groups of regulatory areas on a 3-year cycle. Proposals to create new or modify existing regulations and management plans are submitted by ADF&G and the public (any individual can submit a proposal to the BOF) for evaluation by the BOF. During its deliberations the BOF receives input and testimony through oral and written reports from ADF&G staff, members of the general public, representatives of local ACs, and special interest groups such as fishing associations and clubs. Members of the public can respond to regulation changes and allocation by submitting written proposals and testifying directly to the BOF, by participating in local AC meetings, or by becoming members of local ACs.

ADVISORY COMMITTEES

Local ACs have been established throughout the state to assist the Boards of Fisheries and Game in assessing proposed regulation changes and fisheries and wildlife issues. AC meetings allow opportunity for direct public interaction with ADF&G staff attending the meetings, where they are available to answer questions and provide clarification of proposed regulatory changes that affect resource issues of local and statewide concern. The Board Support Section within ADF&G's Division of Administrative Services provides administrative and logistical support for the BOF and ACs. During 2017, ADF&G had direct support responsibilities for 84 ACs in the state.

Within the NW/NSMA, there are 9 ACs: the Arctic, Kotzebue, Lower Kobuk, Noatak/Kivalina, Northern Norton Sound, Northern Seward Peninsula, St. Lawrence Island, Southern Norton Sound, and Upper Kobuk committees. In addition, ACs from the Yukon River drainage occasionally comment on proposals concerning Northwest fisheries.

RECENT BOARD OF FISHERIES ACTIONS

The BOF meets annually but deliberates on each individual regulatory area on a 3-year cycle. The most recent meeting for the NW/NSMA took place in January 2016 in Fairbanks. At this meeting, the BOF adopted a proposal expanding the area in which hook and line attached to a rod or pole is legal subsistence gear within the Kotzebue District, and added the term "rod and reel" to the lawful subsistence gear in the proposed expanded area of the Kotzebue District. At the 2013, meeting the BOF adopted a proposal reopening the sport fishery for chum salmon in most of the Nome Subdistrict. This subdistrict includes all marine and fresh waters between Cape Rodney and Topkok Head. The exceptions within the subdistrict were the Penny and Cripple rivers, which remained closed to sport fishing for chum salmon.

ADF&G EMERGENCY ORDER AUTHORITY

ADF&G has emergency order (EO) authority (5 AAC 75.003) to modify time, area, and bag/possession limit regulations. EOs are implemented to deal with conservation issues for resident species. EOs are also implemented as a tool for inseason management of salmon fisheries. Inseason management is usually carried out in accordance with a fisheries management plan approved by the BOF. EOs issued under this authority for the NW/NSMA during 2017 are summarized in Appendix A.

FEDERAL SUBSISTENCE

The Alaska National Interest Lands Conservation Act (ANILCA) established a priority subsistence use of fish and game for federally qualified rural residents on lands and waters for which the federal government asserts jurisdiction. The State of Alaska has also established a priority for subsistence use of fish and game by Alaska residents (AS 16.05.258) on all lands and waters but cannot discriminate between rural and urban residents (Alaska State Constitution Article VIII, sections 3 and 15). Because of this difference, the federal government asserted authority to ensure a priority subsistence use of fish and game for rural residents on federal lands and certain adjacent waters. On October 1, 1999, the federal government asserted regulatory authority for assuring the rural priority for subsistence fisheries on federal public lands, which includes nonnavigable waters on public lands. Following the *State of Alaska v. Katie John* decision by the Ninth Circuit Court in 1995, the federal government expanded the definition of public land to include waters for which the federal agencies assert federal reserved water rights. Under current practice, the federal land-management agencies adopt regulations to provide for the priority subsistence use by qualified rural residents in nonnavigable waters within federal public lands (including Bureau of Land Management [BLM] lands) and in navigable waters adjacent to or within federal conservation system units (generally does not include BLM lands). The state retains all other fish and wildlife management authorities, including management on federal land.

Development of regulations for subsistence fisheries under the federal subsistence program occurs within the established Federal Subsistence Board (FSB) process. The public provides input concerning regulation changes by testifying in Federal Subsistence Regional Advisory Council (RAC) meetings or by becoming council members. Ten RACs have been established throughout Alaska to assist the FSB in determining local subsistence issues and providing recommendations on proposed fishing and hunting regulations that affect the fish and game populations under consideration. Each RAC meets twice a year, and subsistence users and other members of the public can comment on subsistence issues at these meetings.

Within the NW/NSMA, the subsistence fisheries for which the federal government asserts management responsibility include those within and adjacent to the Bering Land Bridge National Preserve, Selawik National Wildlife Refuge, Kobuk Valley National Park, Noatak National Preserve, Cape Krusenstern National Monument, Alaska Maritime National Wildlife Refuge, Gates of the Arctic National Park, and the Arctic National Wildlife Refuge. The Unalakleet Wild and Scenic River (wild classification only) is under federal fisheries management, but only from the headwaters down to the Chiroskey River. In addition, portions of the Kobuk, Noatak, Salmon, and Selawik rivers are designated as Wild and Scenic Rivers (wild classification only). The NW/NSMA fisheries fall under the purview of the Seward Peninsula, Northwest, and North Slope RACs. The most recent meetings were held in March (Seward Peninsula RAC and North Slope RAC), and February 2018 (Northwest RAC). No fisheries-related proposals were addressed by the RACs in 2018. However, at the 2008 Seward Peninsula RAC meeting, that council supported a proposal to close the federal public waters of the Unalakleet River drainage (upstream from the mouth of the Chiroskey River, or approximately 23 river miles from the village) to the taking of king salmon. This closure request was in response to concerns regarding the harvesting of king salmon on the spawning grounds. The RAC's recommendation of support was forwarded to the FSB, and the proposal was adopted by the FSB in March 2009. A listing of the addresses and telephone numbers for these federal management units can be found in Appendix B.

REGION III DIVISION OF SPORT FISH RESEARCH AND MANAGEMENT STAFFING

The Region III Division of Sport Fish staff biologists are organized into a research group and a management group. The management group consists of a management supervisor, an area biologist for each of the 5 management areas, and 1 or more assistant area management biologists. Area biologists evaluate fisheries and propose and implement management strategies through plans and regulation in order to meet divisional goals. A critical part of these positions consists of interaction with the BOF, ACs, and the general public. Stocked waters biologists plan and implement the regional stocking program for recreational fisheries. The regional management supervisor also supervises the regional fishing and boating access program.

The research group consists of a research supervisor, a salmon research supervisor, a resident species supervisor, research biologists, 1 stocked waters biologist, and various field technicians. Research biologists plan and implement fisheries research projects in order to provide information needed by the management group to meet divisional goals. The duties of the management and research biologists augment one another.

STATEWIDE HARVEST SURVEY

Sport fishing effort and harvest of sport fish species in Alaska have been estimated and reported annually since 1977 using a mail survey (http://www.adfg.alaska.gov/sf/sportfishingsurvey/). The Statewide Harvest Survey (SWHS) is designed to provide estimates of effort, harvest, and catch on a site-by-site basis. It is not designed to provide estimates of effort directed toward a single species. Species-specific catch-per-unit-effort (CPUE) information can seldom be derived from the report. Questionnaires are mailed to a stratified random sample of households containing at least 1 individual with a valid fishing license (resident or non-resident). Information gathered from the survey includes participation (number of anglers and days fished), number of fish caught, and number harvested by species and site. These surveys estimate the number of angler-days of fishing effort expended by sport anglers fishing in Alaska waters, as well as the sport harvest. Beginning in 1990, the survey was modified to include estimation of catch (release plus harvest) on a site-by-site basis. Survey results for each year are available the following year; hence, the results for 2017 were available in fall 2018. Additionally, creel surveys have been used to verify the mail survey for fisheries of interest or for fisheries that require more detailed information for inseason management.

The utility of SWHS estimates depends on the number of responses received for a given site (Mills and Howe 1992; Clark 2009). In general, estimates from smaller fisheries with low participation are less precise than those of larger fisheries with high participation. Therefore, the following guidelines were implemented for evaluating survey data:

1. Estimates based on fewer than 12 responses should not be used other than to document that sport fishing occurred;
2. Estimates based on 12 to 29 responses can be useful in indicating relative orders of magnitude and for assessing long-term trends; and
3. Estimates based on 30 or more responses are generally representative of levels of fishing effort, catch, and harvest.

For purposes of reporting and organizing statistics in the SWHS, the Seward Peninsula/Norton Sound, Northwest Alaska, and North Slope areas are designated as survey areas W, X, and Z.

SPORT FISH GUIDE LICENSING AND LOGBOOK PROGRAM

Since 1998, the Division of Sport Fish has operated a program to register and/or license both sport fishing guides and sport fishing guide businesses, and to collect information on sport fishing participation, effort, and harvest by saltwater and freshwater guided clients (Sigurdsson and Powers 2009). In 1998, the BOF adopted statewide sport fishing guide regulations (5 AAC 75.075) that required all sport fishing guides and businesses to register annually with ADF&G. At this time, the BOF also adopted statewide regulations that required logbooks for saltwater charter vessels. Logbooks collect information on charter activity (location, effort, and harvest) necessary for the BOF for allocation and management decisions specific to king salmon (*Oncorhynchus tshawytscha*), rockfish (*Sebastes* spp.), and lingcod (*Ophiodon elongatus*) and for the North Pacific Fishery Management Council (NPFMC) for allocation of Pacific halibut (*Hippoglossus stenolepis*).

In 2004, the Alaska Legislature adopted House Bill 452, which established licensing requirements for sport fishing guide business owners and sport fishing guides on a statewide basis (effective 2005). This legislation also required logbook reporting for all freshwater guiding businesses, in addition to the existing saltwater reporting requirements. The logbook data provides location of fishing effort, level of participation, and number of species kept and released by clients. This information is used for the regulation, development, and management of fisheries and has been published annually since 2009 (data since 2006) in a Fishery Data Series report (Sigurdsson and Powers 2016, *in prep*).

For the years 2006–2016, a total of 9,493 guided anglers fished in the NW/NSMA, with the largest percentage fishing in the Seward Peninsula/Norton Sound area (84%). The total number of guided anglers that have fished the NW/NSMA is less than 1% of the statewide total for 2006–2016 (1,353,062 anglers; Sigurdsson and Powers 2016, *in prep*).

SECTION I:
NORTHWEST/NORTH SLOPE MANAGEMENT AREA OVERVIEW

MANAGEMENT AREA DESCRIPTION AND FISHERIES RESOURCES

The NW/NSMA includes all waters north of the Yukon River drainage in Norton Sound, the Seward Peninsula, Kotzebue Sound (including the major drainages of the Kobuk and Noatak rivers), and all north-draining waters of the Brooks Range east to the Canadian border (Figures 2–6). The total land area consists of approximately 147,992 mi^2 (383,301 km^2). Located within the NW/NSMA are the communities of Utqiavik (formerly Barrow), Point Hope, Kivalina, Noatak, Kotzebue, Noorvik, Kiana, Ambler, Shungnak, Kobuk, Selawik, Buckland, Deering, Shishmaref, Nome, Teller, Brevig Mission, White Mountain, Golovin, Elim, Koyuk, Shaktoolik, Unalakleet, St. Michael, and Stebbins. Access to most of the communities and water bodies is limited to aircraft or boat. Three roads emanating from Nome provide access to surrounding communities and drainages; Teller (Nome-Teller Highway), the Kuzitrin River drainage (Nome-Taylor Highway), and Council (Nome-Council Road; Niukluk-Fish river drainages).

Fish species present in the NW/NSMA include anadromous Dolly Varden *Salvelinus malma*; king, coho *O. kisutch*, chum *O. keta*, sockeye *O. nerka*, and pink salmon *O. gorbuscha*; Bering cisco *Coregonus laurettae*; broad whitefish *C. nasus*; and humpback whitefish *C. pidschian*. Also present are freshwater-resident Arctic grayling *Thymallus arcticus*, Dolly Varden, Arctic char *S. alpinus*, northern pike *Esox lucius*, sheefish *Stenodus leucichthys*, round whitefish *Prosopium cylindraceum*, least cisco *C. sardinella*, humpback whitefish, broad whitefish, burbot *Lota lota*, and lake trout *S. namaycush*.

Norton Sound/Seward Peninsula Subarea

Drainages in southern Norton Sound (Figure 3) include the Golsovia, Unalakleet, Egavik, Shaktoolik, Inglutalik, Ungalik, and Koyuk rivers. All but the Koyuk River drain the Nulato Hills, which separate Norton Sound from the Yukon and Koyukuk river valleys. Of these, the Unalakleet River is the largest and most heavily utilized. The village of Unalakleet is located at the mouth of this river. The Unalakleet River has been designated a National Wild River, and it supports anadromous populations of Dolly Varden; king, coho, chum, and pink salmon; and resident populations of Dolly Varden, Arctic grayling, and whitefishes *Coregonus* sp. Other area streams provide the opportunity for high-quality fisheries for the same species but are not as intensively fished because of their remote nature and difficult access.

Many streams located along the southern half of the Seward Peninsula between Koyuk and Teller (Figure 4), including the Fish, Niukluk, Eldorado, Nome, Snake, Sinuk, Feather, Tisuk, Pilgrim, and Kuzitrin rivers, are accessible via the Nome road system and offer sport fishing opportunity for Arctic grayling, Dolly Varden, salmon, and northern pike (northern pike are found in the Fish, Pilgrim, and Kuzitrin rivers). Small sockeye salmon runs have historically occurred in the Pilgrim and Sinuk rivers, although these runs increased markedly from 2003–2008. Based on counting-tower and weir information, a few remnant late-run sockeye salmon are present in other locations in Norton Sound. King salmon are present in the Pilgrim, Niukluk, and Fish rivers. Trophy Arctic grayling, larger than 3 lbs (1.4 kg), are present in many Seward Peninsula waters. The state record Arctic grayling (5 lb 3 oz) was caught and released from the Fish River drainage in 2008. Remote streams such as the Koyuk, Tubutulik, Kwiniuk,

and Agiapuk rivers are accessible by aircraft or boat from nearby villages. These rivers receive little sport fishing effort but provide opportunity for remote high-quality fisheries. Scanlon and DeCicco (2007) provide more detail on these fisheries and other remote systems.

Kotzebue Sound/Chukchi Sea Subarea

Major drainages flowing into Kotzebue Sound and Chukchi Sea include the Selawik, Kobuk, Noatak, Wulik, Kivalina, and Buckland rivers (Figure 5). The Noatak River is a National Wild River and most of the drainage is included in the Noatak National Preserve. The extreme upper headwaters of both the Noatak and Kobuk rivers are included in Gates of the Arctic National Park. A portion of the Lower Kobuk Valley, between the villages of Kiana and Ambler, is included in the Kobuk Valley National Park. The Salmon River, the upper mainstem of the Kobuk River, and the Selawik River are also National Wild Rivers. Much of the Selawik River valley is part of the Selawik National Wildlife Refuge.

The Noatak River drainage supports resident populations of whitefish, Arctic grayling, Dolly Varden, lake trout, burbot, and northern pike. Sheefish use the lower reaches of the river for feeding during the spring but are not known to spawn there (Alt 1987). This system is known for its trophy-size Dolly Varden. Many thousands of anadromous Dolly Varden overwinter in the lower 200 miles (300 km) of the river and spawn in some of the river's tributary streams. The Noatak River produces a large run of chum salmon that contributes to a Kotzebue-based commercial fishery. During the commercial salmon fishery in August, a significant incidental harvest of adult Dolly Varden can occur.

The Kobuk River contains the largest spawning population of sheefish in Northwestern Alaska. Sheefish migrate more than 300 miles to spawn in the upper reaches of the drainage. Hotham Inlet (known locally as Kobuk Lake), Selawik Lake, and the delta system at the river's mouth serve as winter feeding areas for juvenile and adult sheefish. The Alaska state record sheefish, 53 lb, was taken in 1986 from the Upper Kobuk River. Abundant numbers of whitefish utilize the river, as well as Selawik Lake and Hotham Inlet. Whitefish support important subsistence fisheries in villages along the river. Dolly Varden, northern pike, Arctic grayling, burbot, lake trout, and Arctic char inhabit various parts of the Kobuk River watershed.

The Selawik River also supports a spawning population of sheefish that shares rearing and winter feeding areas with the Kobuk River population. Sheefish in both populations grow more slowly, live longer, and attain a larger size than those in other areas of Alaska (Alt 1987). The Selawik River drainage and associated wetlands provide abundant habitat for whitefish and northern pike.

Other important waters include the Wulik and Kivalina rivers that drain into the Chukchi Sea near the village of Kivalina. These drainages provide rearing, spawning, and wintering habitat for diadromous Chukchi Sea Dolly Varden. The Alaska state record Dolly Varden, 27 lb 6 oz, was taken in 2002 from the Wulik River. All 5 species of North American Pacific salmon, Arctic grayling, burbot, and whitefish occur in these relatively small drainages and with the exception of chum salmon in the Wulik River, most populations of these other species are small.

North Slope Area

The North Slope of the Brooks Range includes all waters north of the Brooks Range flowing into the Beaufort and Chukchi seas from Point Hope on the west to the Canadian border on the east, including adjacent saltwater areas (Figure 6). Major drainages in this area include the Colville, Sagavanirktok, Canning, and Kuparuk rivers. These drainages provide rearing, spawning, and

wintering habitat for diadromous Beaufort Sea Dolly Varden. The state's third largest lake, Teshekpuk Lake, is found on the coastal plain, as are thousands of smaller lakes. Most of these lakes are inaccessible by road and too shallow to support fish populations, but there are dozens of lakes that contain lake trout, Arctic char, Arctic grayling, and burbot. These populations are generally slow-growing and are able to support only minimal harvests.

COMMERCIAL FISHERIES

Although small when compared to the major commercial fisheries in southeast and southwest Alaska, the commercial fisheries in Northwest Alaska form an economic base for income and employment in many local communities. Commercial harvests of salmon, herring, halibut, and crab are usually much larger than sport harvests for those species (except on the North Slope, where currently there are no commercial fisheries for salmon, and consequently all references to commercial fisheries in this report refer to those in Norton and Kotzebue sounds). In addition, extremely limited commercial fisheries exist for freshwater species such as sheefish, Dolly Varden, and whitefish.

Commercial fisheries for salmon in the Norton Sound District have been ongoing since 1961. The initial species of interest were king and coho salmon, but commercial fisheries have since developed for chum and pink salmon. The district is divided into 6 subdistricts to facilitate management of individual stocks or stock groups. These subdistricts are 1) Nome, 2) Golovin, 3) Moses Point, 4) Norton Bay, 5) Shaktoolik, and 6) Unalakleet (Figure 7). Conservation concerns for chum salmon stocks have resulted in no commercially harvested chum salmon in the Nome Subdistrict during 1996–2014. However, beginning in 2015 a small directed commercial fishery for chum salmon was opened and 4,861 fish were harvested. In 2017, 6,788 chum salmon were harvested in the Nome Subdistrict, along with 1,605 pink and 5,973 coho salmon, which is the largest coho salmon harvest in over 25 years (Menard et al. *in prep*). Average commercial harvests over the recent 5-year period (2012–2016) in the entire Norton Sound District were 408 king, 1,541 sockeye, 92,086 coho, 133,618 pink, and 97,580 chum salmon (Table 1). In 2017, commercial harvests in Norton Sound were 538 king, 2,975 sockeye, 191,254 coho, 20,321 pink, and 163,973 chum salmon. The coho salmon commercial harvest has averaged over 100,000 fish annually since 2014, after not having surpassed 100,000 fish since 2008 (Menard et al. 2017, *in prep*).

The Port Clarence District includes all waters from Cape Douglas north to Cape Prince of Wales, including the drainages of the Pilgrim and Kuzitrin rivers (Figure 7). Commercial salmon fishing has been prohibited in this district since 1967. Few stocks are present, and their run sizes are relatively small; however, the sockeye salmon run into Salmon Lake that passes through the district increased to an average of over 56,000 fish for the years 2003–2007 (Menard et al. 2017, *in prep*). In 2007, due to these recent increases in sockeye salmon returns, a commercial fishery for sockeye salmon was opened with a guideline harvest limit of 10,000 sockeye salmon. Participation was low (3 permit holders), and catches of chum salmon exceeded sockeye salmon 3 to 1 (3,183 to 1,152) and the fishery was discontinued (Soong et al. 2008). Escapement of sockeye salmon has averaged 31,475 fish/year for 2009–2017 (Table 2).

The Kotzebue Sound District includes all waters from Cape Prince of Wales to Point Hope and is the northernmost commercial fishing district in Alaska (Figure 8). The current commercial fishery opened under state management in 1962, but there are documented sales of salmon in the Kotzebue area dating back to the early 1900s. This is primarily a chum salmon fishery with a few king salmon taken annually and an incidental take of Dolly Varden that pass through the fishery in

August. Average commercial harvests 2012–2016 in the Kotzebue Sound District were 377,803 chum salmon and 361 Dolly Varden (Table 1; Menard et al. 2017, *in prep*). In 2017, the chum salmon harvest in the Kotzebue Sound District was second largest in 32 years at 462,951 fish (Table 1). In some years, there has also been a sheefish directed under-ice commercial fishery in Hotham Inlet. Documented annual harvests in this fishery have averaged fewer than 50 fish in most years, and the harvest quota of 25,000 pounds has never been met. The Division of Commercial Fisheries conducts annual assessments of salmon escapements using weirs, counting towers, and aerial surveys. Weirs and towers are thought to provide more accurate measures of escapement than aerial surveys, and these methods have been expanded to cover more streams during recent years (Table 2). The status of Norton Sound chum salmon stocks of concern was reviewed by the BOF as part of the 2010 meeting cycle, and a biological escapement goal (BEG) for chum salmon based on combined weir, tower, and aerial survey counts in Nome Subdistrict streams was established. In addition, sustainable escapement goals (SEGs) have recently been developed for salmon stocks that lacked adequate data for the development of more formalized BEGs (Table 2). Currently, there are 19 escapement goals for Norton Sound area salmon stocks (8 for chum, 5 for pink, 3 for coho, 2 for king, and 2 for sockeye salmon; Conitz et al. 2015).

SUBSISTENCE FISHERIES

Approximately 27,000 people live in the NW/NSMA (US Census Bureau 2010). Except for the 2 larger communities of Nome and Kotzebue, the population is scattered among 31 small villages along the coast and the major area rivers. Most of the population is composed of Alaska Natives, many of whom rely heavily on the subsistence use of fish and wildlife for their livelihoods in a mixed market–subsistence economy. Although personal-use fisheries are also allowed, there has been no participation in these fisheries in the NW/NSMA, largely because all Alaska residents qualify as subsistence users. Subsistence harvests of salmon, Dolly Varden, sheefish, whitefish, and crab are very important to the livelihood of the many small villages in the NW/NSMA and are much larger than the sport fish harvests, which generally make up the smallest component of overall use in most years.

Subsistence use of salmon is monitored using village surveys conducted by ADF&G Division of Subsistence and by permits issued by and returned to the Division of Commercial Fisheries. Recent subsistence salmon harvests (2012–2016) have averaged about 64,000 fish in the Norton Sound District (Table 3). This average harvest was composed of 1,360 king, 1,035 sockeye, 13,747 coho, 33,546 pink and 14,344 chum salmon. In 2017, 69,709 salmon were harvested in the Norton Sound District. This harvest was composed of 1,075 king, 1,354 sockeye, 21,082 coho, 31,972 pink, and 14,226 chum salmon. The recent 5-year (2012–2016) average subsistence salmon harvest in the Port Clarence District was 19,268 fish, composed of 41 king, 7,329 sockeye, 619 coho, 3,866 pink, and 5,602 chum salmon (Table 3; Menard et al. 2017, *in prep*). In 2001, the BOF passed a regulation expanding legal gear for subsistence fishers to include a line attached to a rod or pole in all waters of Northern Norton Sound from Cape Espenberg along the coast to Bald Head Point. This area encompasses all waters of the Port Clarence District and the Nome and Golovin subdistricts (Figure 7). Although standard sport fishing gear can be used for subsistence fishing in these areas, sport fish methods and means regulations still apply (e.g., no snagging in freshwater). Sport fish bag and possession limits by species as specified in 5 AAC 70.011 also apply, except when fishing through the ice or when a subsistence permit is required (such as in the Port Clarence District and the Nome and Golovin subdistricts), in which case the limits specified in the subsistence permit will apply. However, in all areas where sport gear is legal, subsistence

gear is legal as well. Fishers cannot combine sport fish bag and possession limits with subsistence harvest permit limits.

The cyclical nature of salmon abundance in Norton Sound streams is reflected by the large variations in annual escapements (Table 2). In 2003, subsistence fishing opportunity in the Nome Subdistrict of Norton Sound was severely restricted because of low salmon abundance. In 2004, fishing opportunity was expanded because of abundant sockeye and pink salmon. In 2005–2007, higher-than-expected runs of chum salmon, in addition to abundant pink and sockeye salmon runs, allowed for a more relaxed subsistence fishing schedule. In 2008, chum salmon returns were down, and restrictions were put in place for the subsistence fishery in the Nome Subdistrict; however, pink salmon escapements were near record highs in many areas (Table 2). Sockeye salmon escapements in the Pilgrim River, which averaged over 50,000 fish for the years 2003–2008, have averaged less than 11,000 fish from 2009–2016 (Table 2; Menard et al. 2017, *in prep*). The sockeye salmon count at the Pilgrim River weir was 55,533 in 2017; enough to both satisfy escapement needs as well as allow for a limited subsistence fishery. In addition to salmon, other fish harvested for subsistence in Norton Sound include saffron cod, rainbow smelt, Dolly Varden, and whitefish.

In the Kotzebue Sound District, the recent 10-year (2007–2016) subsistence salmon harvest has averaged 27,674 chum salmon annually (Table 3); however, subsistence harvest surveys for all species were not conducted in all 11 Kotzebue Sound District villages in all years, and therefore, these reported catches underestimate the total harvest by some unknown amount. For example, in 2007 the residents of Kivalina harvested a total of 4,568 chum salmon; however, this survey did not include villages along the Kobuk and Selawik rivers or the village of Kotzebue, and so total chum salmon harvests were probably much higher (Magdanz et al. 2010).

In the Kotzebue Sound District, sheefish and other whitefish species are also an important subsistence resource, especially in Kotzebue, Selawik, and the villages along the Kobuk River. The relative importance of whitefish is higher in the Kotzebue Sound District than in many other areas of the state, with much of the whitefish harvest including sheefish harvested by jigging through the ice in Hotham Inlet in the spring. In 2011, residents of Selawik harvested 250,000 lbs of whitefish, of which 28% were sheefish (Fall et al. 2014), and in 2012 the residents of the 5 Kobuk River villages (Kiana, Amber, Shungnak, Kobuk, and Noorvik) harvested 214,000 lbs of whitefish, of which 47% were sheefish (Braem et al. 2013).

ESTABLISHED MANAGEMENT PLANS AND POLICIES

Regulations governing fisheries in the NW/NSMA are found in 5 AAC 69.101 through 5 AAC 69.995 (North Slope Area sport fishing) and 5 AAC 70.001 through 5 AAC 70.995 (Northwestern Area sport fishing), and in 5 AAC 01.100 through 5 AAC 01.190 (subsistence fishing). The *Unalakleet River King Salmon Management Plan*, which encompasses sport, subsistence, and commercial regulations, is found in 5 AAC 04.395.

Fisheries-specific management objectives for the management area have been identified in management plans for Arctic grayling and lake trout. In addition, a series of general divisional criteria have been prepared to guide establishment of fishery objectives, including the following:

- **Management and protection of existing fish resources**. Divisional activities should strive to manage and protect Alaska's wild fish stock resources for future generations;

- **Public use and benefits of existing fish resources**. Alaska's fishery resources should be made available for public use and benefit on a sustained yield basis;
- **Rehabilitation of depressed stocks and damaged habitat**. Division activities should strive to restore and maintain fish stocks and habitat damaged by human activities; and
- **Enhancement of natural production or creation of new opportunities**. The division should pursue creation of new sport fishing opportunities through rehabilitation of natural stocks or creation of new fisheries where these opportunities do not negatively impact other fisheries.

Two region-wide management plans that affect Arctic grayling and lake trout fisheries in the area have been completed. Revision of existing plans, as well as the development of additional fisheries management plans, will occur as needed in response to changes in use patterns as new quantitative information becomes available.

The *Wild Arctic Grayling Management Plan* (5 AAC 69.155; 5 AAC 70.055) directs ADF&G to manage wild Arctic grayling populations in the NW/NSMA for long-term sustained yield through a conservative harvest regime. The plan establishes and defines 3 management approaches under which ADF&G shall manage wild Arctic grayling populations in the NW/NSMA: 1) the regional management approach; 2) the conservative management approach; and, 3) the special management approach. The plan also outlines guidelines and considerations for ADF&G, the public, and/or BOF to change or address the management approach for a water body or fish stock.

The *Wild Lake Trout Management Plan* (5 AAC 69.140; 5 AAC 70.040) directs ADF&G to manage wild lake trout populations in the NW/NSMA by employing a conservative harvest regime and by maintaining harvest below the maximum sustained yield level. ADF&G may take 1 or more management actions if there is a conservation or biological concern for the sustainability of the fishery or a stock harvested in that fishery. These actions include reduction of bag and possession limit, reduction of fishing time, allowing only catch-and-release, and modification of methods and means of harvest. The plan also specifies allowable measures to reduce harvest if the harvest level exceeds sustainable yield for a 2-year period. Finally, the plan establishes a process for designating special management waters and means for limiting harvest in these areas to meet the management objectives.

MAJOR ISSUES FOR THE NORTHWEST/NORTH SLOPE MANAGEMENT AREA

1. *Unalakleet River king salmon*. The Unalakleet River sustains the highest sport fishing effort of any single river in the NW/NSMA and supports the largest directed king salmon fishery in the area. In addition, the residents of Unalakleet and Shaktoolik depend heavily on king salmon for subsistence uses, and when escapements are large enough, income through a directed commercial fishery. Currently there is a sustainable escapement goal (SEG) of 1,200 to 2,600 king salmon on the North River, which is a large tributary of the Unalakleet River. After a historic high of 4,185 fish in 1997, tower counts on the North River have declined steadily, and counts have failed to reach the lower end of the SEG for 5 out of the last 11 years (2007–2017; Table 2). In 2013, the count was 564 fish, which was the all-time low until it was eclipsed in 2016 (513 fish), however in 2016 high water caused poor visibility for several days during the peak of the run, and it is likely that some fish passed the tower undetected. Due to low projections the sport fishery for king salmon in the Unalakleet

River has been restricted or closed every year since 2013. In addition, recent results from enumeration projects suggest that the proportion of the escapement that spawns in the North River may be changing, leading to questions about the effectiveness of in-season management using tower counts. Uncertainties regarding the reasons for the declines in drainagewide escapement, coupled with continued pressure from multiple user groups, makes the Unalakleet River king salmon stock a primary concern for fisheries managers in Northwestern Alaska.

2. *Wulik River Dolly Varden*. Development of a world-class zinc deposit at the Red Dog site in the Upper Wulik River drainage carries the risk of heavy-metal contamination on one of the most important streams in Northwest Alaska for Dolly Varden. The risk of heavy-metal contamination to Red Dog and Ikalukrok creeks occurs from 1) natural leaching of the ore body as it is stripped for ore production and 2) from discharge of contaminated waters into the river. A contamination problem in 1989 and 1990 has been controlled with additional wastewater treatment and the construction of a clean water bypass system in Red Dog Creek. Water quality is monitored by the Department of Natural Resources (DNR) and mine personnel. Contamination from dust along the road corridor has recently been documented by the National Park Service (NPS). In addition, the life of the mine has been extended to the discovery of a new ore body nearby (called the Aqqaluk extension), which will extend the operational life of the mine from an original date for ore depletion of 2012 until 2031. The Division of Sport Fish has conducted aerial surveys of Dolly Varden overwintering in the Wulik River annually for many years and, in cooperation with the Division of Habitat, collects fish from which tissues are sampled for heavy metal analyses twice each year. A project to use DIDSON® (Dual frequency Identification Sonar) to enumerate the spring outmigration began as a pilot project in 2014 and was conducted with mixed success in 2015 and 2016, and has been discontinued.

3. *Nome area gold mining*. The future development of large-scale lode deposits of gold near Nome has the potential to degrade fish habitat in the Snake, Cripple, and Solomon river drainages. Recently, a large increase in the number of recreational suction-dredging operations has occurred in the nearshore marine waters of the Nome Subdistrict, generating concerns over turbidity plumes and conflicts with subsistence fishers. Interest in mining is directly related to the world price of gold. Although the price of gold peaked in 2011 at nearly $2,000/oz, prices have remained high enough in the years following ($\geq$ $1,200/oz in 2017) to keep mining interest high in the Nome area.

4. *Rural resentment of sport fishing and sport anglers*. At public meetings in this area, local residents sometimes express resentment toward "outsiders" who come into remote areas traditionally used by local people for subsistence hunting or fishing. They explain that there is a cultural proscription against the concept of sport fishing in that people do not have the right to "play" with food resources. This point of view can be particularly strong toward catch-and-release practices and has led to some resentment directed toward sport anglers who wish to fish in remote waters of NW/NSMA, and to proposals before the BOF that would have eliminated catch-and-release in some fisheries.

5. *Effects of federal subsistence fisheries management on sport fishing opportunity in the NW/NSMA.* In October 1999, federal fishery managers assumed responsibility for ensuring a rural subsistence priority on navigable waters adjacent to or within the boundaries of federal conservation units. There is continued concern that a result of this action will be reduced opportunity for sport fishing throughout Alaska. Since there is a large amount of federal public land within the NW/NSMA that is used by local residents for subsistence purposes, the potential loss of sport fishing opportunity in remote areas of the NW/NSMA is of concern to anglers and sport fish managers. The ADF&G continues to work with federal managers and Federal Subsistence RACs to address fisheries issues as they arise.

ACCESS PROGRAM

The Wallop-Breaux Amendment to the Sport Fish Restoration Act (Dingell-Johnson or D-J) mandates that at least 15% of the federal funds collected from taxes on boat gas and sport fishing equipment be used by the states for the development and maintenance of motorized boating access facilities. A broad range of access facilities can be approved for funding if they are constructed to achieve a state fishery management objective. These facilities can include boat ramps and lifts, docking and marina facilities, breakwaters, fish cleaning stations, restrooms, and parking areas.

To date, few access projects have been proposed for the rural areas of the NW/NSMA; however, a boat launching facility was built in the village of Unalakleet using Access funds in 2004. In early 2010, a request from the city manager of Nome was submitted for a cooperative project with ADF&G to build a boat launch, parking area, and possibly a restroom facility on the mouth of the Snake River. However, it was unclear whether the city of Nome had the resources to maintain these facilities once they are built, and therefore, any further planning for this project was suspended until this issue is resolved.

INFORMATION AND EDUCATION

Information regarding regulations, publications, stocking and fishing reports, news releases, and EOs for the NW/NSMA can be found by following the *Fishing* and then *Sport* links at the ADF&G website (http://www.adfg.alaska.gov/index.cfm?adfg=fishingSport.main). The *Interior Area* and *Northwest Drainages* sections on this website provide area descriptions, and at the *Fishing Information* and *Fishing Brochures* links, several Division of Sport Fish publications are available for download, including *Nome Roadside Fishing Guide*, *Sheefish Catch & Release* (for anglers interested in fishing the Kobuk or Selawik River drainages), and *Sport Fishing along the Dalton Highway* (for those interested in fishing along the roadside on the North Slope). Also, *Dolly Varden and Arctic Char in Northern Alaska* can be helpful for anglers who fish in the NW/NSMA, because both species are found in the area.

There are 3 regional information and education (I&E) staff located in the Fairbanks office. An Information Officer II and a seasonal Fisheries Technician III respond to questions from the public at the office and via phone and e-mail. In addition, I&E staff update the regional web page, distribute fishery brochures and fishing regulations, and coordinate the Fairbanks Outdoor Show booth, Kid's Fish & Game Fun Day, and the Becoming an Outdoors-Woman (BOW) program. An Education Associate II coordinates the sport fishing component of the Alaska Conservation Camp and works with schools in various communities throughout the region to provide a curriculum in sport fishing and aquatic education.

SPORT FISHING EFFORT, HARVEST, AND CATCH

Effort, harvest, and catch statistics for NW/NSMA sport fisheries have been estimated from responses to the SWHS since 1977 and reported under the headings of Seward Peninsula–Norton Sound Drainages (Area W), Northwest Alaska Drainages (Area X), and North Slope Drainages (Area Z; http://www.adfg.alaska.gov/sf/sportfishingsurvey/). The results of the SWHS indicate that effort in the NW/NSMA has remained more or less stable since 1996; however, estimated annual sport fishing effort since 2010 has dropped precipitously from historical averages (DeCicco 2006; Table 4). For the years 2012–2016, total sport fishing effort for the NW/NSMA averaged 18,315 angler-days, over 6,000 less than the prior 5-year (2007–2011) average of 25,143, with most of the decrease coming from Seward Peninsula waters (Table 4). In 2017, the number of angler-days in the NW/NSMA was 12,245, 44% less than the recent 10-year average of 21,729 angler-days (Table 4).

The Seward Peninsula and Norton Sound subarea supports most of the sport fishing effort in the NW/NSMA. Effort there has averaged 10,205 angler-days (57% of the area total) for the years 2012–2016 (Table 4). Rivers supporting the most sport fishing effort in the NW/NSMA have been the Unalakleet, Fish/Niukluk, and Nome rivers. Angler effort averaged 2,849 angler-days for the Unalakleet River for 2012–2016, approximately 28% of the total effort in the subarea (Table 4). The Nome River has been closed to directed fishing for Arctic grayling and chum salmon since the early 1990s (although sport fishing for chum salmon reopened in 2013), and it is likely that these closures contributed to a reduction of fishing effort on this stream. Annual effort in the Nome River averaged 2,154 angler-days for 2012–2016, comprising 21% of the total effort for the subarea (Table 4), and is primarily directed at pink and coho salmon. The Fish/Niukluk river system has sustained an annual average of 1,595 angler-days of effort for 2012–2016. Estimated effort on the Snake and Sinuk rivers has averaged about 710 and 457 angler-days respectively for 2012–2016 (Table 4).

In the Kotzebue/Chukchi Sea subarea, sport fishing effort has been somewhat more variable, ranging from about 3,500 to 7,400 angler-days per year for 2007–2016 (Table 4). In 2017, there were an estimated 1,882 angler-days in the subarea, the lowest ever recorded (Table 4). Part of the large decrease in angler-days in the Kotzebue/Chukchi Sea subarea may be attributed to the adoption by the BOF in 2016 of a proposal expanding the area in which hook and line attached to a rod or pole is legal subsistence gear within the Kotzebue District (Kotzebue District is the Commercial Fisheries Division definition of the area encompassing the Kotzebue/Chukchi Sea subarea, which is definition of the area used by the Division of Sport Fish) and added the term "rod and reel" to the lawful subsistence gear in the proposed expanded area of the Kotzebue District. This regulation made it unnecessary for resident anglers to purchase sport fishing licenses if they want to use sport fishing gear in the Kotzebue/Chukchi Sea subarea. The large drainages of the Kobuk and Noatak rivers support more than 75% of the freshwater effort in this subarea during most years, and the remainder is dispersed among smaller drainages such as the Wulik, Kivalina, and Selawik rivers, and many of the area's lakes. Expense of travel, difficulty of access, and small human population probably account for the low levels of sport fishing effort reported in this region.

In the North Slope subarea, sport fishing effort is generally light but variable, with much of the effort focused on Dolly Varden, Arctic char, lake trout, and Arctic grayling in streams and lakes along the Dalton Highway (North Slope Haul Road) where access is less difficult. The average effort for the years 2012–2016 was 3,795 angler-days, with more than 60% of that coming from

Haul Road fisheries (Table 4). In 2017, sport fishing effort was 2,138 angler-days with almost 74% of the effort directed at Haul Road fisheries.

Harvests of Pacific salmon in 2017 were well below the recent 5- and 10-year averages (Table 5). Catches of Pacific salmon in 2017 were also below recent averages (Table 6). Salmon harvest in 2017 was 7,656 fish, well below the recent 10-year average of 10,911 fish, with pink salmon harvest (962 fish in 2017) well below the previous years' harvest of 8,565 fish (Table 5). The Unalakleet River has provided for 87% of the harvest and 90% of the catch of king salmon in the NW/NSMA in the past 10 years (Table 7). With a predicted low escapement in 2017, the sport fishery for king salmon was closed to fishing by EO effective May 1, but after escapement counts increased at the North River counting tower and Unalakleet weir, the fishery was reopened to a one fish bag limit and one fish annual limit effective July 9 (Appendix A). Catches of Pacific salmon in the NW/NSMA in 2017 were 23,288 fish, well below the recent 10-year average of 31,195 (Table 6). Much of the fluctuation in salmon catches and harvests in the NW/NSMA can be attributed to the size of the pink salmon runs, which can vary dramatically from year to year throughout Norton Sound (Table 2). Harvest and catch of Arctic grayling and Dolly Varden in 2017 were also below recent averages. Harvest of Dolly Varden in 2017 was 1,717 fish, compared to the recent 10-year average of 3,369 fish. Similarly, harvest of Arctic grayling in 2017 was 733 fish, compared to the recent 10-year average of 1,992 fish (Table 5). Catches of both Dolly Varden and Arctic grayling in 2017 fell from recent 10-year averages. Catches of Dolly Varden were 6,736 in 2017 and of Arctic grayling were 8,573, compared to recent 10-year averages of 14,357 and 18,290 fish, respectively (Table 6).

Harvest and catch of lake trout, sheefish, burbot, whitefish, and northern pike were all below 10-yr averages, with no lake trout, northern pike, whitefish, or burbot catches reported in 2017 (Tables 5 and 6). More detailed descriptions of specific important fisheries by location and species can be found in Section II.

SECTION II:
MAJOR NORTHWESTERN AND NORTH SLOPE AREA FISHERIES

NW/NSMA waters offer some of the most remote and diverse angling opportunities available in Alaska. Opportunities to fish for Dolly Varden, sheefish, and Arctic grayling in pristine areas without encountering other anglers are widespread. Angling opportunities for salmon, especially chum, pink, and coho salmon, are not as well-known but can be excellent. Marine sport fisheries have been virtually nonexistent throughout the area, although in Norton Sound, anglers occasionally try trolling for salmon (king, coho, and pink) on calm days. The proportion of angler-days spent fishing in saltwater is generally less than 5% of the total annual areawide effort. Jigging through the ice for saffron cod, smelt, flounder, sheefish, Arctic grayling, and Dolly Varden is common near coastal settlements, but these fisheries generally operate under subsistence fishing regulations.

This section provides a summary of significant sport fisheries by species in the NW/NSMA in 2016. Discussion of each fishery will address 1) a historical perspective; 2) recent fishery performance (stock status); 3) fishery objectives and management; 4) current issues; 5) recent actions by the board; and, 6) ongoing and recommended management and research activities. Recent fishery performance will focus on data from 2017. Information regarding the 2018 season were included where available, but estimates of sport effort, catch, and harvest are not yet available for the 2018 season.

NORTHWESTERN ALASKA SALMON FISHERIES

Sport fishing for salmon takes place throughout the management area. However, the vast majority of salmon fishing occurs in the Seward Peninsula/Norton Sound subarea, with concentrated effort near Unalakleet and in waters accessible from the Nome area road system. Some salmon fishing effort occurs in association with wilderness float trips in Kotzebue Sound drainages, but the amount of sport fishing effort expended toward salmon in the northern part of the management area is very light and harvests are very small.

During the recent 5-years (2012–2016), about 48% of the total average salmon harvest has been coho, 38% pink, 14% chum, <1% king, and <1% sockeye salmon. In 2017, 78% of the total salmon harvest was coho, 13% pink, 7% chum, 2% sockeye, and <1% king salmon (Table 5).

UNALAKLEET RIVER SALMON FISHERIES

Background and Historical Perspective

The village of Unalakleet, with a population of about 800, is located on the shore of Norton Sound at the mouth of the Unalakleet River. Daily air service from Anchorage and Nome provides access for anglers visiting the Unalakleet area. The Unalakleet River supports substantial runs of king, chum, coho, and pink salmon. Most of the angling effort on the Unalakleet River is directed toward king and coho salmon, but other species of salmon, Arctic grayling, and Dolly Varden are also targeted. The king salmon run usually begins in mid-June, peaks during the first week of July, and continues through late July. Anglers access the river by boat from the village of Unalakleet and are composed of a mix of local residents, visitors who rent boats or fish with friends, and visitors who stay at 1 of the 2 sport fishing guide operations on the river. Most sport fishing effort occurs

in the lower 15 miles of the Unalakleet River and in the lower 5 miles of the North River, which is a tributary that enters the Unalakleet River about 7 miles upstream from its terminus at the Bering Sea. Sport fishing for king salmon in the Unalakleet River is popular with both local residents and guided and nonresident anglers. Historically, about 15% of the king salmon harvested from the river each year are taken by guided anglers (Sigurdsson and Powers 2016, *In prep*).

There are 2 private lodges on the Unalakleet River, upstream of the North River, which provide guided fishing trips for salmon, Dolly Varden, and Arctic grayling. The U.S. Air Force operated a sport fishing recreational camp on the Unalakleet River, 8 miles upstream of the village, during the 1960s. A commercial sport fishing lodge was constructed there in the late 1960s, and the Unalakleet Native Corporation owned the lodge for several years and contracted operations. This lodge is currently in private ownership and can accommodate up to 15 clients at once. The other, smaller operation generally has 2–6 clients at once and focuses primarily on fishing for coho salmon in August. Guiding operations from the Yukon River drainage will sometimes visit the river via small plane during the peak of the king and coho salmon runs. While the majority of angling on the Unalakleet River used to be by unguided anglers, the proportion of guided anglers has increased in the last 20 years. An unpublished survey by the Division of Sport Fish in the 1990s estimated that only about 8.5% of salmon anglers on the Unalakleet River were guided. Based on estimated effort levels from the SWHS and known effort by the guiding businesses via the guide logbook program, it is likely that guiding currently accounts for about 15–30% of the total angling effort on the Unalakleet River (Sigurdsson and Powers 2016, *In prep*).

Recent Fishery Performance

For the years 2001–2017, the Unalakleet River sustained the highest sport fishing effort of any single river in the NW/NSMA in all but 2 years. The 2002 effort was the highest on record at 8,195 angler-days, and effort for the years 2012–2016 averaged 2,849 angler-days (Table 4). Unalakleet River salmon harvests trended upward between 1991 and 2000 (DeCicco 2006) and remained relatively stable until 2008, when a record number of salmon were harvested (8,861 fish), principally pink and coho salmon (Tables 7–10). In 2017, the harvest of all salmon species was 4,750 fish, and the average annual sport harvest of all salmon species from the Unalakleet River for the years 2012–2016 was 3,729 fish. Coho salmon comprised about 81% of the average harvest, while pink salmon made up 13% and chum salmon comprised 5% of the harvest. Approximately 75% of the entire NW/NSMA harvest of coho salmon was taken from the Unalakleet River in 2017, while just 13 king salmon were estimated to be harvested, likely resulting from early-season closures to the sport fishery (Tables 7 and 8; Appendix A1).

Estimated sport harvest of king salmon in the Unalakleet River remained fairly stable from 1993 to 2002, averaging about 431 fish annually (DeCicco 2006). For the years 2003–2009, king salmon harvest averaged 291 fish per year (Table 7). This decline in harvest was most likely a result of king salmon restrictions (no retention effective the first or second week of July) in 6 of the 7 years during this period. In addition, beginning in 2007 the annual harvest limit for sport-caught king salmon was reduced from 4 fish to 2 fish by the BOF. In 2008, estimated harvest increased to 580 fish; however, this number may be inflated because 1 respondent reported catching and harvesting 32 "jack" king salmon (<20 inches) in a year with record low escapement (903 fish counted at the North River tower). This response seems very unlikely, and these fish were probably Dolly Varden or pink salmon. The harvest estimate for king salmon ≥20 inches was 108 fish, a reasonable number considering the small size of the escapement and the harvests from recent years. Catches

of king salmon have averaged 117 fish and harvests have averaged 16 fish annually for 2011–2015 (Table 7).

There have been no directed commercial fishing openings for king salmon since 2001 in the Unalakleet Subdistrict (Menard et al. 2017, *In prep*). Unalakleet and Shaktoolik king salmon stocks were designated as "stocks of concern" by the BOF in January 2004. King salmon subsistence harvests in Unalakleet have ranged from 90 fish in 1966 to 4,191 fish in 1997 (Menard et al. 2017, *In prep*). The recent 5-year average (2012–2016) harvest was 673 fish, and the 2017 subsistence harvest was estimated at 687 king salmon. The sport fish harvest over the same 5-year period averaged 16 king salmon (Table 7). In 2017, 369 king salmon were reported caught and 13 harvested in the sport fishery (Tables 6 and 7).

In 2017, the Division of Commercial Fisheries restricted subsistence fishing time in the marine waters of the Unalakleet Subdistrict as well as closed subsistence fishing in the Unalakleet River in order to provide for escapement while allowing for a small subsistence harvest. As a result, an emergency order was issued on April 17, closing sport fishing for king salmon and prohibiting the use of bait in all southern Norton Sound waters (Appendix A1). As daily escapement counts increased, the lower end of the Sustainable Escapement Goal (SEG) was projected to be met and a second emergency order was issued on July 12 reopening southern Norton Sound waters to a one fish annual limit. (Appendix A1). The final count was 1,044 fish, below the escapement goal (1,200–2,600 king salmon), however the final count at the weir on the mainstem Unalakleet River was 2,928 fish, the highest count since its inception in 2010 (Table 2).

Coho salmon are the most sought-after salmon species in the Unalakleet drainage. The run usually begins in late-July, peaks during mid-August, and continues through mid-September. Estimated sport harvest of coho salmon in the Unalakleet River has averaged 3,031 fish for the years 2012–2016 (Table 8). In 2017, 4,446 coho salmon were harvested, the highest number since 2009 (Table 8). Approximately 48% of coho salmon caught were harvested, while about 19% of pink salmon, 12% of the king salmon, and 9% of chum salmon (2012–2016 average) caught were harvested (Tables 8–10).

From 2012 to 2016, commercial harvests of coho salmon in the Unalakleet Subdistrict have averaged 54,361 fish, however in 2017 the harvest was a record 111,872 fish (Menard et al. 2017, *In prep*). During the same period (2012–2016), subsistence harvests of coho salmon in the community of Unalakleet averaged 6,041 fish (Menard et al. 2017, *In prep*).

Historic escapement data for coho salmon in the entire Unalakleet River drainage are not available. In addition, the run of coho salmon into the Unalakleet River drainage generally begins in mid-July and continues through September, well after enumeration projects have ceased operation. Information on the proportion of the run that spawns in the mainstem Unalakleet River was not available until recently; however, counting-tower numbers from the North River probably give an indication of recent run strength. Based on the tower counts, the 2005 and 2007 escapements were over twice the size of the 2004 and 2006 escapements (Table 2; Menard et al. 2017, *In prep*). In 2009, the escapement was the highest on record with 22,226 coho salmon past the counting tower. In both 2011 and 2012, tower counts of coho salmon were well below recent counts; however, in both years the tower was inoperable due to high water for several days during the historical peak of the coho salmon run (Menard et al. 2017, *In prep*). In 2017, the tower count of coho salmon at the North River was low at 2,446 fish, with many days of high water during the run making counting impossible (Table 2).

Fishery Objectives and Management

Prior to 2007, there were no specific management objectives identified for salmon fisheries on the Unalakleet River. In 2007, the BOF adopted the *Unalakleet River King Salmon Management Plan*, which mandates inseason management actions in the subsistence, sport, and commercial king salmon fisheries to achieve the escapement goal based on North River tower count projections. In 2007, a king salmon sustainable escapement goal (SEG) of 1,200 to 2,600 fish was established for the North River. The management goal in the Unalakleet River is to maintain adequate escapement of king salmon into the system that will support utilization by the various user groups.

Current Issues and Fishery Outlook

Although sport fishing has been ongoing in the Unalakleet River drainage for many years, there is some local resentment of visiting anglers, represented by a few Unalakleet residents who have frequently expressed their point of view during local AC meetings that "outsiders" are competing for the local salmon resources.

Previous declines in chum and coho salmon runs throughout Western Alaska affected the Unalakleet River drainage, although the effect appears to be less dramatic than in Nome Subdistrict streams, which have since recovered and regularly make escapement goals. Recent increases in escapements and commercial catches suggest that coho and chum salmon returns in the Unalakleet River are at more acceptable levels, particularly for coho salmon (Table 2; Menard et al. 2017, *In prep*). While the commercial harvests of king salmon in the Unalakleet Subdistrict have been minimal during the past 10 years, sport harvests have stayed fairly consistent until 2012–2017, when almost no king salmon were harvested in the sport fishery due to preseason closures.

The upper reaches of the Unalakleet River (from the Chiroskey River to the headwaters) is a designated National Wild River and falls under federal subsistence management authority. Until recently, federal and state management have not been in conflict for fisheries in the Unalakleet River drainage. However, in March 2009, the FSB closed the federal public waters of the Unalakleet River (upstream from the mouth of the Chiroskey River, or approximately 23 river miles from the village) to the taking of king salmon during July 1–31. It is unclear how this closure has affected any anglers intending to catch king salmon in the future; however, the vast majority of the sport fishing effort occurs below the Chiroskey River and so little effect on harvest is anticipated.

Recent Board of Fisheries Actions

In 2007, the BOF adopted the *Unalakleet River King Salmon Management Plan*, which used thresholds within the escapement goal range and projected North River tower counts to trigger inseason management actions in the subsistence, sport, and commercial fisheries. With the adoption of this plan, the annual limit was reduced from 4 to 2 king salmon 20 inches or longer. No proposals for the Unalakleet River salmon sport fisheries were adopted by the BOF at either 2016 meeting, and there are no proposals regarding the Unalakleet River or Subdistricts 5 and 6 to deliberate for the 2019 meeting.

Current or Recommended Research and Management Activities

Salmon escapements in the Unalakleet River are monitored using a counting tower in the North River, a floating weir in the mainstem Unalakleet River above the confluence with the North River, and aerial surveys. The tower is a cooperative project funded through the Norton Sound Economic

Development Corporation (NSEDC) and operated by NSEDC with guidance by ADF&G Division of Commercial Fisheries, and it provides a reliable estimate of escapement into the North River because of water clarity. Aerial surveys are difficult in the Unalakleet River because of its dark bottom and tannin-stained water. These surveys provide an index of the minimum escapement but are unreliable as an indicator of total escapement in this river.

In 2010, a floating weir was installed in the mainstem Unalakleet River approximately 14 river miles upstream of the village to enumerate and sample king salmon from mid-June through July each year. The weir was installed successfully; however, there were problems capturing king salmon at the weir for biological sampling, and the crew had to beach seine upriver to collect age, sex, and length (ASL) data. Improvements to trap design were made for the 2011 season, and king salmon were easier to capture. In addition, because king salmon were still moving upriver when the weir was removed at the end of July 2010, the subsequent seasons have been extended into mid-August to ensure that all king salmon were counted in 2018 when the weir was operational until August 8. This is a federally funded project through the Office of Subsistence Management, with cooperation from BLM, NSEDC, and the ADF&G Division of Commercial Fisheries.

A 3-year coho salmon radiotelemetry project, conducted by ADF&G Division of Sport Fish, supported in part by BLM, began in 2004. Approximately 200 coho salmon were implanted with radio transmitters each year and tracked to spawning locations. Results of this project suggest that 8–15% of coho salmon entering the Unalakleet River migrate up the North River to spawn (Joy and Reed 2007). A similar research project was conducted on king salmon in the Unalakleet River during 1997 and 1998. In 1997, 37% of radiotagged king salmon spawned in the North River, and 40% in 1998 (Wuttig 1998 and 1999). These data are used to expand the North River tower estimate to allow a relative estimate of the escapement in the entire drainage. In 2009 and 2010, the radiotelemetry experiment on king salmon was repeated, and preliminary results show that 34% of the escapement went into the North River in 2009 and 53% in 2010. The 2010 results are significantly higher than the previous 1997 and 1998 findings, which could be biased low based on late run timing of king salmon up the North River in these years (Joy and Reed 2014).

In 2011, the Division of Sport Fish initiated a research project to investigate juvenile king and coho salmon ecology in the Unalakleet River. This project was designed to estimate productivity (number of smolt produced per spawner), condition, and growth rates, as well as to determine if a relationship exists between salmon productivity and effects of marine-derived nutrients (MDN) on smolt production. Preliminary results suggest that pink and chum salmon fry constitute 10–20% of king and coho salmon diets, that king salmon begin their outmigration to sea in the spring under the river ice, and that coho salmon primarily utilize off-channel waters for feeding while king salmon are more often found in the mainstem Unalakleet and North Rivers (Philip Joy, Biologist, ADF&G, Fairbanks, personal communication). This project was discontinued in 2013; however, additional funding is being sought to continue this project in the future, possibly adding the use of coded-wire tags to estimate marine survival of king and coho salmon.

Division of Sport Fish staff have frequently assisted and cooperated informally with the Division of Commercial Fisheries and the Native Village of Unalakleet (NVU) on projects, including the partial funding of counting towers, surveys for adult salmon abundance, and observation of spawning concentrations.

NOME AREA ROADSIDE SALMON FISHERIES

Background and Historical Perspective

Nine rivers, accessible from the road system near Nome, sustain some level of sport fishing effort for salmon (Figure 4). The Nome River has accounted for about 12% of all the sport fishing effort in the entire NW/NSMA during 2012 to 2016 (Table 4). Effort on the Nome River dropped from a high of 7,194 angler-days in 1990 to about 651 angler-days in 2003 (Table 4). Trends in effort have generally coincided with the abundance of pink salmon available to anglers; however, recent fluctuations in summer employment in the Nome area associated with mining have possibly contributed to the recent effort variation as well. The recent 5-year average (2012–2016) on the Nome River was 2,154 angler-days (Table 4). An average of 1,873 salmon was harvested annually from the Nome River during this period, of which 74% were pink salmon (Tables 7–10). The alternate-year strong pink salmon run in Norton Sound has a major influence on salmon harvests in sport fisheries on road-accessible streams. This relationship has been strongest in the Nome River because of its proximity to Nome and the ease of access to visitors and residents alike. Coho salmon catch and harvest has been down, with the recent 5-year average being well below the recent 10-year average, although the 2017 harvest of 973 fish was the highest since 2008 (Table 8).

Chum salmon escapements had been increasing in the Nome River in recent years since the collapse in 1990 and had reached up to 7,034 fish in 2007, but in 2009 these numbers had dropped again to 1,565 fish. In 2017, the chum salmon escapement into the Nome River was 8,340 fish, the highest count since the inception of the weir in 1993 (Menard et al. 2017, *In prep*). The pink salmon escapement dropped from over 1.1 million fish in 2008 to just 16,490 fish in 2009; however, due to the alternating strong (even-year) and weak (odd-year) run life-cycle of pink salmon, this drop was not unexpected. The 2007 parent year escapement for the 2009 return was 24,395 fish. The pink salmon escapement in 2017 the escapement was 717,770 fish, the largest odd-year run on record (Table 2). These levels of escapement are considered sufficient to provide for subsistence and sport harvests.

The Niukluk and Fish rivers are also popular sport fishing locations for salmon (Figure 4). One small guiding operation is located on the Niukluk River, and another uses helicopters to transport clients to the upper reaches of these rivers to fish primarily for Arctic grayling, but also coho salmon and Dolly Varden. Many Nome residents have summer cabins on the Niukluk River or fish camps along the river. Residents of White Mountain also travel upriver to the Niukluk for subsistence as the river has several good spots to beach seine for salmon. Since the construction of the bridge over Safety Sound in 1980, as well as improvements to the road, access to the Niukluk and Fish rivers has improved, and this area has become a desirable destination for the road-bound angler. For the years 2012–2016, the drainage sustained an average annual effort of 1,595 angler-days (Table 4), and an average of 1,071 salmon have been harvested annually from the Fish and Niukluk rivers, most of which (81%) are coho salmon (Tables 7–10). Since 2005, the lower bound of the escapement goal range for coho salmon (2,400–6,100) has been met every year through 2011 at the counting tower on the Niukluk River, averaging over 7,000 coho salmon a year during this time (Table 2). The 2012 count of 1,729 is considered incomplete, because the counting tower was inoperable after August 16 due to high water, well before the historical coho salmon escapement midpoint date of August 21. Historically, king salmon have not been found in large numbers in the Niukluk River, and escapement of king salmon into the Niukluk River has been less than 200 fish. The Niukluk River counting tower is no longer in operation and since 2014

salmon escapements are counted at a tower on the mainstem Fish River downstream of the mouth of the Niukluk River (Table 2). Recent research shows that approximately 40% of the coho salmon that enter the Fish River drainage spawn in the Niukluk River (Bell et al. 2011).

The Pilgrim River, with its headwaters at Salmon Lake, has historically been less popular for sport fishing for salmon, but is a popular location to subsistence fish for sockeye salmon. The Pilgrim River sustained an average annual effort of 305 angler-days for the years 2012–2016 (Table 4), and about 9 salmon were harvested annually during that period, all of which were coho salmon (Tables 7–10). Some of this effort was directed toward other species, because the Pilgrim (and the nearby Kuzitrin River) provides anglers with access to the best northern pike and whitefish fishing on the Nome road system. There is a Bureau of Land Management (BLM) campground at the outlet of Salmon Lake, and from there, the river can be floated for about 25 river miles to the bridge at mile 65 of the Kougarok Road. Riverboats can be launched at the bridge for access to downstream locations. The Pilgrim River is also open to subsistence fishing with gillnets, beach seines, and dip nets, so it is likely that local residents who desire sockeye salmon from the Pilgrim River would use this gear under a subsistence fishing permit rather than by sport fishing with hook-and-line. This may explain, in part, the lower sport fishing effort and salmon harvest on the Pilgrim River, when compared to those systems with larger runs of coho and pink salmon, species that are more easily caught by sport fishing gear (such as Nome and Niukluk rivers). Until 2013, the Fish/Niukluk and the Pilgrim rivers were the only road-accessible rivers where sport fishing for chum salmon was allowed; however, the combined annual harvests over the last 5 years (2012–2016) from these drainages have only been 23 chum salmon, all of which came from the Fish River drainage (Table 10).

Large sockeye salmon escapements during 2003–2008 drew additional subsistence effort to this drainage (Table 2; Menard et al. 2017, *In prep*). All 5 species of Pacific salmon occur in the Pilgrim River. Sockeye salmon spawn in Salmon Lake, and runs initially appeared to respond positively to lake fertilization conducted by Norton Sound Economic Development Corporation (NSEDC), as well as favorable marine conditions (C. Lean, Biologist, NSEDC, Nome, personal communication). However, recent escapements have decreased, and the efficacy of fertilization to enhance smolt condition or adult returns remains unclear (Hamazaki et al. 2012). Escapement of sockeye salmon past the weir in the Pilgrim River for the years 2004–2008 ranged from 20,448–85,520 fish, but has averaged 16,370 fish for the years 2009–2017 (DeCicco 2006; Table 2). These compare to an average escapement of 5,400 for 3 years of enumeration between 2000 and 2002 (Table 2).

The mouth of the Snake River is in downtown Nome. This small stream can be accessed from a bridge at about mile 8 of the Teller Road and from the nearby Glacier Creek Road. Over the recent 5-year period (2012–2016), the Snake River has sustained an average annual effort of 710 angler-days, with an annual harvest of 205 salmon, of which about 65% were pink salmon and 35% were coho salmon (Tables 4, 7–10). Other popular road-accessible waters include the Solomon and Sinuk rivers. Annual harvests in these rivers, combined for the recent 5-year period (2012–2016), have averaged about 184 coho salmon and 288 pink salmon (Tables 8–9). During years of high pink salmon abundance (even years), this species has dominated catches and harvests in most Nome roadside streams (Table 9).

Recent Fishery Performance

While pink salmon are by far the most prevalent salmon found in Norton Sound roadside streams, with over 1 million fish returning to some streams in even years, estimated sport harvest of pink salmon averaged only 1,368 fish for the years 2012–2016 (Table 9). Although they are less abundant, coho salmon are a more popular sport fish, probably due to their size, aggressiveness, and superior flavor compared to pink salmon. Estimated sport harvest of coho salmon in roadside fisheries around Nome for the years 2012–2016 averaged 1,524 fish per year and comprised 54% of the total salmon harvest. Prior to 2013, chum salmon fishing had been closed for many years because of depressed stocks, although an average of 140 chum salmon have been harvested annually from Nome roadside streams since the fishery reopened (Table 10). Both runs and harvests of sockeye and king salmon in the Nome area are negligible; however, sockeye salmon have recently returned in numbers high enough on the Pilgrim River to provide for the popular subsistence fishery.

Sport fishing effort in the Fish/Niukluk river system has ranged from a high of about 4,800 angler-days in 1999 to 767 angler-days in 2014 and averaged 1,595 angler-days for the years 2012–2016 (Table 4). Estimated harvest of salmon was 106 fish in 2017, well below the recent average (2012–2016) of 1,071 fish (Tables 7–10). Although sport fishing for chum salmon is allowed in this drainage, harvest has remained low (Table 10), and most of the chum salmon harvested by hook-and-line are by subsistence fishers. A low harvest of only a few hundred pink salmon occurred in the even years since 1998 despite an abundant run of this species, with over 1 million fish in the Niukluk River in some years. This low harvest of pink salmon is probably due to the poor condition of the fish by the time they reach the Niukluk River, although 969 pink salmon were harvested in 2008, in a year when the escapement on the Niukluk River was almost 670,000 fish (Tables 2 and 9). Just 12 pink salmon were harvested in the sport fishery in 2016 (Table 9).

The Pilgrim River is the other road-accessible water where chum salmon sport fishing is still allowed; however, harvest hasn't been reported since 1995. Effort there in 2017 was estimated at 164 angler-days, well below the recent 5-year (2012–2016) average of 305 angler-days (Table 4). Large returns of sockeye salmon from 2004 to 2008 probably reduced sport effort on other species and other systems; although escapements have fluctuated widely since 2009 (Table 2). The high quality of the sockeye salmon coupled with ease of access and ability to use subsistence gear (gillnets and seines) in the river provides local residents with an abundant, easily harvested source of high-quality fish without having to use sport fishing gear for less desirable species.

Fishery Objectives and Management

There have been no specific management objectives identified for salmon sport fisheries for the Nome roadside streams. The goal of sport fishery management in these waters is to maintain opportunity for anglers to participate in the fisheries and to ensure that escapement goals are met. Sport fishery harvests are small, and emergency actions to restrict sport harvest are generally not contemplated unless escapement-monitoring projects indicate that a particular run is small and that restrictions in subsistence fisheries will be necessary in order to meet escapement goals. One SEG, based on aerial surveys, is in place for sockeye salmon in Salmon Lake, at the headwaters of the Pilgrim River. SEG goals based on tower estimates and weir counts are in several rivers along the Nome Road system, although the Niukluk River SEGs have been removed now that the tower is no longer in operation (Table 2).

Current Issues

Until recently, Seward Peninsula chum salmon stocks had been in a steady decline since the early 1980s (Menard et al. 2017, *In prep*). This led to increasingly restrictive sport and commercial management and the implementation of a Tier II subsistence fishery (limited to fishers who have a customary and direct dependence on a resource) from 1999–2005 in the Nome Subdistrict. Chum salmon runs have improved in recent years to allow the subsistence fishery to be managed as a Tier I fishery since 2006. All rivers in Northern Norton Sound, from the Sinuk River in the west to Topkok Head in the east, were closed to sport fishing for chum salmon by regulation in 1992. Chum salmon runs have stabilized and even increased in some drainages in recent years, suggesting that runs may be in the process of recovering; and restrictions on commercial and sport fisheries are no longer necessary. Throughout the entire subdistrict, escapement averaged over 73,000 chum salmon for the years 2006–2016, well above the BEG range of 23,000–35,000 fish, and in 2017 the escapement was a record 123,781 fish. However, the decision by the BOF to reopen the chum salmon sport fishery to a bag and possession limit of 3 fish per day in 2013 was not embraced by many Nome-area residents and will likely remain a source of conflict between ADF&G and local subsistence fishers. Although it is anticipated that sport harvests will remain inconsequential in relation to the size of the escapements, ADF&G managers will nonetheless monitor tower and weir counts in the Nome Subdistrict carefully and implement restrictions if escapement goals for chum salmon are not projected to be met.

In 2012, a disagreement between Division of Commercial Fisheries managers and Council Native Corporation over coho salmon management led to the cancellation of the land lease on which the Niukluk River counting tower was stationed, and consequently the tower and camp were removed. It is unlikely that the counting tower on the Niukluk River will be operating in the near future, therefore in 2013 the materials and resources from this project were transferred to the Solomon River, which previously did not have an on-the-ground salmon enumeration project. In 2018, the Solomon River counting project was only in operation between June 30 and August 8, and counted 3,383 chum, 458,125 pink, and 162 coho salmon.

Recent Board of Fisheries Actions

In 2013, the BOF adopted a proposal to reopen the sport fishery for chum salmon to a bag and possession limit of 3 fish per day in all Nome Subdistrict waters except for the Penny and Cripple rivers. These rivers remain closed due to their very small size and subsequent small runs of chum salmon. No BOF actions were taken regarding this fishery at the 2016 meeting.

Current and Recommended Research and Management Activities

Current research and management activities on Nome roadside salmon populations are primarily conducted by the Division of Commercial Fisheries in conjunction with NSEDC's fisheries office. These groups cooperatively operate escapement enumeration weir or tower projects on the Nome, Solomon, Eldorado, Pilgrim, Snake, and Fish rivers. The weirs direct the movement of all fish, which are counted as they are permitted to pass through an opening in the weir several times each day. Since 2001, a weir has been operated by BLM, NSEDC, or the Division of Commercial Fisheries at the outlet of Glacial Lake on the Sinuk River to enumerate sockeye salmon migrating into the lake. In 2012, a video enumeration pilot study was begun on the Lower Sinuk River to count all species of salmon, but the study had mixed results and was discontinued. Recently, NSEDC in cooperation with LGL-Alaska has conducted experiments on the Fish, Niukluk, and Nome river drainages attempting to estimate coho salmon escapements using abundance of smolt,

as well as measuring available freshwater fry habitat. To date, the results have shown that the relationship between smolt abundance and subsequent adult returns has been difficult to measure. In 2015, the Division of Commercial Fisheries, in cooperation with the Division of Sport Fish and NSEDC, began a 2-year project to examine movements of chum salmon captured and released in the marine waters of the Nome Subdistrict using acoustic transmitters. This project involved placing receiving stations at several locations in marine waters as well as at all of the major chum salmon-producing streams in the Nome Subdistrict. Results showed that most tagged fish were later detected in the Sinuk, Bonanza, and Nome rivers, with a small proportion of tagged fish being recaptured by fishers near Kotzebue (Bell et al. 2018). In addition, results suggest that chum salmon harvested in the marine waters of the Nome Subdistrict were primarily bound for rivers inside the Nome Subdistrict for spawning. Staff from the Division of Sport Fish assisted with receiver deployment, and fish capture and tagging, and report-writing.

NORTHWESTERN ALASKA DOLLY VARDEN AND ARCTIC CHAR

Background and Historical Perspective

In Northwestern Alaska, Arctic char occur in lakes in the Kigluaik Mountains and in some headwater lakes in the Kobuk and Noatak river drainages, while Dolly Varden are common inhabitants of most coastal streams and large rivers (Figures 2–6). Although ADF&G typically combines Dolly Varden and Arctic char for bag limits and data collection for harvest surveys, they are two different species with distinctly different life histories. Arctic char are present only as lake-resident populations, while Dolly Varden may be present as lake-resident, stream-resident, or anadromous populations. Arctic char distribution is very limited in Northwestern Alaska, and the vast majority of "char" fisheries are actually directed toward Dolly Varden.

Many residents of Northwestern Alaska maintain a traditional subsistence lifestyle in which Dolly Varden comprise an important part of their traditional harvest and, in some communities, outrank salmon and whitefish in importance to the subsistence economy. The number of Dolly Varden harvested for subsistence purposes are largely undocumented in Northwestern Alaska but vastly exceed the number taken by sport anglers. Intermittent community subsistence harvest estimates dating back to 1959 for the villages of Kivalina and Noatak (Scanlon 2008), and personal observation by the area biologist and subsistence resource specialist suggest that 15,000 to 30,000 Dolly Varden are harvested annually in this area (James Magdanz, Subsistence Resource Specialist, ADF&G, Kotzebue, personal communication). In 2007, the residents of Kivalina harvested 67,739 pounds of Dolly Varden, second only to bearded seal in terms of pounds of harvested subsistence foods; and in Noatak, 33,771 pounds of Dolly Varden were harvested, second only to caribou (Magdanz et al. 2010). Fish are captured with gillnets or beach seines during open water periods and with hook-and-line during winter. Dolly Varden are also an important subsistence resource in Norton Sound; however, their relative importance is minor compared to salmon.

Observations and infrequent aerial surveys suggest that Dolly Varden spawner abundance is low in most rivers; however, spawning occurs in almost all drainages of Norton Sound, some northern Seward Peninsula rivers, and the major drainages of Kotzebue Sound and the Chukchi Sea. Aerial surveys of spawning Dolly Varden conducted during the mid-1990s indicated that about 9,000–12,000 spawned annually in the Noatak drainage (Table 11). Total abundance of spawning Dolly Varden in Northwestern Alaska is unknown. Partial surveys for the years 2002–2005 and angler reports suggested that spawner abundance in Noatak, Wulik, and Kivalina river streams had

declined to some degree; however, it appears based upon anecdotal subsistence fishing reports that fishing has been good, and subsistence needs for Dolly Varden are being met in Northwestern Alaska.

Anadromous Dolly Varden make their first seaward migration at age-3 or age-4 in the spring to feed during the summer then return to freshwater each winter. Upon reaching sexual maturity at ages 6–9, they return to their home river to spawn. Each fall, nonspawning Dolly Varden return to freshwater to overwinter in mixed-stock aggregations. Some Dolly Varden stocks spawn in August, while others spawn in September or October. During summer, spawning Dolly Varden are caught in some Northwestern Alaskan streams; however, most sport fisheries for Dolly Varden target overwintering populations either in the fall as they enter freshwater from the sea or in the spring as they move toward the sea. Because overwintering populations are composed of mixed stocks, potentially from a wide geographic area, harvests in the few rivers with good angler access have been sustainable. Harvests can be substantial in streams along the Nome road system, and if directed toward a single stock, they might not be sustainable.

Movements of Norton Sound Dolly Varden coincide with those of salmon and are sometimes present in streams during summer to feed on salmon eggs, especially during years of high pink salmon abundance. They are also likely to remain in streams during the spring following a large pink salmon run in order to feed on abundant outmigrating salmon fry. The timing of the fall movement of Dolly Varden into Seward Peninsula streams can vary widely based on weather and water levels, resulting in annual changes in the availability of Dolly Varden to the fall fishery. Fisheries and harvests in this area follow these patterns of availability. In 1994, the BOF adopted the current bag and possession limits for Dolly Varden and Arctic char in the AYK region with 10 fish per day, only 2 fish 20 inches or longer allowed in marine or flowing waters and 2 fish per day (no size limit) allowed in lakes. Due to habitat preferences, these regulations allow a liberal limit for Dolly Varden while protecting spawning fish and a conservative limit for Arctic char (found primarily in lakes) without the need for anglers to differentiate between these 2 closely related species.

Drainages of Kotzebue Sound and the Chukchi Sea are known for the large size of anadromous Dolly Varden available to the sport angler. Since the inception of ADF&G's Trophy Fish Program in 1967, 73 out of 251 qualifying fish (29%) in the Dolly Varden/Arctic char category have come from the NW/NSMA. In addition, the current Alaska sport fish angling record for Arctic char/Dolly Varden (27 lb 4 oz) was a Dolly Varden taken from the Wulik River in 2002, surpassing the previous record of 20 lb 12 oz taken from the same river in 2000.

Abundance and size composition were estimated for Dolly Varden overwintering in the Nome River in 1991 and 1992 and the Solomon River in 1991. In addition, the movement of marked fish from the Nome River in 1991 to other rivers in 1992 was estimated (DeCicco 1992a and 1993a). These data, in combination with harvest estimates and observed changes in abundance, have been used to guide ADF&G management activities. The results indicate Dolly Varden that overwinter in a particular stream may overwinter in other streams during subsequent years. Hence, a restrictive bag limit in a single stream does not necessarily protect a single stock because fish range widely and stocks mix over a broad geographic area. During the winter of 2000–2001, Dolly Varden were radiotagged in the Nome and Solomon rivers to document the critical wintering areas in these rivers and found a general pattern of gradual downstream movement, with several fish that were tagged in the Solomon River later detected in the Bonanza River (DeCicco 2001).

Surveys in the Kotzebue Sound subarea have occurred intermittently since 1967, but in recent years they have been limited to aerial index counts of spawning Dolly Varden in Noatak River tributary streams with the assistance of the NPS, and index counts of Dolly Varden overwintering in the Wulik River with the assistance of the ADF&G-Division of Habitat and the Red Dog Mine. Data on the abundance of Dolly Varden overwintering in the Wulik River will continue to be collected, in cooperation with these agencies. A genetics study was funded through the USFWS (US Fish and Wildlife Service) Office of Subsistence Management (OSM) to determine the relationships among stocks north and south of the Bering Strait. Results suggested that stocks in western Alaska are structured along geographic lines with good separation among stocks (Crane et al. 2005). A detailed study of a single spawning stock in the Noatak drainage was begun in 2001. This spawning stock assessment project was completed, but high water conditions during critical times of fish movement in both 2001 and 2002 resulted in incomplete data (Scanlon 2004). In October 2003, 15 Dolly Varden were radiotagged in the Wulik River to determine movement over the course of the winter. These fish remained in the same vicinity as tagged until June 2005 (A. DeCicco, 2006, unpublished data). At that time, 2 fish, likely spawners, remained in the Wulik River, and 1 had been captured at Kivalina. The remaining radiotagged fish could not be located and it is believed that these fish had already migrated to salt water.

Recent Fishery Performance

Over the recent 5-year period (2012–2016), sport harvests of Dolly Varden and Arctic char have averaged 804 fish annually in the Seward Peninsula/Norton Sound subarea and 675 fish in the Kotzebue Sound/Chukchi Sea subarea (Table 12). The historically higher harvests in the Seward Peninsula/Norton Sound area are most likely because local residents have good road access to fishing areas where fish taken by hook-and-line are used for food. In the Kotzebue Sound subarea, most fishing sites are accessed by aircraft or raft, and much of the effort is from outside the local area by anglers seeking a high-quality fishing experience. Estimated sport fishing effort levels in both the Seward Peninsula/Norton Sound subarea and the Kotzebue Sound subarea have been fairly consistent over the past several years. Average annual catch for 2012–2016 was 4,960 Dolly Varden in the NW/NSMA (Table 13). During the recent 5-year period (2012–2016), about 70% of all Dolly Varden caught in the NW/NSMA were released.

Dolly Varden harvests have been reported in most of the rivers in the Seward Peninsula/Norton Sound subarea, with the highest harvests coming from the Nome, Unalakleet, Sinuk, and Fish/Niukluk rivers (Table 12). In the Kotzebue/Chukchi Sea subarea, the highest harvests are from the Noatak and Wulik rivers and the “other rivers” category, which includes the Kivalina River (Table 12).

The Wulik River is located about 90 miles north of Kotzebue and is well known as an excellent fishing destination for large Dolly Varden (Figure 5). The river is about 90 miles long and enters the Chukchi Sea through Kivalina Lagoon near the village of Kivalina. Dolly Varden from the Wulik River are heavily used for subsistence by the residents of Kivalina (Magdanz et al. 2011). Sport fishing occurs throughout the open water period, but most effort and harvest occurs during late August and September when Dolly Varden return from the marine waters to overwinter in the river.

Fishery Objectives and Management

Management of Dolly Varden in Norton Sound streams is structured to maintain opportunity and allow a relatively liberal bag limit from mixed stock population aggregations. In the Kotzebue

subarea, the intent is to maintain a high-quality fishery with the opportunity to harvest a small number of large-sized Dolly Varden (20 inches or larger) under a bag limit that protects the spawning component of the population (generally over 20 inches in length), minimizes conflicts with subsistence users, and does not adversely affect the population structure. Dolly Varden show a differential size structure between population groups north and south of the Bering Strait (with fish found north of the Bering Strait generally reaching much larger sizes and not becoming sexually mature until they reach approximately 20 inches, unlike those found in streams below the Bering Strait). Therefore, these management objectives can be addressed with the same general bag and possession limit regulation of 10 fish per day with only 2 fish 20 inches or larger in length for both population groups.

Current Issues and Fishery Outlook

The Wulik River is probably the most important overwintering Dolly Varden stream in Northwestern Alaska, with over 100,000 anadromous Dolly Varden overwintering during some years (Table 11). The Red Dog zinc mine located in the headwaters of this drainage poses a potential threat to these fish and the water quality of the river. Water quality near the mine is systematically monitored to ensure that it is operated in an environmentally sensitive manner. The Red Dog Mine funds a program run by ADF&G's Division of Habitat to monitor heavy-metal concentrations in receiving waters and fish tissues. Fish tissues are sampled for heavy metals in the spring and fall each year on a continuing basis in cooperation with DNR. The recent discovery of additional ore bodies is likely to add new challenges from mineral development in this important drainage.

Dolly Varden in Norton Sound are wide-ranging; they spawn in most rivers and overwinter in all major drainages. In the Kotzebue Sound subarea, the sport fishery is likely to grow slowly in popularity as more anglers experience these high-quality fishing opportunities. Until these fisheries grow to the point that harvests are thought to affect spawner abundance, spawner success, or population structure, it is unlikely that additional management action will be necessary. Recent aerial survey counts suggest that the population of overwintering fish in the Wulik River is stable, and counts have regularly exceeded 100,000 fish but have dropped off in recent years, partially due to poor counting conditions in 2012 and 2013. The 2017 aerial survey, conducted under good counting conditions, counted 62,557 fish, however warm weather likely delayed migration to freshwater for some fish and this should be considered a minimum count of the overwintering population. Spawning and overwintering populations will continue to be monitored in the future when possible.

Recent Board of Fisheries Actions

No proposals for the Northwest Dolly Varden and Arctic char fisheries were adopted by the BOF at either the 2013 or 2016 meetings.

Current and Recommended Research and Management Activities

In 2012 and 2013, ADF&G, in cooperation with the University of Alaska Fairbanks and Red Dog Mine, deployed pop-up satellite archival (P-SAT) tags in 52 Dolly Varden in the Wulik River in June to examine marine movements and temperature and depth preferences of outmigrating fish during the summer months. Of the 46 tags from which some data was recovered, results showed that 22 tagged fish stayed in the Kotzebue Sound area, including 8 that went immediately to the Noatak River to spawn, but that 9 fish each year travelled approximately 125–250 miles (200-400

km) from the Wulik River to suspected feeding areas in the Chukchi Sea near Russia (Seitz et al. 2014). In addition, these tags provided information on preferred temperature and depth occupancy, showing that once the fish reached the feeding areas in the Chukchi Sea, they made dives of 33ft–164 ft (10m–50 m) almost continuously throughout the day.

In 2012, ADF&G, in cooperation with NPS, began a research project on Dolly Varden in the Noatak River using radiotelemetry to look for overwintering locations of nonspawning fish that enter the Noatak River in September just prior to freeze-up. Unlike the Wulik River, the Noatak River is very wide and deep in many places, making aerial surveys of overwintering fish difficult. Consequently, there is no reliable information on the number of non-spawning, overwintering fish using the Noatak each year. Based on the information regarding major overwintering locations, 2 DIDSON side-scanning sonar units (1 on each bank) were planned to be used to enumerate the outmigration of Dolly Varden after ice-out. However, preliminary results show that Dolly Varden that overwinter in the Noatak River do so in areas too wide to successfully count them with sonar (Schwanke 2012), and the objectives of this project were modified so that overwintering locations and outmigration were the main focus. During 2014, dates of downstream passage past the fixed tracking station for 68 fish ranged from May 20 to July 19, although all but one fish had migrated by June 19, and over 70% of the fish passed during a 7-day period during 7–13 June (Schwanke and Johnson 2016).

In 2014, ADF&G, in cooperation with Red Dog Mine, began a feasibility project using a DIDSON side-scanning sonar unit to enumerate the outmigration of Dolly Varden after ice-out from the Wulik River. A suitable site was chosen, and the sonar was able to count fish; however, due to cold temperatures and high, turbid water, the outmigration had only just begun when field operations ceased. Over 6 days in early-June, the sonar counted 229 fish moving downstream and 52 fish moving upstream, with counts of fish moving downstream gradually increasing in the 3 days before the sonar was removed from the water (James Savereide, Biologist, ADF&G, Fairbanks, personal communication). These numbers were much smaller than anticipated; however, during this project the water stayed high and turbid throughout our stay, and it rained frequently. It is likely that because of the cold temperatures and high, turbid water, the outmigration had not begun by the time we ceased to operate the sonar and not because of any technical or logistical challenges. In 2015, the water levels were lower and the project was extended several days, and consequently 29,000 fish were counted moving downstream. However, milling behavior of the Dolly Varden (moving back and forth across the sonar beam) led to uncertainty in the true downstream count (James Savereide, Biologist, ADF&G, Fairbanks, personal communication). In 2016, a warm, early spring and subsequent warm water temperatures caused the outmigration to occur several weeks earlier than normal, and consequently, most fish had passed the sonar site before it was deployed. Funding for the DIDSON was not renewed for 2017.

In 2016, ADF&G, with funding from FWS, began a project to collect and genetically analyze fin clips taken from juvenile Dolly Varden from three known spawning streams (Salmon, Hunt, and Tutuksuk rivers) in the Kobuk River drainage. The objective was to add more stocks to the Northwest Alaska genetic baseline for mixed-stock subsistence harvest analysis. This project addressed the need to improve the method developed by Crane et al. (2005) that identifies the origin of Dolly Varden harvested in the Wulik River subsistence fishery so managers can assess the impacts on the Dolly Varden stocks represented in this overwintering aggregation. In July 2016, samples were successfully collected from juvenile Dolly Varden in the Salmon and

Tutuksuk rivers, however due to time constraints the Hunt River was not sampled. ADF&G has secured funding to continue this project in 2018 and 2019. Adding three known Dolly Varden spawning stocks in the Kobuk River to the established baseline will improve the mixed-stock identification of this important subsistence fishery.

NORTHWESTERN ALASKA ARCTIC GRAYLING

Background and Historical Perspective

Sport fisheries for Arctic grayling in the NW/NSMA are relatively small when compared to the remainder of the AYK Region, with average annual harvests of 478 fish in the Seward Peninsula/Norton Sound subarea and 517 fish in the Kotzebue/Chukchi Sea subarea for the years 2012–2016 (Tables 14 and 15). Catches averaged 4,594 fish in the Seward Peninsula/Norton Sound subarea and 3,069 in the Kotzebue/Chukchi Sea subarea, indicating that most Arctic grayling captured in these fisheries are released. Even though the harvests are relatively small, Arctic grayling are the most numerous species harvested in the Kotzebue/Chukchi Sea subarea and normally the third or fourth most commonly harvested species in the Seward Peninsula/Norton Sound subarea.

The Seward Peninsula has long been known for its production of large Arctic grayling, with approximately 13% of all trophy Arctic grayling registered with ADF&G's Trophy Fish Program. However, many populations are quite small, and because they often inhabit small streams, they must be managed as independent stocks with regulations tailored to the individual populations (or groups of similarly structured populations) to prevent overexploitation.

Since 1989, the stock status of Arctic grayling populations in several rivers where sport fishing occurs on the Seward Peninsula has been monitored (DeCicco 1990, 1991, 1992b, 1993b, 1994–1999, 2002, 2004, 2007; DeCicco and Gryska 2007; DeCicco and Wallendorf 2000; Gryska 2004, 2006, 2015, 2016 *in prep*; Gryska and Taras 2007; Joy 2006; Viavant 2014). The Nome River stock was found to be overexploited, while the current levels of harvest on the Niukluk, Fish, Pilgrim, Snake, and Sinuk rivers populations are believed to be sustainable. The Solomon River was found to have a very low Arctic grayling population and was closed to fishing for Arctic grayling in 1992.

Arctic grayling densities in most Seward Peninsula rivers are low. They generally range from about 40 to 60 fish per mile in the Nome and Sinuk rivers, to about 200 fish per mile in the Pilgrim River. Densities in the Niukluk and Fish rivers are higher at about 470 and about 500 fish per mile, respectively (DeCicco 2002; Viavant 2014). In contrast, Interior Alaska Arctic grayling populations often exceed 500 fish per mile (Ridder et al. 1993; Ridder 2000). Arctic grayling from rivers on the Seward Peninsula are large in general and are generally older and larger when they first spawn than Arctic grayling in Interior Alaska streams. Arctic grayling from the Snake River were found to be 50% mature at 307 mm fork length (FL) and 99% mature at 404 mm FL (DeCicco and Gryska 2007). Arctic grayling from Northwestern Alaska can live for more than 20 years, and 1 fish from the Eldorado River was determined to be approximately 29 years old using otolith analysis. Some Arctic grayling may survive to grow very large, particularly in rivers where fishing effort is light. For example, in the lightly exploited Sinuk River, almost 70% of the 2003 sample was age-8 or older, and the average total length of all fish sampled was over 457 mm (Joy 2006).

Arctic grayling occur in most streams and in many of the lakes in the Kotzebue area, but most are inaccessible by road and therefore lightly exploited. Most Arctic grayling in this area are caught

in association with wilderness float trips or as an alternate species in trips directed toward fishing for Dolly Varden or sheefish. For the years 2012–2016, the estimated harvest rates were only about 17% of the total catch (Table 15).

Prior to 1988, the bag limit for Arctic grayling in the NW/NSMA was 15 fish, only 2 of which could be 20 inches or larger. In 1988, the BOF established a separate bag and possession limit for Arctic grayling in Northern Norton Sound of 5 per day, with only 1 fish 15 inches or longer. The effect of this change is reflected in harvest estimates that averaged about 4,300 Arctic grayling annually for the years 1980–1988 but dropped to about 1,550 from 1990 to 2000. This regulatory change probably contributed to the near doubling of the Arctic grayling populations in the Fish and Niukluk rivers when compared to estimates from the early 1990s (Gryska and Taras 2007; Viavant 2014; Gryska 2016).

Recent Fishery Performance

Seward Peninsula/Norton Sound Subarea

Estimated harvests of Arctic grayling by sport anglers in the Seward Peninsula/Norton Sound subarea have declined since 1991 when harvest peaked at 5,121 fish. For the years 2012–2016, harvests averaged 478 fish per year (Table 14).

The estimated catch of Arctic grayling fluctuates greatly from year to year, ranging from approximately 4,000 to 15,000 fish during the past 10 years; however, catches dipped to 1,198 fish in 2017. Catches of Arctic grayling increased to 7,489 fish in 2015 and 5,489 fish in 2016. Catch-and-release appears to be a prevalent practice in the Seward Peninsula/Norton Sound subarea because the proportion of Artic grayling catch that was harvested was only 10% during 2012–2016.

Current exploitation rates on most Northwestern Alaska Arctic grayling populations are unknown, but because most are in remote areas and harvests are low, exploitation is believed to be light. Some estimates of exploitation in Nome-area roadside streams are available by combining harvest data with abundance data. Based on this information, exploitation rates of Arctic grayling were estimated to range from 10% to 20% in some streams during the early 1990s. More recent estimates for the Niukluk and Fish rivers suggest that annual exploitation in these streams has been less than 5% over the past 10 years. In addition, guided anglers have caught over 21,000 grayling in the Seward Peninsula/Norton Sound subarea for the years 2006–2016 but harvested just 87 fish (Sigurdsson and Powers 2016, *In prep*). These data suggest a change in angler motivation away from harvest as a primary reason for fishing.

Kotzebue Subarea

In the Kotzebue/Chukchi Sea subarea, Arctic grayling harvests for the years 2012–2016 have ranged between 237 and 664 fish (Table 15). Catches over the same period have ranged quite widely from 904 in 2014 to 4,799 in 2016. In 2017, the harvest and catch were 24 and 1,171 fish, respectively. The percentage of catch that was harvested has averaged about 17% annually over the recent 5-year period (Table 15). Most Arctic grayling from this subarea are harvested in association with float trips or while fishing for other species. It is likely that harvests will remain relatively stable or below recent averages until participation in this subarea increases significantly.

Fishery Objectives and Management

Research on status of resident Arctic grayling populations in the rivers accessible from the road system in Northern Norton Sound has been ongoing for approximately 20 years. Arctic grayling in Northwestern Alaska may live for more than 20 years and attain a large size. Data collection on population abundance, age, and size composition by river throughout this period has allowed the development of regulations tailored to individual rivers or groups of rivers that share population characteristics. Overall management objectives for these Arctic grayling populations are to maintain a given abundance of fish ≥15 inches in length, and to allow for population recovery in systems that have been stressed by overexploitation. The areawide bag and possession limits are 5 fish per day, with only 1 fish 15 inches or longer. This bag limit is appropriate for drainages with Arctic grayling populations that have characteristics of lightly exploited populations. These characteristics include large average size and a high proportion of sexually mature fish that are 7 years of age or older in the population. Abundance is directly related to the river's size and flow characteristics; therefore, both abundance and population density may vary by river. Rivers that share these characteristics and regulations include the Fish/Niukluk River system and the Eldorado and Sinuk rivers. On the other extreme are overexploited populations where abundance is very low. Rivers like the Nome and Solomon are in this category and are consequently closed to all fish for Arctic grayling.

Populations that intermediate between these 2 categories include those in the Pilgrim and Snake rivers. These populations contain a smaller proportion of sexually mature fish. They have been affected somewhat by harvest, but Arctic grayling are still relatively abundant, and populations appear stable. In these rivers, the regulations allow harvest of 2 Arctic grayling per day, with only 1 fish 15 inches or longer. Populations are assessed periodically to estimate whether they are maintaining desired characteristics. Recent stock assessments of Arctic grayling populations in road-accessible waters suggest that the current management approach is working, and that population size and size compositions are being sustained.

Management objectives have not been developed for remote Arctic grayling waters of the remainder of the Seward Peninsula or the Kotzebue subarea. Anglers rarely visit these waters, and populations are presumed to be unexploited. General regulations for these waters provide for a bag and possession limit of 5 fish, with no size limit. Until effort and harvests increase dramatically, it is likely that regulations will remain unchanged.

In 2004, the *Wild Arctic Grayling Management Plan* was adopted. The plan created 3 management approaches with associated regulatory options: regional, conservative, and special management. The regulations adopted under the regional management approach (5-fish bag and possession limit, season open year-round) did change the general Arctic grayling regulations in the NW/NSMA from 10 to 5 fish, with the exceptions of the Dalton Highway Corridor, Northern Norton Sound, and the Unalakleet River drainage, which already had bag limits of 5 fish, and those fisheries classified under the conservative and special management approach. The Snake and Pilgrim rivers are classified under the conservative management approach, and the Nome and Solomon rivers are classified under special management.

Current Issues and Fishery Outlook

There is concern on the part of the public and ADF&G staff that populations of Arctic grayling in the vicinity of Nome that are road accessible, especially the Nome and Solomon rivers, have been overexploited and may not recover for many years. The abundance of fish ≥15 inches has been

depressed since 1999 (DeCicco 2007). An experimental restoration project in 1998 to increase survival of young-of-the-year Arctic grayling by rearing them in a gravel pit failed (DeCicco 2004). Additional restoration efforts were conducted more recently using a different rearing pond, and in 2002 and 2003, a total of 1,574 pen-reared Arctic grayling were released into the Nome River. The population was reassessed in 2005 to estimate the abundance and contribution of pen-reared fish into the Nome River. Although the number of small fish captured was insufficient to estimate abundance, more were captured than in past assessments, indicating that there may be an increase in smaller Arctic grayling in this river. By 2009, it was believed that these fish should be large enough to be recruited to the sampling gear for a stock assessment to estimate abundance. In June 2009, catches were so low that samples sizes were not met in order to estimate abundance. Other road-accessible populations would be vulnerable to overexploitation if fishing practices and motivations were to change; however, at this time other populations appear to be stable and are able to sustain the current low levels of catch and harvest.

Northwestern Alaska, particularly waters of the Seward Peninsula, provides some of the best opportunities in the state to capture large (e.g., >18 in) Arctic grayling. Under the current regulations, it appears that these trophy fisheries are being maintained. Populations in the Fish and Niukluk rivers have recovered from relatively low levels of abundance in the early 1990s, and the outlook in these rivers is promising. Populations in both the Pilgrim and Sinuk rivers are slightly larger than when last assessed and appear to be sustaining current levels of exploitation, and the population in the Pilgrim River appears stable.

Recent Board of Fisheries Actions

No actions were taken specific to NW/NSMA Arctic grayling fisheries at either the 2013 or 2016 BOF meetings.

Current or Recommended Research and Management Activities

In 2013, a stock assessment project was conducted to estimate abundance of Arctic grayling in a 14 mi (22 km) index area of the Niukluk River from the outlet of the Casadepaga River to the village of Council. Using mark-recapture techniques, 10,715 fish (SE = 1,369) ≥350 mm FL were estimated in this index area (Gryska 2016), well above the desired minimum abundance of 3,500 fish ≥350 mm FL for this index area. A similar assessment project was conducted on the Snake River in 2016 in a 9 mi (14 km) index area, and an estimated 809 fish (SE = 161) ≥350 mm FL were estimated in this index area (Gryska *in prep*), above the desired minimum abundance of 600 fish ≥350 mm FL for this index area. In 2018, a stock assessment project was conducted to estimate abundance of Arctic grayling in a 25 mi (40 km) index area of the Sinuk River. However, catch rates were too low during the first event to warrant a second event and the project was discontinued. Low catch rates were likely due to the large number of pink salmon (over 1,000,000) in the river at that time and not due to low abundance of Arctic grayling. No other stock assessment projects on Nome roadside Arctic grayling populations are planned for the near future, however if funding becomes available, stock assessments may continue. A management plan is being updated to specifically address Nome roadside Arctic grayling fisheries using bag and possession limits based on specific threshold abundances, and to establish precision criteria for estimates of abundance generated from future stock assessments (Scanlon *in prep*).

KOTZEBUE SOUND SHEEFISH

Background and Historical Perspective

Within the NW/NSMA, spawning stocks of sheefish occur only in the Kobuk and Selawik rivers (Alt 1975) with the exception of a small population that resides in the Koyuk River of Norton Bay. Sporadic catches of sheefish have been recorded in the Serpentine River upstream of Shishmaref, but it is not known if they spawn there (Jim Menard, Area Biologist, ADF&G, Nome, personal communication).

The drainages of Kotzebue Sound are known for the large size of sheefish available to the sport angler. These remote trophy sport fisheries are considered by many to be among the pinnacle of Alaskan freshwater sport fishing. Since the inception of ADF&G's Trophy Fish Program in 1967, 17 of the 22 qualifying sheefish have come from the Kobuk River.

Kotzebue Sound sheefish are distributed throughout the nearshore estuarine areas of Kotzebue Sound. The major concentration occurs in Hotham Inlet but also occurs in the Sheshalik and Krusenstern areas and in southern Kotzebue Sound (Figure 5). Nearly all sheefish occupying the estuarine environment during summer are immature or nonspawning adults. Adult prespawning fish move upstream during summer on the Kobuk and Selawik rivers to spawn in the fall. The Kobuk River stock spawns upstream from the village of Kobuk, with the greatest observed concentrations between the Mauneluk River and Beaver River. After spawning is complete in late September or early October, fish disperse to downstream overwintering areas. Tag recoveries have shown that the 2 stocks mix in Hotham Inlet winter habitats but maintain fidelity to their spawning areas.

Kotzebue Sound sheefish support subsistence, commercial, and sport fisheries. Subsistence fishing is given priority and is currently unrestricted, with little reliable harvest reporting. The commercial fishery and much of the subsistence harvest takes place through the ice while sport fisheries are mainly summer and fall activities. The same populations of sheefish contribute to all harvests. The annual commercial sales of sheefish in Kotzebue ranged from 0 to 850 fish between 1991 and 2004. No commercial catch was reported for the years 2005–2017, although several hundred fish are caught each year while commercial fishing for chum salmon and retained for personal use (Menard et al. 2017, *In prep*). Much of the whitefish subsistence harvest including sheefish occurs by jigging through the ice in Hotham Inlet in the spring. In 2011, residents of Selawik harvested 250,000 lbs of whitefish, of which 28% were sheefish (Fall et al. 2014), and in 2012 the residents of the 5 Kobuk River villages (Kiana, Amber, Shungnak, Kobuk, and Noorvik) harvested 214,000 lbs of whitefish, of which 47% were sheefish (Braem et al. 2013). Sheefish are also taken by jigging lures under the ice in Hotham Inlet and Selawik Lake, but harvests are poorly documented. Overall, it is likely that 15,000–25,000 sheefish are taken for subsistence annually in Northwestern Alaska.

The Division of Sport Fish conducted studies of the ecology, movements, and growth of sheefish between 1966 and 1979. Much of this work was conducted in Northwestern Alaska and was summarized by Alt (1987). After conducting a feasibility experiment in 1994, ADF&G Division of Sport Fish, in cooperation with the NPS, began a project to estimate abundance of sheefish spawning in the Kobuk River. This project continued through 1997 and established baseline estimates on spawner abundance, age, size, and sex composition of the spawning population. Tag-recovery data indicated that although some sheefish were capable of spawning in consecutive years, most spawned every other year. However, more recent results from radiotelemetry research

conducted on the Kobuk River sheefish population showed that anywhere from 18% to 49% of Kobuk River sheefish exhibit sequential-year spawning, including males and females. This evidence suggests that Kobuk River sheefish choosing a spawning strategy are not solely influenced by the energetic requirements needed to spawn (Savereide 2013). Spawner abundance in the Kobuk River was estimated at approximately 32,000 fish in 1995, 43,000 fish in 1996, and 33,000 fish in 1997 (Taube and Wuttig 1998). The USFWS (Underwood et al. 1998) estimated the abundance of sheefish spawning in the Selawik River at 5,200 fish in 1995 and 5,150 fish in 1996. More recently anecdotal reports based on catches by residents of Kotzebue, Sheshalik, and the Kobuk River villages indicate that sheefish abundance appears high and current harvests are sustainable. The USFWS repeated abundance estimates in the Selawik River in 2004 and 2005. Estimates indicated that spawner abundance was approximately 24,000 fish in 2004 and 46,000 fish in 2005 (Hander et al. 2008). Most of the increase was in the smaller size classes of spawners and indicates strong recruitment into the spawning population.

Most sheefish sport fishing effort in the NW/NSMA occurs on the Kobuk River spawning population. Most areawide subsistence harvest of sheefish occurs on the entire (spawners and nonspawners) population. When taken in combination, average annual sport harvests of about 274 fish are easily sustainable (Table 16). Although spawner abundances have been periodically estimated, the total size of the areawide population is not known, and the sport harvest must be viewed in relation to other ongoing harvests. Recent data support the assumption that subsistence harvests are much greater than either commercial or sport harvests (Fall et al. 2014). In order to ensure sustained yields from these population(s), a management approach involving subsistence and commercial fisheries for sheefish is recommended. Sheefish are very fecund fish with some large females containing over 400,000 eggs. Such populations may be subject to episodic recruitment events depending on environmental conditions. If spawner abundances are maintained above some threshold level, intermittent years of good recruitment should carry the population through years when environmental conditions are less favorable.

Recent Fishery Performance

Estimated annual sport harvests of sheefish by anglers in Northwestern Alaska since 1993 have fluctuated from a high of about 2,500 fish to a low of about 60 fish with an average annual harvest of 274 fish for the years 2012–2016 (Table 16). In 2016, the harvest was just 46 fish and the catch was 158 fish, all from the Kobuk River and both well below recent averages. Average sheefish catch for the years 2012–2016 was 274 fish, indicating that about 70% of all sheefish captured in Northwestern Alaska by sport anglers are released. In a 1997 experiment to determine hooking mortality rates of sheefish in the Kobuk River, the mortality of fish caught and released on sport fishing gear was found to be low (3.3% for treble-hook lures and 1.7% for single-hook lures; Stuby and Taube 1998). Overall, mortality was 2.4%. Despite the worldwide reputation of this destination, the level of fishing effort is still quite low. The 5-year (2012–2016) average effort on the Kobuk River was 1,724 angler-days (Table 4). The Kobuk River accounted for about 15% of the overall estimated freshwater sport fishing effort in the Kotzebue subarea (1,882 total angler-days) in 2016 (Table 4).

Fishery Objectives and Management

The Kobuk River sheefish fishery is managed to maintain opportunity to participate in this unique high-quality sport fishery while keeping harvests from spawning areas low. In order to accommodate local use of this resource downstream from major spawning areas, the bag limit is

10 sheefish downstream of the Mauneluk River. In the spawning area upstream of the Mauneluk River, the bag and possession limit is 2 fish. The majority of anglers visiting the Kobuk River to fish for sheefish use the area upstream of the Mauneluk River. The Selawik River has similar regulations, with the bag and possession limit of 10 sheefish downstream of the Tagagawik River, and a bag and possession limit of 2 sheefish upstream of this tributary.

Current Issues and Fishery Outlook

Alaska Native residents of Kobuk River villages have expressed concern over some practices of sport anglers on the Upper Kobuk River near the sheefish spawning grounds. Catch-and-release fishing is considered by some local residents to be disrespectful and damaging to the fish. Discarding filleted carcasses in the water is thought by some to drive other sheefish away from the area. Catch-and-release fishing is viewed as a conservation tool by ADF&G and many anglers, and although sheefish may be sensitive to rough handling, ADF&G has demonstrated that they can be released without significant mortality. An educational brochure explaining proper catch-and-release techniques for sheefish was developed in association with the NPS in Kotzebue and is made available to those fishing on the Upper Kobuk River. It is hoped that with proper handling, impacts of catch-and-release fishing to the spawning population can be minimized.

The outlook for sheefish fisheries in Northwestern Alaska is good in the immediate future. Although subsistence harvest levels are substantial, populations and spawner abundances appear stable and sport harvests are low.

Recent Board of Fisheries and Management Actions

No proposals were submitted specific to the Northwest Area sheefish fisheries for the 2013 and 2016 BOF meetings.

Current or Recommended Research and Management Activities

Recent research conducted cooperatively with the USFWS and the NPS has provided substantial background data on spawner abundance for the 2 stocks comprising the Kobuk-Selawik sheefish population. These data will be used as a baseline for comparing future population assessments. In 2008, ADF&G, in cooperation with USFWS, began a 5-year study on the Kobuk River sheefish population using radiotelemetry to determine spawning locations, spawning frequency, and timing of postspawner outmigration to Hotham Inlet. Results showed that sheefish exhibited a variety of spawning strategies but 32–42% of males and 32–37% of females spawned at least every other year (Savereide 2013; Savereide and Huang 2016). In 2011, USFWS began a study of the genetic composition of the wintertime subsistence harvest in Hotham Inlet, specifically to see what proportion comes from the Selawik River stock and what proportion is from the Kobuk River. Unfortunately, the number of samples from each population did not provide sufficient differentiation to perform mixed-stock analysis at the level needed for this study, and simulation results indicated additional baseline samples were needed (Hander et al. 2013).

In 2004, a permafrost slump located approximately 31 mi (50 km) upstream from the Selawik River spawning area for sheefish began to deposit a large amount of silt into the river, and the hillside has continued to erode during the open water season. It has been speculated that the effects could potentially affect spawning success for sheefish in the Selawik River by clogging interstitial spaces in the gravel and cobble substrate where fertilized eggs are thought to settle and develop through the winter (Waters 1995). In fall 2011, USFWS initiated an experiment to look for any effects of the thaw slump on recruitment and survival of eggs deposited after the slump occurred,

using the Kobuk River population as a control. Comparison of cumulative age distributions of Selawik and Kobuk River collections indicated a younger sample of fish from the Kobuk River in 2011–2016, with few recruits to the spawning population detected in the Selawik River since the thaw slump occurred (Hander et al. 2017). Beginning in 2011, the USFWS used a DIDSON® sonar to enumerate the outmigration of sheefish in the Selawik River during their late-September to mid-October post-spawning migration to their wintering grounds. Counts ranged from 5,665 fish in 2014 to 32,943 fish in 2016 (Hander et al. 2017); however, in all years ice formation on the river precluded the use of the sonar throughout the outmigration and these counts should be considered minimum estimates.

In 2014, ADF&G initiated a project to enumerate the post-spawning outmigration of sheefish in the Kobuk River using sonar during their late-September to mid-October post-spawning migration to their wintering grounds in Hotham Inlet, as part of a larger fishery inventory and monitoring project related to the potential construction of a road from the Dalton Highway to the Ambler Mining District near the village of Ambler. Over 8,500 sheefish were counted moving downriver between September 19 and October 6; however, cold temperatures and icy conditions precluded the project from counting throughout the outmigration (Wuttig et al. 2015). In 2016, sonar was used to count the sheefish outmigration and between 4,178 fish were counted (Matter and Savereide 2017); however, high water and freezing temperatures again precluded the sonar from operating throughout the outmigration and this count is considered low. Preliminary analysis of counts from the 2018 sonar project on the Kobuk River indicate that over 28,000 sheefish outmigrated in September and October (Matter and Savereide *in prep*).

NORTH SLOPE DOLLY VARDEN AND ARCTIC CHAR

Background and Historical Perspective

In the North Slope subarea of the NW/NSMA, Arctic char occur in lakes of the north-facing drainages of the Brooks Mountain Range. The closely-related Dolly Varden are common inhabitants of most large rivers on the North Slope in most drainages of the eastern coastal plain from the Canadian Border to the Colville River. ADF&G groups Dolly Varden and Arctic char together for regulatory purposes, primarily because of the difficulty of distinguishing between them based solely on physical appearance; however, the 2 species have distinct life history traits. Because distribution of Arctic char is limited in the North Slope subarea, essentially all fisheries are directed toward Dolly Varden.

Dolly Varden are a major component of the harvest and catch in the North Slope area, contributing more than 43% of the harvest and 36% of the catch for the primary sport species for the years 2012–2016 (Table 17). On the North Slope, most sport fisheries for char target overwintering populations of Dolly Varden either in the fall as the fish return to freshwater from the sea or in the spring as they move toward the sea to feed, although some prespawning fish are caught in late summer.

On the North Slope, Dolly Varden spawn and overwinter in upwelling areas. Dolly Varden become increasingly concentrated in the spring areas beneath and adjacent to the inriver glaciers (*aufeis*) that form during winter. Streams that are known to support significant populations of Dolly Varden in the North Slope subarea include the Ivishak, Kongakut, Hulahula, Canning, Sagavanirktok, and Anaktuvuk rivers (Figure 6). Overwintering locations are, in some cases, different from spawning locations such that nonspawning fish from several neighboring tributaries may concentrate in a single drainage. The Upper Ivishak River, a tributary of the Sagavanirktok

River, provides a large overwintering area used by fish in nonspawning years from nearby tributaries such as the Ribdon, Lupine, and Echooka rivers.

The population of Dolly Varden using the Sagavanirktok River is considered potentially vulnerable because of habitat degradation resulting from oil and gas development that has occurred in Prudhoe Bay (Sagavanirktok River Delta). Access for anglers to the migratory route of this stock is provided by the Dalton Highway, which parallels most of the mainstem of the Sagavanirktok River. In 1994, the entire length of the Dalton Highway was opened to public travel. Prior to this, the North Slope portion of the road was technically open only as far north as the Wiseman area in the Upper Koyukuk River drainage.

Aerial surveys of index areas in several North Slope rivers, mostly in the Ivishak, Hulahula, and Anaktuvuk rivers, have been conducted periodically since 1971 to monitor the Dolly Varden stocks, although no surveys were conducted between 2008 and 2016 (Viavant 2009; Scanlon 2017). Counts have ranged from 2,700 to 36,000 fish, with the largest counts coming from the Ivishak River. Research conducted by ADF&G and funded by USFWS-OSM for the years 2001–2003 used radiotelemetry, mark-recapture abundance estimates, and aerial surveys to demonstrate that aerial surveys of overwintering aggregations of Dolly Varden in North Slope drainage can be used as an indicator of overwintering abundance (Viavant 2001–2003, 2005, 2008, 2009).

A large increase in fishing effort and catch of Dolly Varden and the other 2 key sport species (Arctic grayling and lake trout) was anticipated with the opening of the entire length of the Dalton Highway to public travel in 1994, and again with the improvement of the roadway south of Atigun Pass in 2001 and 2002. Estimates from the SWHS do not indicate that this increase has occurred (Table 4).

Recent Fishery Performance

Estimates of catch and harvest of Dolly Varden from the North Slope subarea suggest a sustainable level of use. Total average annual catch has been 3,731 fish and average harvest has been 467 fish for the years 2012–2016 (Table 17). In 2017, harvest was estimated to be 158 Dolly Varden, with a total catch of 2,270 fish, both well below recent averages. Historically, about 60% of the total catch and 50% of the harvest of Dolly Varden has come from waters adjacent to the Dalton Highway.

Fishery Objectives and Management

Fishery management for Dolly Varden and Arctic char reflects the different life history characteristics that these 2 closely related species exhibit. Dolly Varden, which inhabit streams and are often anadromous, can be exploited at much higher rates than lake-dwelling Arctic char. The life history characteristics of lake-dwelling Arctic char are very similar to lake trout (i.e., slow growing, long lived, advanced age at maturity), and it is likely that most of these populations can support only low rates of exploitation.

In lakes, Arctic char are managed to provide a conservative level of yield. In streams, Dolly Varden are managed to encourage participation in the fishery while limiting harvest of spawning-age adults.

Current Issues and Fishery Outlook

There is a concern among indigenous people of the North Slope that a growing sport fishery for Dolly Varden may conflict with local subsistence fisheries.

Oil and gas development adjacent to and within the migration routes of Dolly Varden in North Slope waters carries the potential for serious effects through contamination or alteration of habitat. Dolly Varden using the Sagavanirktok River drainage migrate through Prudhoe Bay, one of the most heavily industrialized areas in Alaska. Current plans for oil and gas leases in the foothill region of National Petroleum Reserve-Alaska are of particular concern. These new lease areas include the critical overwintering–spawning habitat in the spring areas of the Anaktuvuk River drainage. Seismic surveys are planned for the portions of the Sagavanirktok, Anaktuvuk, and Canning rivers that are the primary spawning and overwintering habitats for these Dolly Varden stocks. ADF&G staff continue to assert that these critical habitats must be excluded from all surface development and that travel routes must be redirected.

Recent studies in the Sagavanirktok River drainage (Viavant 2005) indicated a fluctuating abundance of overwintering and spawning Dolly Varden from earlier surveys (Scanlon 2008). Fluctuations in the abundance of Dolly Varden stocks on the North Slope have been previously reported (Yoshihara 1973; Bendock and Burr 1984).

The results from the radiotelemetry study in 2001–2003 show that the specific locations of critical spawning and overwintering habitat used by anadromous Dolly Varden in the Beaufort Sea drainages may change significantly between years within a relatively large area within a drainage (Viavant 2003). Protection of such habitat should not be based on locations determined from only a single or even a few seasons.

Dolly Varden will probably continue to provide a substantial portion of the sport fishery that occurs on the North Slope, and the waters within the Dalton Highway corridor will continue to support most of the total catch and harvest of Dolly Varden in the North Slope subarea. Increased numbers of visitors are reportedly taking float trips on streams (Kongakut, Hulahula, Canning rivers) in ANWR. Modest increases in catch and harvest of Dolly Varden can be anticipated with the increased visitor use of the area.

Recent Board of Fisheries Actions

No proposals were submitted specific to the North Slope Dolly Varden/Arctic char fisheries for the 2013 and 2016 BOF meetings.

Current or Recommended Research and Management Activities

While there is substantial information regarding the freshwater ecology of Dolly Varden from rivers on the North Slope, there is little direct information about their summer ocean ecology and distribution. Therefore, in 2014, researchers from the University of Alaska Fairbanks, and ADF&G attempted to use pop-up satellite archival (P-SAT) tags to study the oceanic habits, distribution, and migration patterns of non-spawning Dolly Varden that summer in the Beaufort Sea. In June and July 2014, 13 PSAT tags were deployed in large Dolly Varden (9 in the Ivishak River, 4 in the marine waters near Kaktovik) to examine temperature, depth, and daily geolocation estimates. Of these 13 tagged fish, 5 never left the Ivishak River and likely moved upstream to spawn, 1 was found in the Kongakut River, 2 were found in the Hulahula River, 2 sent brief transmissions but no fixed location was made, and 3 never reported. It appears that most, if not all, of the fish tagged were spawning fish, and an inability to identify non-spawning fish for tagging precluded researchers from getting information on marine movements and feeding behavior (Seitz and Scanlon 2015).

Tag deployment strategies were modified for 2015 in an attempt to better target non-spawning fish that will spend time in the Chukchi Sea to feed, and preliminary data from 22 fish show larger proportions of time spent at liberty in marine waters. In addition, of the 8 Dolly Varden tagged with satellite tags in the Kongakut River in September 2015, 4 survived the winter and end locations were detected on offshore waters of the Beaufort Sea (Seitz and Scanlon 2017).

In 2016, ADF&G began a 4-year study to conduct aerial surveys of overwintering Dolly Varden in important overwintering streams of the North Slope (the Ivishak, Canning, Kongakut, Hulahula, and Anaktuvuk rivers). Due to inclement weather and turbid water conditions, successful counts were achieved only on the Ivishak (4,912 fish), Hulahula (3,167 fish), and Canning (1,735 fish) rivers. Based upon weather and water temperatures, as well as locations and condition of located fish, it appears that most counted fish were spawners and that the larger groups of non-spawning, overwintering fish had not ascended the rivers yet (ADF&G, unpublished data). The Ivishak River was turbid for most of the length of the study area due to material-laden spring water flowing in from the Saviukviak River, a tributary stream near the top of the index area (Scanlon 2017). In 2017, due to inclement weather only the Ivishak River was surveyed, and 6,842 fish were counted in low-light conditions, however the water coming from the Saviukviak River was much clearer than in 2016 (Scanlon 2018). Annual monitoring of these stocks is important, particularly considering the importance of Dolly Varden to subsistence fishers and the increased oil and gas development activity in this area.

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TABLES AND FIGURES

Table 1.–Commercial salmon and Dolly Varden harvest from the Norton Sound and Kotzebue districts, 2003–2017.

	Norton Sound					Kotzebue	
Year	King Salmon	Sockeye Salmon	Coho Salmon	Pink Salmon	Chum Salmon	Chum Salmon	Dolly Varden
2003	12	21	17,060	0	3,560	25,423	176
2004	22	47	42,016	0	6,296	51,038	124
2005	151	12	85,523	0	3,983	75,971	181
2006	20	3	130,808	0	10,042	137,961	278
2007	19	2	126,136	3,769	22,431	147,087	960
2008	83	60	120,309	75,525	25,124	190,550	1,629
2009	84	126	87,041	17,364	34,122	187,562	960
2010	140	103	62,079	31,557	117,743	270,343	1,323
2011	185	369	58,917	7,141	110,555	264,321	400
2012	197	134	37,056	205,498	62,772	227,965	300
2013	151	247	53,802	8,338	118,709	319,062	114
2014	84	319	112,756	182,406	107,745	636,187	620
2015	1,288	4,119	153,928	62,888	147,497	305,383	62
2016	183	2,635	102,722	208,745	51,167	400,417	710
2017	538	2,975	191,254	20,321	163,973	462,951	1,253
2007–2016 Average	255	834	91,453	80,328	79,779	294,773	612
2012–2016 Average	408	1,541	92,086	133,618	97,580	377,803	361

Source: Menard et al. 2017, *In prep*.

Table 2.–Salmon escapement goals and documented salmon escapements in Norton Sound, 2007–2017.

River/Fish	Escapement Goal	Type	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Nome River													
Chum	2,900-4,300	SEG-Weir	7,034	2,607	1,565	5,906	3,582	1,987 [b]	4,811	5,589	6,111	7,093	8,340
Pink	13,000 (even years)		24,395	1,186,554	16,490	171,760	14,403	149,119	10,257	96,397	75,603	1,175,723	717,770
Coho			2,437	4,605	1,370	4,114	1,833	224 [b]	2,624	2,637	2,418	2,331	4,983
Snake River													
Chum	1,600-2,500	SEG-Weir	8,147	1,244	891	6,973	4,343	673 [b]	2,755	3,983	4,241	3,666	4,759
Pink			4,634	145,761	769	51,099	7,011	5,954 [b]	1,333	19,536	16,321	204,641	20,906
Coho			1,781	5,206	50 [b]	2,243	343 [b]	14 [b]	1,203	1,424	1,638	1,115	2,957
Eldorado River													
Chum	6,000-9,200	SEG-Weir	21,312	6,746	4,943	21,211	16,227	13,348 [b]	26,121	27,054	25,560	18,938	73,882
Pink			833	244,641	1,119	48,316	489	59,318 [b]	1,029	46,746	1,483	42,699	12,357
Pilgrim River													
Chum			35,334	25,008	5,427	25,379	41,740	25,521	47,557	25,634	41,121	21,379	49,513
Pink			3,616	92,641	483	29,237	3,364	46,134	1,060	4,197	2,807	2,986	80,100
Sockeye			43,432	20,448	953	1,654	8,849	7,085	12,428	9,717	36,052	15,066	55,533
Salmon Lake													
Sockeye	4,800-9,600	SEG-Aerial	20,612	11,672	186	784	5,144	5,830	6,027	5,303	3,030	6,155	26,507
Niukluk River													
Chum	>23,000	SEG-Tower	50,994	12,078	15,879	48,561	23,607	19,576	[c]	[c]	[c]	[c]	[c]
Pink	>10,500	SEG-Tower	43,617	669,234	24,204	434,205	15,425	249,212	[c]	[c]	[c]	[c]	[c]
Coho	2,400-6,100	SEG-Tower	3,498	13,779	6,861	9,042	2,405	1,729 [b]	[c]	[c]	[c]	[c]	[c]
Fish River													
King			-	-	-	-	-	-	-	954	2,299	828	174
Chum			-	-	-	-	-	-	-	48,100	144,690	69,984	161,333
Pink			-	-	-	-	-	-	-	222,777	218,525	1,282,892	1,388,496
Coho			-	-	-	-	-	-	-	16,929	14,729	3,300 [b]	11,452
North River													
King	1,200-2,600	SEG-Tower	1,950	903	2,352	1,256	864	996	564	3,454	1,950	513 [b]	1,044
Chum			8,046	9,502	9,783	16,131	19,898	9,042 [b]	10,518	13,872	23,100	16,014	22,933
Pink	>25,000	SEG-Tower	583,320	240,286	189,939	150,807	123,892	147,674 [b]	46,668	246,075	465,681	1,045,410	1,464,555
Coho			19,944	15,648	22,226	7,608	3,624	3,036 [b]	8,834	4,995	9,432	2,241	2,446
Unalakleet River													
King			-	-	-	1,021	1,122	804	767	1,126	2,789	505 [b]	2,928
Chum			-	-	-	70,811	110,731	71,593	113,953	97,097	97,885	31,576	143,731
Pink			-	-	-	832,904	340,475	680,070	144,225	1,180,217	1,616,042	4,752,639	5,868,909
Coho			-	-	-	5,382	10,560	17,054	25,566	42,089	40,964	132 [b]	18,005

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Table 2.–Page 2 of 2.

River/Fish	Escapement Goal	Type	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Kwiniuk River													
King	300-550	SEG-Tower	258	237	444	135	57	54	15	429	318	135	54
Chum	10,000-20,000	OEG-Tower	27,756	9,462	8,739	71,388	31,604	5,577 [b]	5,631	39,789	37,831	8,526	33,440
Pink	>8,400	SEG-Tower	54,255	1,442,237	42,960	634,220	30,023	393,302 [b]	13.212	326,558	67,295	1,909,949	508,278
Coho	650-1,300	SEG-Aerial	9,429	10,680	9,036	8,049	3,288	777 [b]	3,940	14,713	7,151	9,220	13,593

[a] Incomplete count because of high water; 1,916 coho salmon counted by aerial survey in the Snake River.

[b] Incomplete count because of high water or tower not run through end of season.

[c] Niukluk River tower project discontinued due to loss of land lease for tower site.

Table 3.–Subsistence salmon harvest in the Norton Sound, Port Clarence, and Kotzebue Districts, 2003–2017.

	Norton Sound						Port Clarence						Kotzebue
Year	King Salmon	Sockeye Salmon	Coho Salmon	Pink Salmon	Chum Salmon	Total Salmon	King Salmon	Sockeye Salmon	Coho Salmon	Pink Salmon	Chum Salmon	Total Salmon	Chum Salmon
2003	4,728	522	11,446	46,336	9,498	72,530	133	3,732	2,194	3,394	2,699	12,152	19201
2004	4,419	458	10,892	70,945	3,592	90,306	177	4,495	1,434	4,113	2,430	12,649	24,637
2005	4,848	914	16,127	60,427	13,765	96,081	276	8,288	1,031	5,817	2,501	17,913	10,616
2006	2,876	572	17,242	56,579	5,992	83,261	152	8,492	726	6,615	2,479	18,464	ND
2007	2,646	938	12,023	21,039	12,048	48,694	85	9,484	705	1,468	4,454	16,196	4,568
2008	2,465	363	17,604	54,927	8,709	84,068	125	5,166	562	7,652	2,517	16,022	ND
2009	4,222	394	17,121	26,610	11,337	60,384	40	1,643	804	1,882	3,060	7,429	ND
2010	2,120	546	11,863	42,254	16,201	72,987	63	824	596	5,202	5,232	1,197	ND
2011	1,359	414	8,538	17,166	14,566	42,043	57	1,611	393	2,610	4,338	9,009	ND
2012	1,235	424	9,573	43,551	12,399	67,182	44	1,422	703	5,200	7,802	15,171	26,693a
2013	861	572	13,372	18,045	15,504	48,354	38	5,243	651	1,788	6,588	14,308	42,216
2014	1,106	763	16,180	37,595	16,233	71,877	21	3,969	564	5,040	5,085	14,679	37,217
2015	1,952	1,879	13,968	25,346	14,767	57,912	64	13,872	550	2,982	4,231	21,699	ND
2016	1,648	1,536	15,640	43,192	12,818	74,834	40	12,140	627	4,322	4,303	21,432	ND
2017	1,075	1,354	21,082	31,972	14,226	69,709	39	15,424	697	5,365	6,886	28,411	ND
2007–2016 Average	1,961	783	13,588	32,973	13,458	62,763	58	5,528	611	3,802	4,754	15,985	27,674
2012–2016 Average	1,360	1,035	13,747	33,546	14,344	64,032	41	7,329	619	3,866	5,602	19,268	35,375

Note: ND indicates years when no subsistence harvest survey was conducted.

[a] Includes the villages of Ambler, Kiana, Kobuk, Noatak, Noorvik, and Shungnak only.

Table 4.–Sport fishing effort (angler-days) by major fisheries and subareas in the NW/NSMA, 2003–2017.

	Seward Peninsula/Norton Sound Subarea								Kotzebue/Chukchi Sea Sub-Area					North Slope Sub-Area			NW/NSMA
Year	Nome	Fish/Niukluk	Unalakleet	Snake	Sinuk	Pilgrim	Other	Total	Noatak	Kobuk	Wulik	Other	Total	Haul Road	Other	Total	Total
2003	651	2,273	3,056	701	430	730	4,810	12,221	1,855	2,039	397	1,830	6,121	1,103	1,607	2,710	21,052
2004	1,636	2,786	4,527	468	466	594	2,393	12,404	1,130	2,760	219	1,246	5,355	873	2,438	3,311	21,070
2005	2,142	1,954	4,768	836	549	327	5,044	15,071	1,310	868	493	393	3,064	1,881	2,471	4,352	22,487
2006	4,517	1,049	4,062	855	1,234	337	4,010	14,830	2,538	2,104	993	699	6,334	1,298	1,806	3,104	24,268
2007	3,887	1,483	4,205	1,873	933	240	4,979	16,667	2,935	1,627	205	260	5,027	799	3,355	4,154	25,848
2008	5,272	3,842	5,129	1,740	878	590	5,422	21,995	1,621	1,183	395	1,222	4,421	3,774	1,825	5,599	32,015
2009	2,808	3,813	5,329	564	447	482	4,004	17,000	2,561	3,283	428	1,159	7,431	1,813	2,092	3,905	28,336
2010	2,326	1,844	3,012	1,032	616	248	1,532	10,610	745	955	334	1,436	3,470	3,724	660	4,384	18,464
2011	725	4,738	3,926	405	467	74	1,005	11,340	3,002	613	443	465	4,523	1,746	1,185	2,931	18,794
2012	1,914	2,685	2,957	404	566	76	1,450	10,052	2,593	1,598	246	533	4,970	3,714	1,343	5,057	20,079
2013	1,093	2,345	4,747	378	464	133	2,277	11,437	2,336	1,303	203	330	4,175	1,415	1,615	3,030	18,642
2014	2,625	767	1,320	583	126	198	2,041	7,660	426	2,412	112	910	3,860	1,568	2,073	3,641	9,542
2015	1,915	866	2,299	403	915	155	1,027	7,580	1,087	1,278	88	1,550	4,003	1,679	1,296	2,975	14,558
2016	3,225	1,312	2,920	1,784	215	961	3,881	14,298	972	2,031	484	1,077	4,564	2,971	1,301	4,272	23,314
2017	2,944	231	3,583	222	201	164	880	8,225	756	285	629	212	1,882	1,591	547	2,138	12,245
2007–2016 Average	2,579	2,370	3,584	917	563	316	2,762	13,090	1,828	1,628	294	894	4,644	2,320	1,675	3,995	21,729
2012–2016 Average	2,154	1,595	2,849	710	457	305	2,135	10,025	1,483	1,724	227	880	4,314	2,269	1,526	3,795	18,315

Source: Alaska Sport Fishing Survey database [Internet]. 1996–. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited October 16, 2018). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/

Table 5.–Sport fish harvest by species in the NW/NSMA, 2003–2017.

Year	King Salmon	Coho Salmon	Pink Salmon	Chum Salmon	Sockeye Salmon	Total Salmon	Dolly Varden/ Arctic Char	Lake Trout	Arctic Grayling	Northern Pike	Whitefish	Sheefish	Burbot
2003	239	3,050	2,285	553	572	6,699	6,257	109	4,373	869	919	735	22
2004	418	5,302	7,549	707	404	14,380	5,711	212	3,675	1,583	2,513	652	79
2005	561	7,076	3,004	436	232	11,309	3,700	177	2,177	564	514	393	50
2006	427	11,643	5,305	1,592	22	18,989	5,613	44	1,483	107	654	607	63
2007	293	6,939	1,631	723	72	9,658	5,883	7	1,735	585	1,147	1,066	0
2008	594	11,927	7,567	2,954	209	23,251	4,523	0	2,181	566	307	61	130
2009	291	6,579	1,305	652	0	8,827	5,747	63	4,604	582	418	946	6
2010	61	5,876	2,712	865	0	9,514	2,551	129	1,206	595	398	595	18
2011	61	3,593	566	764	58	5,042	5,254	0	2,204	148	20	385	134
2012	0	5,099	3,220	691	28	9,038	1,627	237	2,038	781	204	104	0
2013	19	7,367	1,806	2,980	44	12,416	2,537	21	2,002	550	408	218	0
2014	0	3,378	4,603	990	0	8,971	948	101	653	171	0	244	0
2015	0	3,720	1,623	1,687	271	7,301	919	114	1,132	439	20	1,191	38
2016	78	5,554	8,565	815	83	15,095	3,696	108	2,168	125	47	667	20
2017	13	5,944	962	553	184	7,656	1,717	0	733	0	0	46	0
2007–2016 Average	140	6,023	3,360	1,312	77	10,911	3,369	78	1,992	454	297	548	35
2012–2016 Average	19	5,064	3,963	1,433	85	10,564	1,945	116	1,599	413	136	485	12

Source: Alaska Sport Fishing Survey database [Internet]. 1996–. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited October 16, 2018). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/

Table 6.–Sport fish catch by species in the NW/NSMA, 2003–2017.

Year	King Salmon	Coho Salmon	Pink Salmon	Chum Salmon	Sockeye Salmon	Total Salmon	Dolly Varden/ Arctic Char	Lake Trout	Arctic Grayling	Northern Pike	Whitefish	Sheefish	Burbot
2003	1,314	6,013	8,818	3,159	1,323	20,627	17,474	1,175	33,587	2,230	2,226	5,462	33
2004	2,006	16,698	42,795	3,777	680	65,956	17,511	1,139	23,395	4,074	3,409	1,750	144
2005	1,086	24,160	25,830	3,491	346	54,913	14,858	1,193	20,866	1,572	1,210	1,043	50
2006	2,592	20,282	24,749	6,950	334	54,907	19,721	1,197	14,785	2,316	884	5,051	63
2007	1,034	13,449	6,854	6,841	116	28,294	18,535	322	22,153	16,578	1,543	1,639	105
2008	823	28,338	39,416	10,513	446	79,536	25,512	21	23,145	3,508	1,346	482	188
2009	623	17,338	8,197	5,379	112	31,649	25,465	184	30,878	3,061	1,226	5,050	6
2010	99	14,245	8,244	3,743	0	26,331	12,845	258	23,318	3,228	1,621	2,928	43
2011	574	12,042	3,134	6,098	72	21,920	17,283	0	12,675	691	555	647	142
2012	17	9,430	7,062	4,442	28	20,979	11,890	428	25,459	5,481	363	265	0
2013	203	10,357	4,147	6,971	44	21,722	8,843	542	15,303	1,486	674	569	0
2014	0	6,030	8,780	5,344	0	20,154	6,522	613	6,698	647	66	1,214	202
2015	41	6,995	5,869	4,521	299	17,725	5,117	971	12,338	760	29	2,248	38
2016	118	13,474	26,550	3,404	98	43,644	11,555	1,190	10,931	1,055	501	2,033	20
2017	369	12,659	7,283	2,520	457	23,288	6,736	0	8,573	0	0	158	0
2007–2016 Average	353	13,170	11,825	5,726	122	31,195	14,357	453	18,290	3,650	792	1,708	74
2012–2016 Average	76	9,257	10,482	4,936	94	24,845	8,785	749	14,146	1,886	327	1,266	52

Source: Alaska Sport Fishing Survey database [Internet]. 1996–. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited October 16, 2018). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/

Table 7.–King salmon sport harvest and catch in Seward Peninsula/Norton Sound rivers, 2003–2017.

	Harvest								
Year	Nome	Pilgrim	Unalakleet	Fish-Niukluk	Sinuk	Snake	Solomon	Other	Total
2003	0	103	97	39	0	0	0	0	239
2004	0	0	356	22	0	0	0	157	535
2005	0	0	216	37	0	0	0	308	561
2006	0	0	394	0	0	0	0	33	427
2007	0	0	147	0	0	0	0	130	277
2008	0	0	580	0	0	0	0	0	580
2009	13	0	248	30	0	0	0	0	291
2010	0	0	61	0	0	0	0	0	61
2011	0	0	53	0	0	0	0	8	61
2012	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0	0
2015	0	0	0	0	0	0	0	0	0
2016	0	0	78	0	0	0	0	0	78
2017	0	0	13	0	0	0	0	0	13
2007–2016 Average	1	0	117	3	0	0	0	14	135
2012–2016 Average	0	0	16	0	0	0	0	0	16

	Catch								
Year	Nome	Pilgrim	Unalakleet	Fish-Niukluk	Sinuk	Snake	Solomon	Other	Total
2003	0	268	505	515	0	0	0	13	1,301
2004	0	0	1,930	22	0	0	0	401	2,353
2005	0	0	431	74	0	0	0	569	1,074
2006	0	0	2,511	0	0	0	0	65	2,576
2007	0	0	776	0	0	0	0	162	938
2008	0	0	796	0	0	0	0	0	796
2009	13	0	515	95	0	0	0	0	623
2010	0	0	99	0	0	0	0	0	99
2011	0	0	534	32	0	0	0	8	574
2012	0	0	17	0	0	0	0	0	17
2013	0	0	184	0	0	0	0	0	184
2014	0	0	0	0	0	0	0	0	0
2015	0	0	16	25	0	0	0	0	41
2016	0	0	118	0	0	0	0	0	118
2017	0	0	369	0	0	0	0	0	369
2007–2016 Average	1	0	306	15	0	0	0	17	339
2012–2016 Average	0	0	117	4	0	0	0	0	122

Source: Alaska Sport Fishing Survey database [Internet]. 1996–. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited October 16, 2018). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/

Table 8.–Coho salmon sport harvest and catch in Seward Peninsula/Norton Sound rivers, 2003–2017.

	Harvest								
Year	Nome	Pilgrim	Unalakleet	Fish-Niukluk	Sinuk	Snake	Solomon	Other	Total
2003	68	113	1,604	216	0	11	0	1,027	3,039
2004	270	45	3,524	291	13	163	90	1,410	5,806
2005	1,001	48	3,959	400	230	182	0	2,079	7,899
2006	2,768	150	4,985	948	191	414	156	2,671	12,283
2007	797	118	4,117	786	54	142	337	546	6,897
2008	1,793	57	6,029	1,986	322	563	63	1,134	11,947
2009	229	15	5,027	928	74	55	130	121	6,579
2010	602	40	3,006	1,069	210	131	122	696	5,876
2011	68	0	2,493	700	15	9	0	297	3,582
2012	259	0	3,283	1,163	20	103	20	251	5,099
2013	279	0	4,068	1,227	343	86	0	1,064	7,067
2014	458	0	1,452	883	0	91	0	494	3,358
2015	243	0	2,602	302	537	0	0	36	3,720
2016	747	0	3,748	740	0	70	0	206	5,511
2017	973	41	4,446	82	16	0	0	386	5,944
2007–2016 Average	548	28	3,583	978	158	125	67	485	5,964
2012–2016 Average	397	9	3,031	863	180	70	4	410	4,951

	Catch								
Year	Nome	Pilgrim	Unalakleet	Fish-Niukluk	Sinuk	Snake	Solomon	Other	Total
2003	90	203	2,832	1,447	0	11	0	1,603	6,186
2004	428	124	12,655	1,653	13	307	90	2,376	17,646
2005	1,523	48	14,396	1,586	742	325	0	7,563	26,183
2006	4,607	185	9,397	1,320	1,428	597	156	3,232	20,922
2007	919	201	8,967	1,014	184	184	381	1,547	13,397
2008	2,507	222	11,511	7,752	749	941	94	4,488	28,264
2009	270	15	14,425	2,095	131	55	193	136	17,320
2010	680	106	8,968	1,273	558	131	159	2,370	14,245
2011	68	0	9,802	1,279	15	9	0	654	11,827
2012	623	0	6,696	1,657	20	144	20	270	9,430
2013	344	0	5,938	914	454	86	0	1,621	10,357
2014	679	0	3,262	1,023	0	91	0	955	6,010
2015	705	0	4,947	529	656	0	0	141	6,978
2016	843	0	10,702	1,062	16	70	0	738	13,431
2017	2,240	41	9,763	82	44	0	0	489	12,659
2007–2016 Average	764	54	8,522	1,960	278	171	85	1,292	13,126
2012–2016 Average	639	0	6,308	1,237	229	78	4	745	9,241

Source: Alaska Sport Fishing Survey database [Internet]. 1996–. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited October 16, 2018). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/

Table 9.–Pink salmon sport harvest and catch in Seward Peninsula/Norton Sound rivers, 2003–2017.

	Harvest								
Year	Nome	Pilgrim	Unalakleet	Fish-Niukluk	Sinuk	Snake	Solomon	Other	Total
2003	12	437	29	196	0	0	97	1,451	2,222
2004	3,369	0	2,003	353	156	60	0	2,368	8,309
2005	1,193	23	473	58	62	12	23	1,183	3,027
2006	2,422	67	891	134	330	430	100	943	5,317
2007	402	0	618	30	0	0	281	270	1,601
2008	2,954	0	2077	969	175	539	141	1,404	8,259
2009	178	0	579	23	12	35	12	466	1,305
2010	1,716	0	535	99	49	121	63	134	2,717
2011	85	0	391	10	0	0	0	80	566
2012	1,264	0	20	636	329	152	0	819	3,220
2013	302	0	886	0	242	0	0	376	1,806
2014	2,162	0	352	71	206	0	469	1,343	4,603
2015	474	0	222	39	195	0	0	451	1,381
2016	2,737	0	974	177	0	506	0	3,545	7,939
2017	832	0	37	12	0	32	0	49	962
2007–2016 Average	1,227	0	665	205	121	135	97	889	3,340
2012–2016 Average	1,388	0	491	185	194	132	94	1,307	3,790
	Catch								
Year	Nome	Pilgrim	Unalakleet	Fish-Niukluk	Sinuk	Snake	Solomon	Other	Total
2003	73	1,044	3,762	626	68	0	97	3,294	8,964
2004	6,189	163	10,332	10,176	1,352	223	195	15,430	44,060
2005	2,095	38	8,778	1,283	279	70	47	13,324	25,914
2006	6,242	134	4,791	700	2,327	1790	267	8,294	24,545
2007	745	0	4,256	178	121	234	311	909	6,754
2008	8,785	49	15,470	3,491	1,202	810	236	8,587	38,630
2009	238	0	5,593	351	133	35	47	1,404	7,801
2010	2,206	0	3,074	674	581	264	329	1,066	8,194
2011	85	0	2,301	10	0	0	80	658	3,134
2012	2,576	0	814	1,257	632	152	0	1,565	6,996
2013	302	0	2,286	629	242	0	0	688	4,147
2014	2,225	0	3,404	525	206	118	511	1,791	8,780
2015	971	0	2,337	974	195	48	97	986	5,608
2016	9,088	0	3,952	3,203	201	1,431	0	8,027	25,902
2017	3,883	0	2,405	250	32	147	0	492	7,209
2007–2016 Average	2,722	5	4,349	1,129	351	309	161	2,568	11,595
2012–2016 Average	3,032	0	2,559	1,318	295	350	122	2,611	10,287

Source: Alaska Sport Fishing Survey database [Internet]. 1996–. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited October 16, 2018). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/

Table 10.–Chum salmon sport harvest and catch in Seward Peninsula/Norton Sound rivers, 2003–2017.

	Harvest								
Year	Nome	Pilgrim	Unalakleet	Fish-Niukluk	Sinuk	Snake	Solomon	Other	Total
2003	0	0	191	101	0	0	0	0	292
2004	0	0	47	435	0	0	0	16	498
2005	0	0	36	0	0	0	0	294	330
2006	0	0	224	0	0	0	0	120	344
2007	0	0	85	11	0	0	0	9	105
2008	0	0	175	166	0	0	0	414	755
2009	0	0	258	71	0	0	0	83	412
2010	0	0	59	0	0	0	0	59	118
2011	0	0	77	29	0	0	0	33	139
2012	0	0	118	74	0	0	0	17	209
2013	139	0	354	0	0	0	0	1,874	2,267
2014	52	0	377	25	13	0	20	24	511
2015	39	0	78	0	97	0	0	97	311
2016	208	0	28	17	0	15	0	0	268
2017	110	0	254	12	54	0	0	43	473
2007–2016 Average	44	0	161	39	11	2	2	261	520
2012–2016 Average	88	0	191	23	22	3	4	402	733

	Catch								
Year	Nome	Pilgrim	Unalakleet	Fish-Niukluk	Sinuk	Snake	Solomon	Other	Total
2003	0	548	1,681	258	14	0	0	303	2,804
2004	14	33	1,473	979	149	14	0	1,168	3,830
2005	0	64	1,822	177	477	54	0	675	3,269
2006	122	0	1,628	0	709	116	11	300	2,886
2007	121	128	554	190	91	15	105	1,842	3,046
2008	157	0	4,055	277	120	92	204	1,056	5,961
2009	0	0	1,885	71	8	0	0	149	2,113
2010	53	0	2,127	501	52	0	0	124	2,857
2011	13	0	3,944	144	0	17	101	84	4,303
2012	111	0	2,583	190	0	0	0	17	2,901
2013	374	0	1,791	646	0	0	0	1,789	4,600
2014	97	0	3,733	170	13	0	20	160	4,193
2015	234	0	529	1,179	138	20	97	138	2,335
2016	408	0	1,520	34	0	117	0	13	2,092
2017	241	0	1,266	12	80	0	0	444	2,043
2007–2016 Average	157	13	2,272	340	42	26	53	537	3,440
2012–2016 Average	245	0	2,031	444	30	27	23	123	3,224

Source: Alaska Sport Fishing Survey database [Internet]. 1996–. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited October 16, 2018). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/

Table 11.–Aerial counts of Dolly Varden spawning in the Noatak River and overwintering in the Wulik and Kivalina rivers, 1991–2017.

	Spawners	Nonspawners	
Year	Noatak River	Wulik River	Kivalina River
1991	9,605	126,985	35,275
1992	ND	135,135	ND
1993	9,560	144,138	16,534
1994	ND	66,752	ND
1995	6,500	128,705	28,870
1996	12,184	61,005	ND
1997	ND	95,412	ND
1998	ND	104,043	ND
1999	9,636	70,704	ND
2000	ND	ND	ND
2001	ND	92,614	ND
2002	3,655	44,257	ND
2003	ND	ND	ND
2004	ND	101,806	ND
2005	ND	120,848	ND
2006	ND	108,352	ND
2007	ND	99,311	ND
2008	ND	71,463	ND
2009	ND	63,997	ND
2010	ND	36,866	ND
2011	ND	64,499	ND
2012	ND	21,084[a]	ND
2013	ND	23,312[a]	ND
2014	ND	64,351	ND
2015	ND	72,895	ND
2016	ND	70,969	ND
2017	ND	62,557	ND

Note: ND indicates years in which no aerial surveys were conducted.

[a] Weather and ice conditions poor during surveys in 2012 and 2013, resulting in incomplete counts.

Table 12.–Dolly Varden and Arctic char sport harvest in the NW/NSMA by subarea and river, 2003–2017.

	Seward Peninsula/Norton Sound Harvest										Kotzebue/Chukchi Sea Harvest						
Year	Salt Water	Nome River	Pilgrim River	Unalakleet River	Fish-Niukluk River	Sinuk River	Snake River	Solomon River	Other Streams/ Lakes	Total	Salt Water	Kobuk River	Noatak River	Wulik River	Other Streams/ Lakes	Total	Grand Total
2003	0	1,223	482	134	110	712	13	0	2,857	5,531	0	29	354	137	150	670	6,201
2004	72	226	0	3,593	120	42	0	53	212	4,318	0	642	69	148	574	1,433	5,751
2005	95	553	12	500	1,148	141	27	0	141	2,617	0	0	63	176	176	415	3,032
2006	0	959	0	1,307	0	531	51	153	179	3,180	116	71	1,075	989	1,066	3,317	6,497
2007	14	625	0	731	193	144	461	481	159	2,808	20	29	2,379	372	496	3,296	6,104
2008	0	46	0	1,062	1,061	107	46	0	997	3,319	0	0	640	117	212	969	4,288
2009	0	253	0	2,794	108	50	50	0	118	3,373	17	197	853	272	305	1,644	5,017
2010	0	165	0	1,411	12	117	0	24	106	1,835	348	12	59	59	15	493	2,328
2011	0	0	11	2,219	1,631	0	10	0	170	4,041	0	16	503	185	161	865	4,906
2012	0	111	0	88	0	9	33	0	11	252	0	35	587	159	0	781	1,033
2013	0	17	0	483	0	0	0	0	684	1,184	0	76	807	191	0	1,074	2,258
2014	0	0	0	40	0	20	0	15	79	154	0	125	0	0	91	216	370
2015	0	97	0	120	0	195	0	0	0	412	0	0	143	78	0	221	633
2016	0	24	0	1,611	197	45	24	0	115	2,016	0	0	173	780	128	1,081	3,097
2017	0	573	0	485	0	0	0	0	256	1,314	0	0	57	188	0	245	1,559
2007–2016 Average	1	134	1	1,056	320	69	62	52	244	1,883	39	49	614	221	141	1,064	3,003
2012–2016 Average	0	50	0	468	39	54	11	3	178	804	0	47	342	242	44	675	1,478

Source: Alaska Sport Fishing Survey database [Internet]. 1996–. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited October 16, 2018). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/

Table 13.–Dolly Varden and Arctic char sport catch in the NW/NSMA by subarea and river, 2003–2017.

	Seward Peninsula/Norton Sound Catch										Kotzebue/Chukchi Sea Catch						
Year	Salt Water	Nome River	Pilgrim River	Unalakleet River	Fish-Niukluk River	Sinuk River	Snake River	Solomon River	Other Streams/ Lakes	Total	Salt Water	Kobuk River	Noatak River	Wulik River	Other Streams/ Lakes	Total	Grand Total
2003	12	1,276	549	4,284	1,561	840	27	0	5,872	14,421	0	347	728	3,118	99	4,292	18,713
2004	269	374	80	10,928	849	42	0	67	1,587	14,196	0	1,701	503	844	729	3,777	17,973
2005	95	992	59	3,299	2,688	294	423	0	2,231	10,081	0	0	429	2,260	726	3,415	13,496
2006	0	1,947	64	2,986	67	2,767	115	230	2,188	10,364	154	563	2,686	4,001	586	7,990	18,354
2007	14	754	0	4,763	1,852	1,695	481	560	1,222	11,341	50	159	4,601	800	124	5,734	17,075
2008	15	107	0	7,154	1,926	595	61	12	3,723	13,593	0	17	2,748	3,143	733	6,641	20,234
2009	0	629	0	12,746	348	394	16	282	1,931	16,346	17	255	3,380	2,507	65	6,224	22,570
2010	0	224	29	6,987	307	161	0	24	428	8,160	447	144	629	396	59	1,675	9,835
2011	0	0	11	4,837	1,692	0	74	17	697	7,328	0	46	935	956	1,329	3,266	10,594
2012	220	271	0	4,350	280	202	113	0	44	5,480	0	134	873	430	0	1,437	6,917
2013	17	33	9	1,300	64	0	0	0	684	2,107	0	1,645	1,692	590	0	3,927	6,034
2014	0	178	0	276	0	20	0	15	155	644	0	125	61	249	464	904	1,548
2015	0	1,999	16	276	205	195	0	16	0	2,707	16	0	468	235	0	719	3,426
2016	0	240	0	5,155	197	45	24	0	351	5,746	0	0	173	780	128	1,081	6,877
2017	0	709	0	1,891	0	121	0	0	427	3,148	0	0	405	913	0	1,318	4,466
2007–2016 Average	27	422	7	4,784	687	331	77	93	924	7,350	53	253	1,156	1,009	291	3,161	10,511
2012–2016 Average	47	501	5	2,271	149	92	27	6	247	3,347	3	381	653	457	119	1,614	4,960

Source: Alaska Sport Fishing Survey database [Internet]. 1996–Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited October 16, 2018). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/

Table 14.–Arctic grayling sport harvest and catch in Seward Peninsula/Norton Sound rivers, 2003–2017.

	Harvest								
Year	Nome	Pilgrim	Unalakleet	Fish-Niukluk	Sinuk	Snake	Solomon	Other	Total
2003	0	98	131	387	12	140	0	1,010	1,778
2004	0	0	579	102	0	91	0	52	824
2005	0	0	32	402	16	33	0	112	595
2006	0	83	60	0	138	0	0	138	419
2007	0	26	10	12	77	141	0	48	314
2008	0	0	346	322	0	34	0	263	965
2009	0	0	457	456	34	0	0	256	1,169
2010	0	0	148	0	68	0	0	16	232
2011	0	0	10	1342	0	28	0	18	1,398
2012	0	32	0	421	0	67	0	0	520
2013	0	46	80	26	0	0	0	0	500
2014	0	0	0	0	0	0	0	0	0
2015	0	0	0	20	0	0	0	134	154
2016	0	0	129	513	0	552	0	21	1,215
2017	0	0	0	0	0	39	0	327	366
2007–2016 Average	0	10	118	311	18	82	0	110	647
2012–2016 Average	0	16	42	296	0	124	0	101	478

	Catch								
Year	Nome	Pilgrim	Unalakleet	Fish-Niukluk	Sinuk	Snake	Solomon	Other	Total
2003	94	397	6,189	5,495	249	559	80	1,954	15,017
2004	113	0	3,478	1,594	0	238	130	533	6,086
2005	92	48	1,137	3,316	171	338	161	112	5,375
2006	560	220	669	311	1,331	262	83	794	4,230
2007	61	26	2,375	3,287	902	260	0	937	7,848
2008	183	13	3,497	4,073	84	234	0	1,659	9,743
2009	214	0	4,497	6,458	352	364	13	1,724	13,257
2010	28	93	3,304	3,659	348	55	0	146	7,633
2011	0	0	1,937	2,588	0	671	0	18	5,214
2012	9	250	3,442	4,098	0	401	0	0	8,200
2013	0	46	1,264	3,502	107	0	0	348	5,267
2014	20	80	374	1,230	0	0	96	300	1,800
2015	352	47	157	2,915	549	294	63	1,112	7,489
2016	0	21	815	714	9	552	0	103	2,214
2017	0	0	738	0	0	39	0	421	1,198
2007–2016 Average	87	58	2,166	3,252	235	283	17	605	6,667
2012–2016 Average	76	89	1,210	2,492	133	249	32	313	4,594

Source: Alaska Sport Fishing Survey database [Internet]. 1996–. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited October 16, 2018). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/

Table 15.–Arctic grayling sport harvest and catch in the Kotzebue Sound/Chukchi Sea subarea, 2003–2017.

	Harvest				
Year	Kobuk River	Noatak River	Other Streams	Lakes	Total
2003	781	528	129	35	1,473
2004	1,157	317	509	0	1,983
2005	231	38	0	6	275
2006	172	301	270	17	760
2007	307	433	32	64	836
2008	47	232	14	0	293
2009	143	208	35	53	439
2010	214	52	100	0	366
2011	183	238	65	0	486
2012	64	545	17	0	626
2013	308	255	0	0	563
2014	157	41	39	0	237
2015	287	259	102	16	684
2016	190	98	168	40	496
2017	0	24	0	0	24
2007–2016 Average	190	236	57	17	501
2012–2016 Average	201	240	11	11	517
	Catch				
Year	Kobuk River	Noatak River	Other Streams	Lakes	Total
2003	5,860	3,875	658	233	10,626
2004	8,369	652	1,274	0	10,295
2005	1,639	435	826	0	2,900
2006	2,328	1,827	2,735	17	6,907
2007	2,191	1,965	32	1,975	6,163
2008	301	1,722	1,805	112	3,940
2009	4,065	2,542	509	53	7,169
2010	1,540	1,559	1,102	0	4,201
2011	1,054	609	722	0	2,385
2012	701	1,623	335	0	2,659
2013	1,972	1,552	128	0	3,652
2014	125	61	688	30	904
2015	462	1,245	1,480	142	3,329
2016	2,518	1,293	568	420	4,799
2017	113	93	965	0	1,171
2007–2016 Average	1,493	1,417	737	273	3,920
2012–2016 Average	1,156	1,155	640	118	3,069

Source: Alaska Sport Fishing Survey database [Internet]. 1996–. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited October 16, 2018). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/

Table 16.–Sport fish harvest and catch of sheefish from Northwest Alaska, 2003–2017.

	Total Harvest			Kobuk River			Selawik River		
Year	Harvest	Catch	% Harvested	Harvest	Catch	% Harvested	Harvest	Catch	% Harvested
2003	2,509	7,324	34	676	4,517	15	59	59	100
2004	1,634	2,837	58	477	1,575	30	58	58	100
2005	393	1,043	38	393	1,043	37	0	0	0
2006	810	5,254	15	566	4,929	12	0	0	0
2007	1,066	1,639	65	742	1,283	58	0	0	0
2008	61	482	13	0	209	0	0	0	0
2009	946	5,050	19	747	4,474	17	0	0	0
2010	595	2,928	20	86	1,910	5	221	368	60
2011	385	647	60	257	455	57	0	0	0
2012	104	259	40	50	205	24	0	0	0
2013	218	569	38	188	539	24	0	0	0
2014	244	1,214	20	151	982	15	0	0	0
2015	135	1,191	11	93	176	53	0	0	0
2016	667	2,033	59	48	1,219	4	202	269	75
2017	46	158	29	46	158	29	0	0	0
2007–2016 Average	442	1,510	29	236	1,145	21	42	64	66
2012–2016 Average	274	871	31	106	624	17	40	54	75

Source: Alaska Sport Fishing Survey database [Internet]. 1996–. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited October 16, 2018). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/

Table 17.–Sport fishing effort, catch, and harvest of lake trout, Dolly Varden/Arctic char, and Arctic grayling in the North Slope subarea, 2003-2017.

Year	Angler-days		Lake trout		Dolly Varden/Arctic char		Arctic grayling	
	Total	Haul Road	Total	Haul Road	Total	Haul Road	Total	Haul Road
	Harvest							
2003	2,710	1,103	98	0	193	0	1,122	263
2004	3,311	873	75	0	180	105	868	103
2005	4,352	1,881	96	0	493	99	1,313	810
2006	3,104	1,298	10	0	304	170	235	131
2007	4,154	1,873	0	0	151	130	572	293
2008	5,599	3,774	0	0	352	179	810	754
2009	3,905	1,813	0	0	919	98	2,996	454
2010	4,384	3,746	117	0	223	167	608	474
2011	2,931	1,801	0	0	339	207	320	165
2012	5,057	2,516	112	0	594	280	892	424
2013	3,030	1,523	0	0	279	128	939	266
2014	3,641	2,046	90	0	578	123	416	136
2015	2,975	1,681	98	0	286	168	314	119
2016	4,272	2,971	0	0	599	502	457	353
2017	2,138	1,591	0	0	158	87	343	303
2007–2016 Average	3,995	2,374	42	0	432	198	832	344
2012–2016 Average	3,795	2,147	60	0	467	240	604	260

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Table 17.–Page 2 of 2.

Year	Angler-days		Lake trout		Dolly Varden/Arctic char		Arctic grayling	
	Total	Haul Road	Total	Haul Road	Total	Haul Road	Total	Haul Road
	Catch							
2003	2,710	1,103	1,164	103	936	398	7,944	3,326
2004	3,311	873	540	163	803	345	7,014	2,525
2005	4,352	1,881	433	288	1,756	621	12,270	7,769
2006	3,104	1,298	850	401	1,930	53	3,648	759
2007	2,975	1,789	183	183	1,941	1631	8,142	6,463
2008	5,599	3,774	21	21	4,426	1,210	9,293	6,160
2009	3,905	1,813	67	67	3,165	1,187	10,452	5,810
2010	4,834	3,746	246	129	3,010	2,718	11,484	10,736
2011	2,931	1,801	0	0	6,689	5,365	5,076	2,797
2012	5,057	2,516	223	93	4,973	3,072	14,600	12,903
2013	3,030	1,523	221	221	2,809	1,892	6,384	2,954
2014	3,641	2,046	481	246	4,974	1,429	3,153	1,703
2015	2,975	1,681	971	755	2,410	1,970	4,784	3,625
2016	4,272	2,971	528	310	3,490	2,927	3,918	2,627
2017	2,138	1,591	0	0	2,270	1,974	6,204	5,330
2007–2016 Average	3,995	2,374	294	203	3,789	2,340	7,729	5,578
2012–2017 Average	3,795	2,147	485	325	3,731	2,258	6,568	4,762

Source: Alaska Sport Fishing Survey database [Internet]. 1996–. Anchorage, AK: Alaska Department of Fish and Game, Division of Sport Fish (cited October 16, 2018). Available from: http://www.adfg.alaska.gov/sf/sportfishingsurvey/

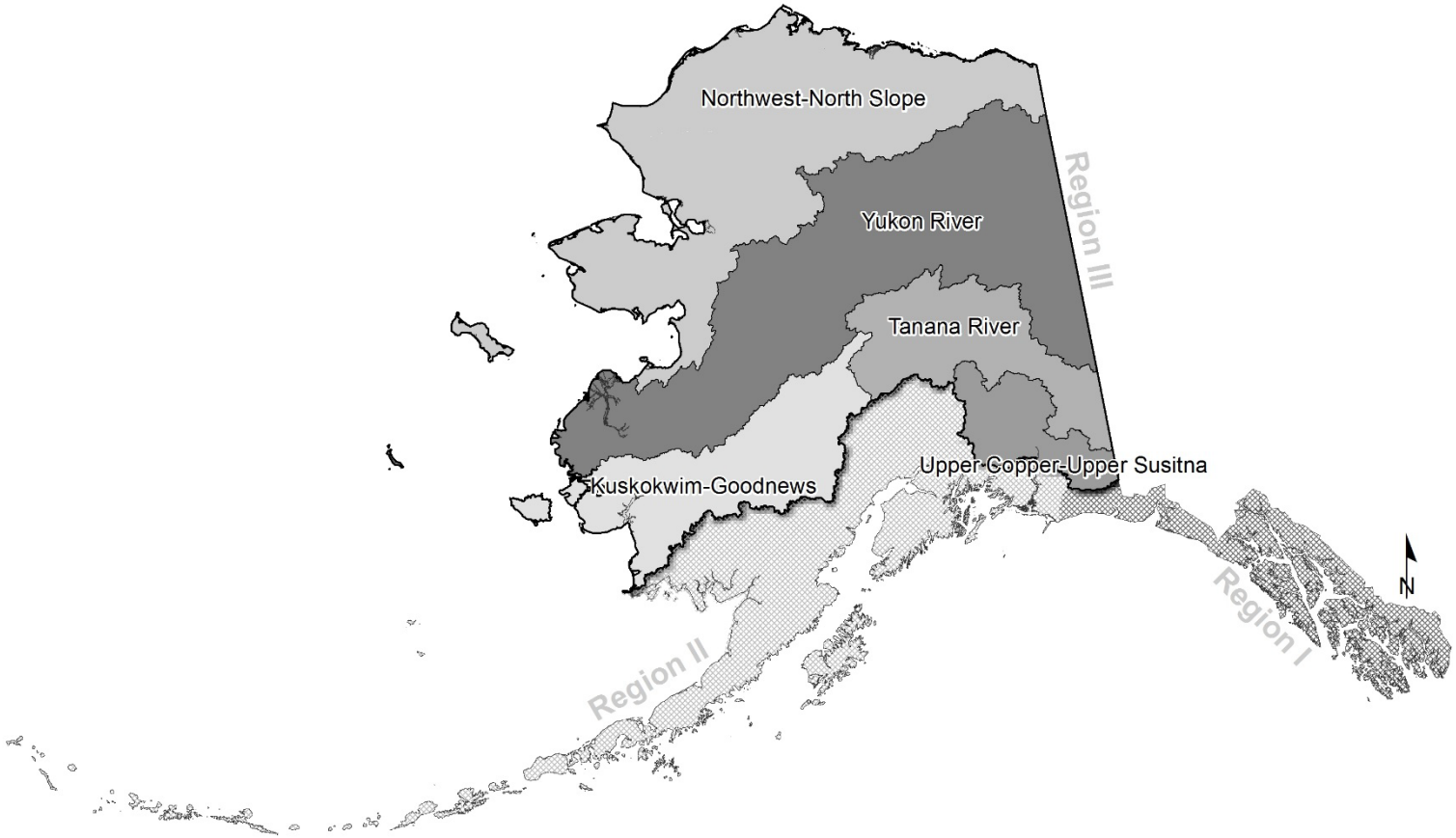

Figure 1.–Map of the sport fish regions in Alaska and the 5 Region III management areas.

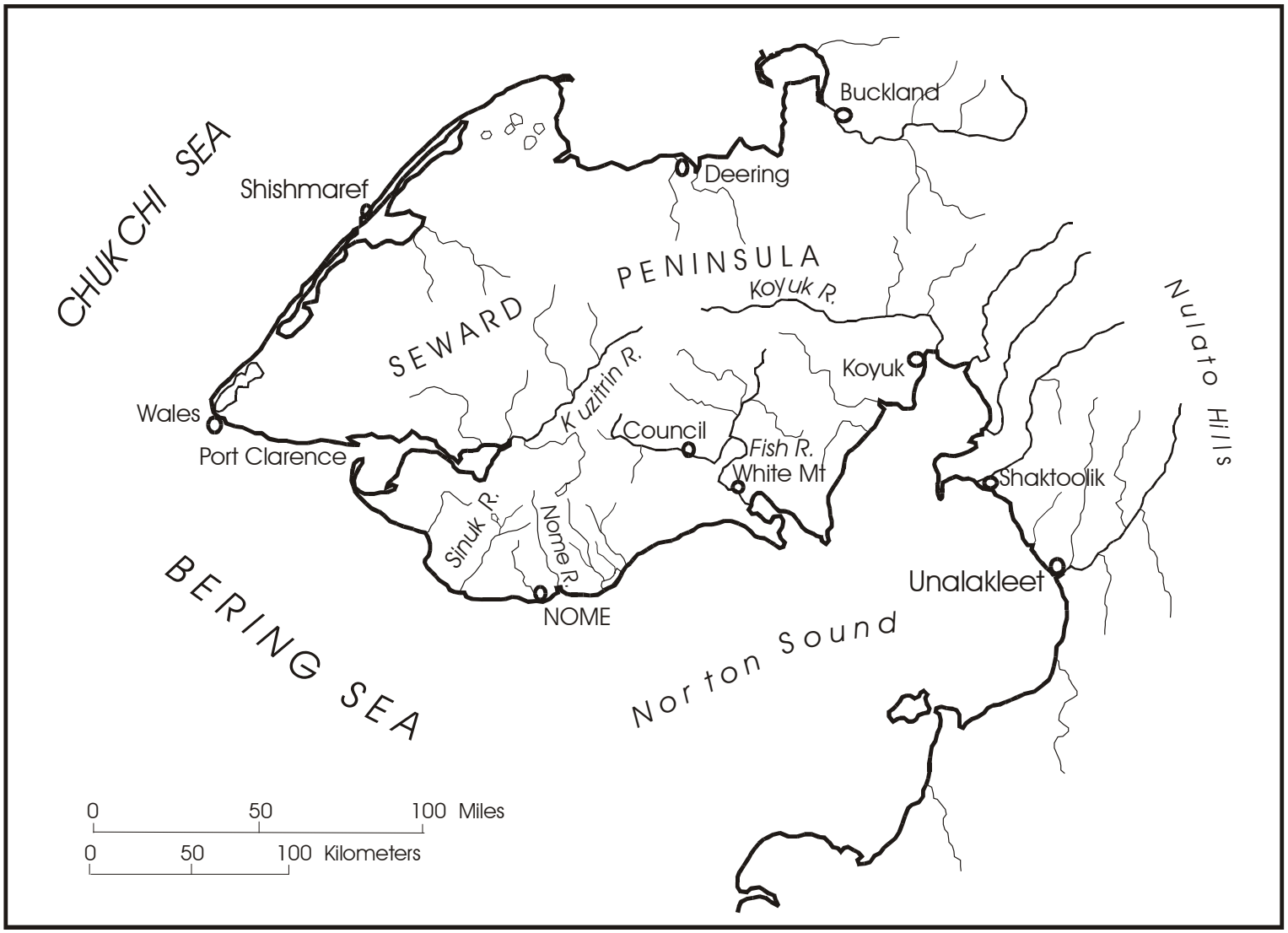

Figure 2.–The Seward Peninsula/Norton Sound subarea.

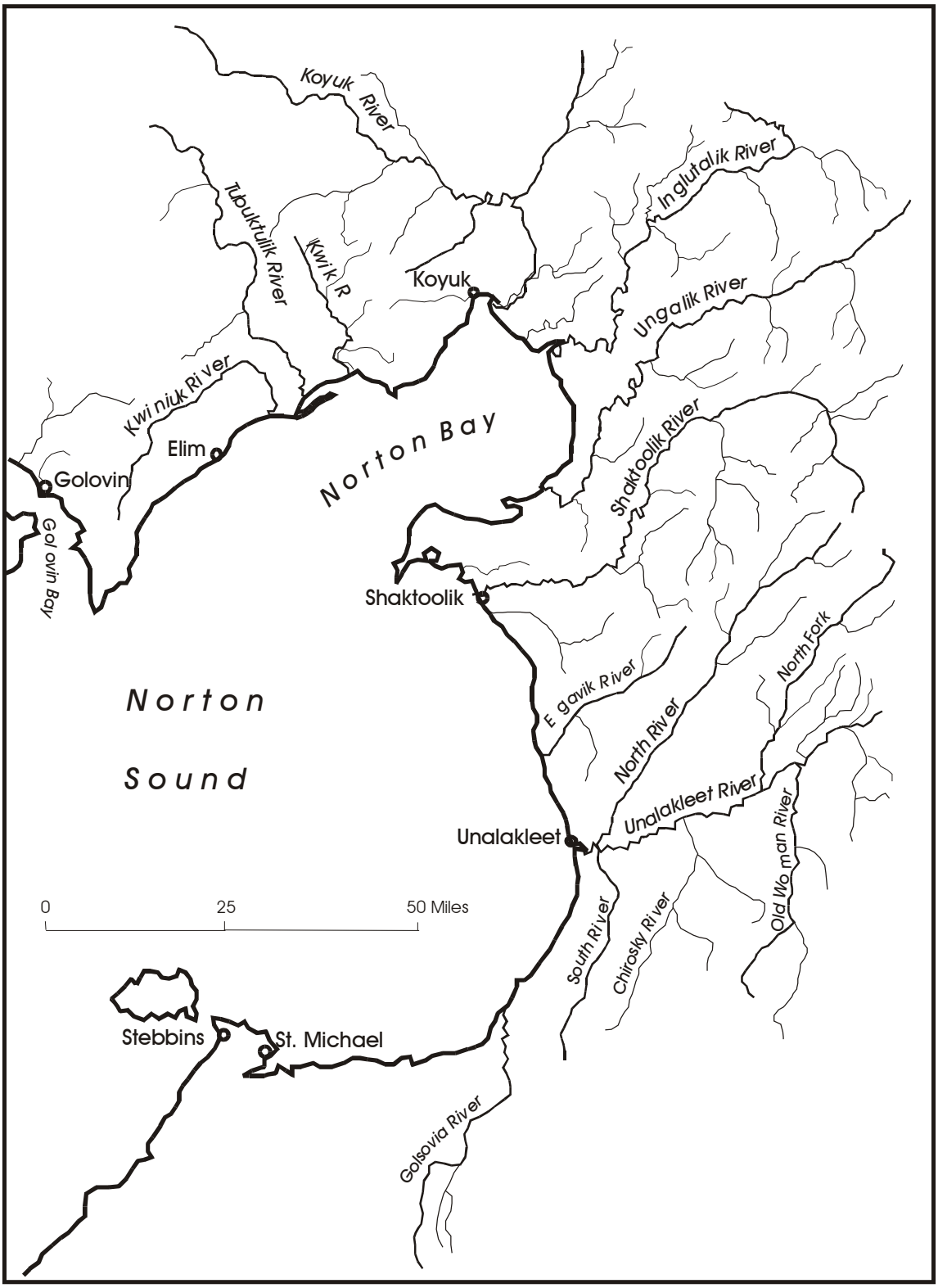

Figure 3.–Major drainages of Southern Norton Sound.

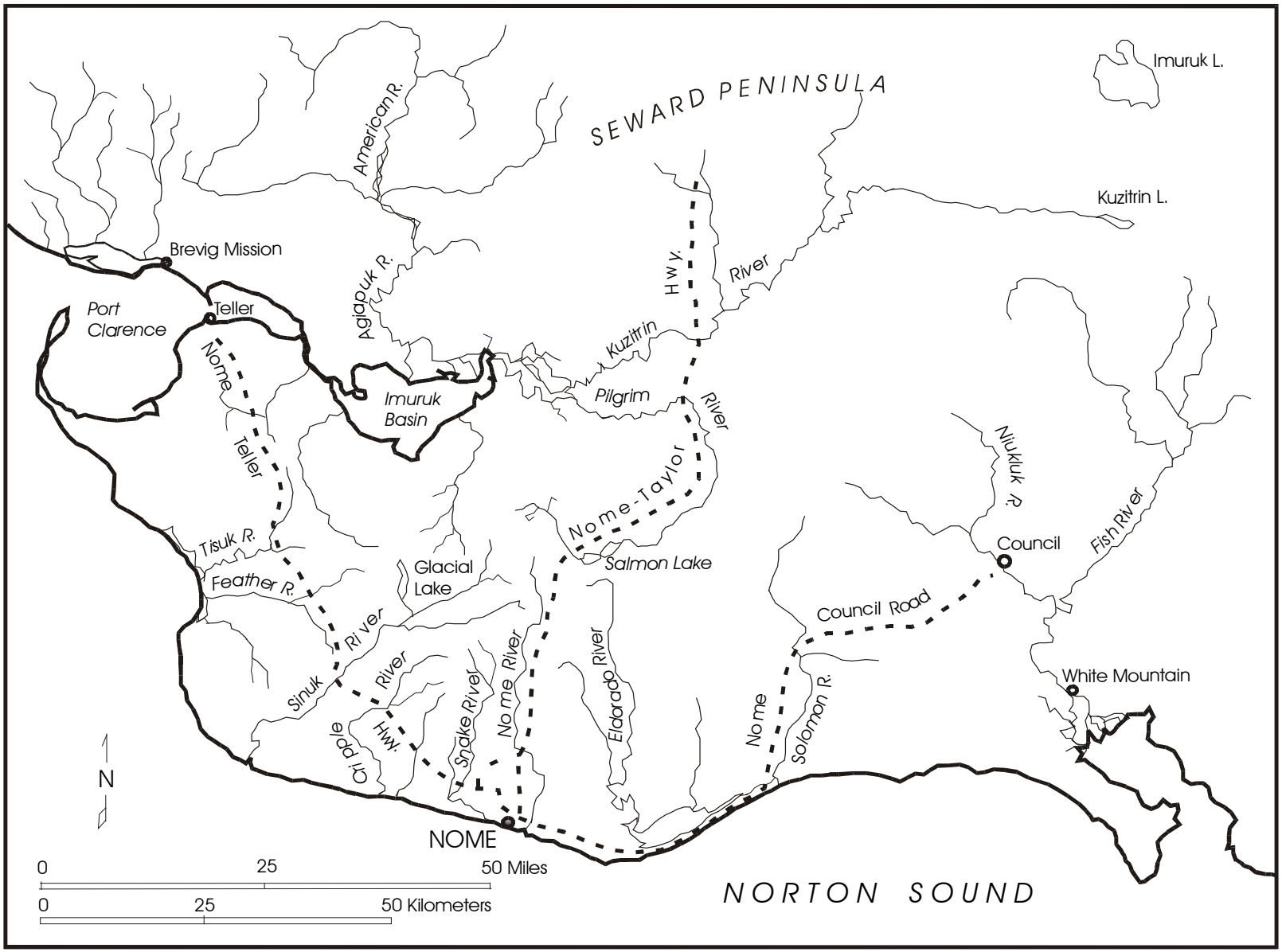

Figure 4.–Southern Seward Peninsula with road-accessible waters.

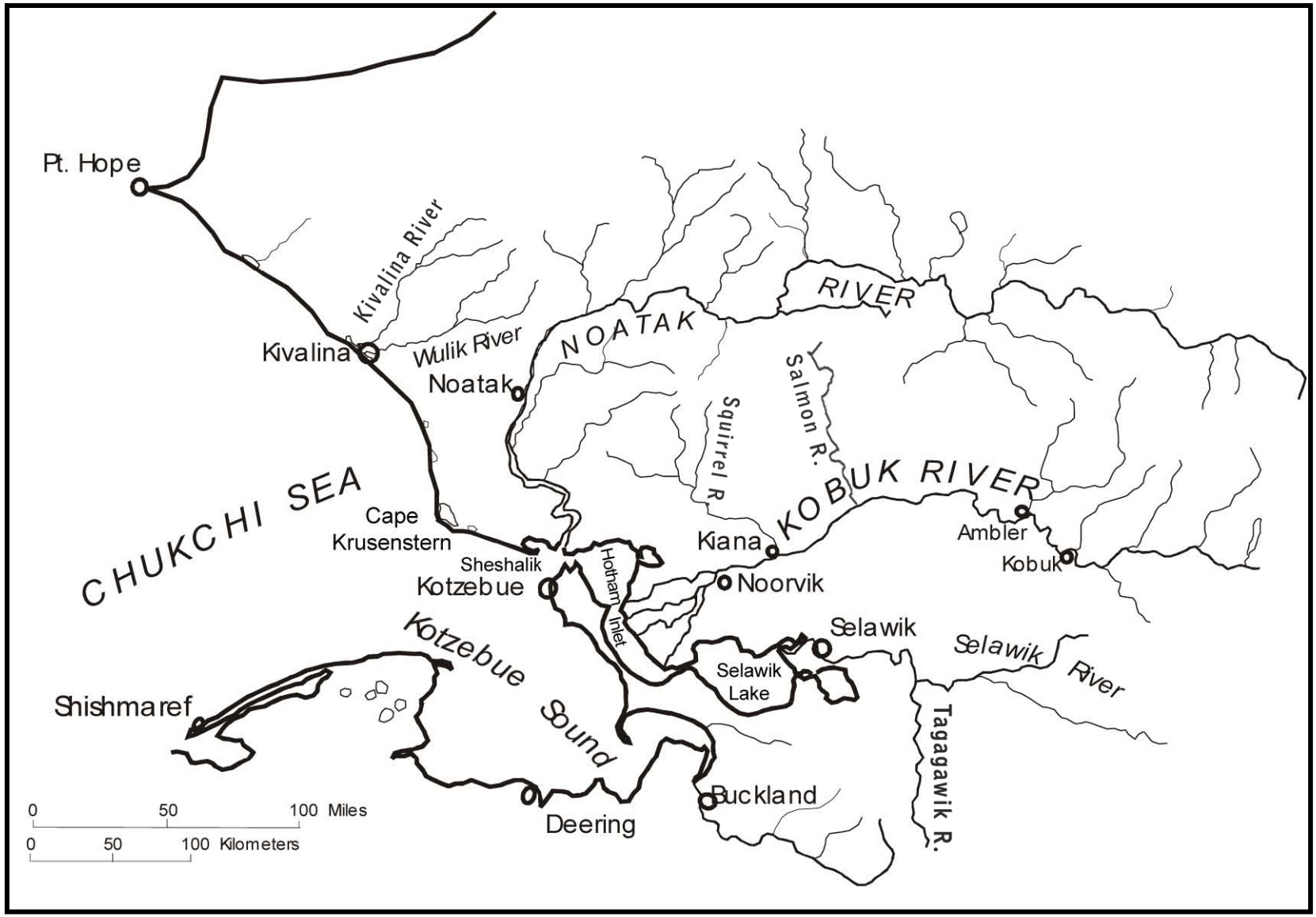

Figure 5.–Kotzebue Sound/Chukchi Sea subarea.

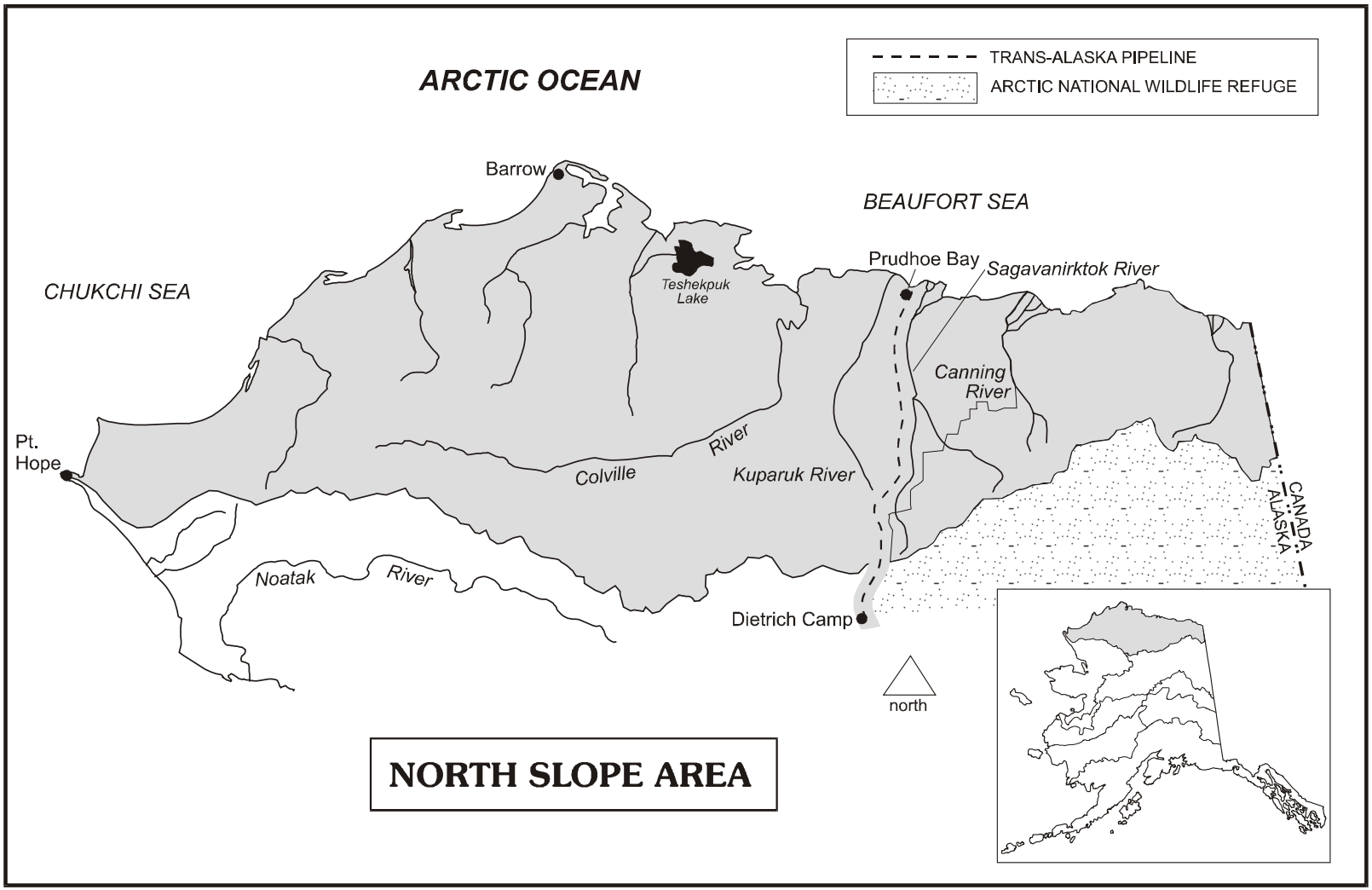

Figure 6.–North Slope subarea.

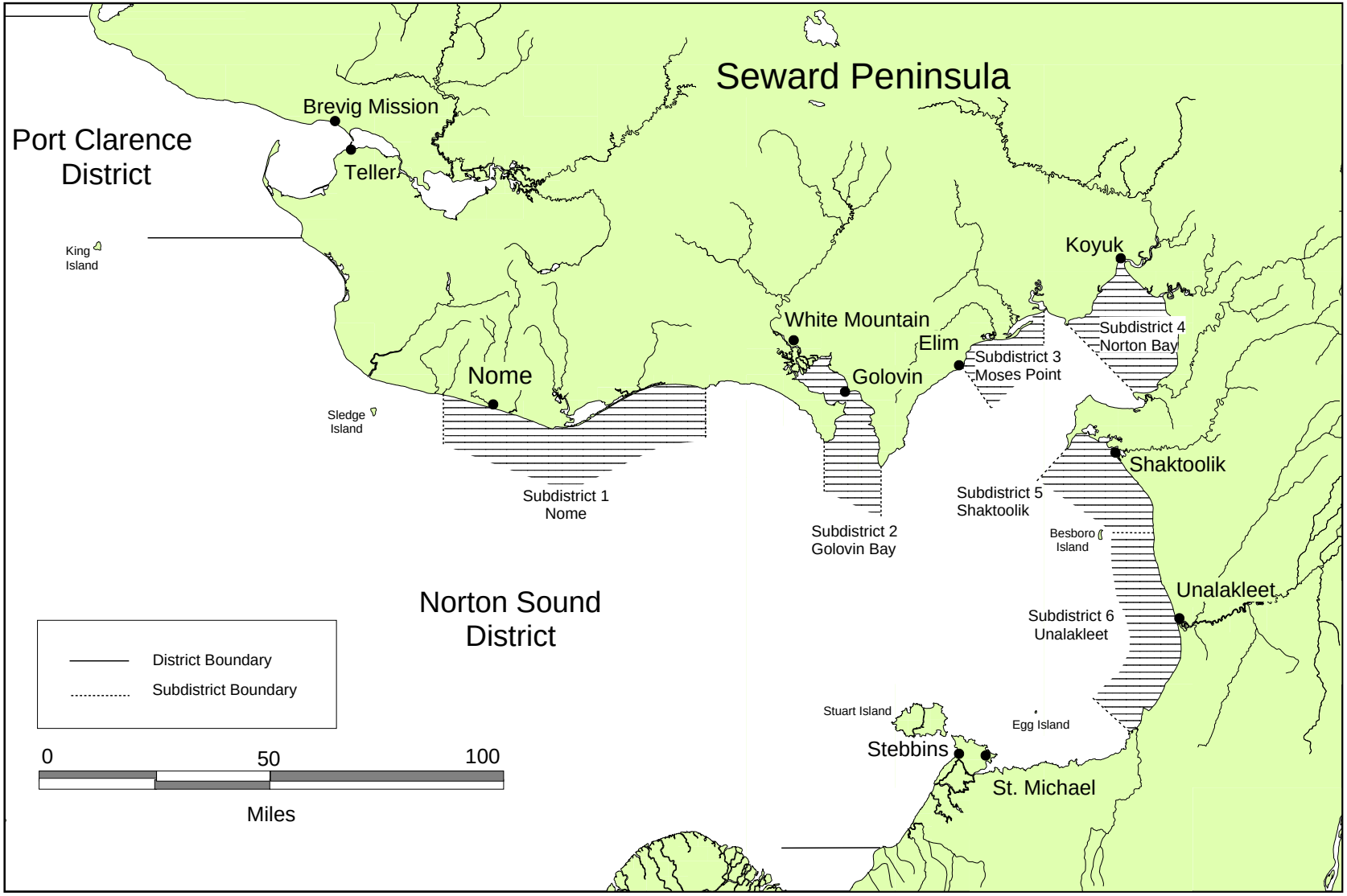

Figure 7.–Commercial salmon fishing subdistricts in Norton Sound and Port Clarence.

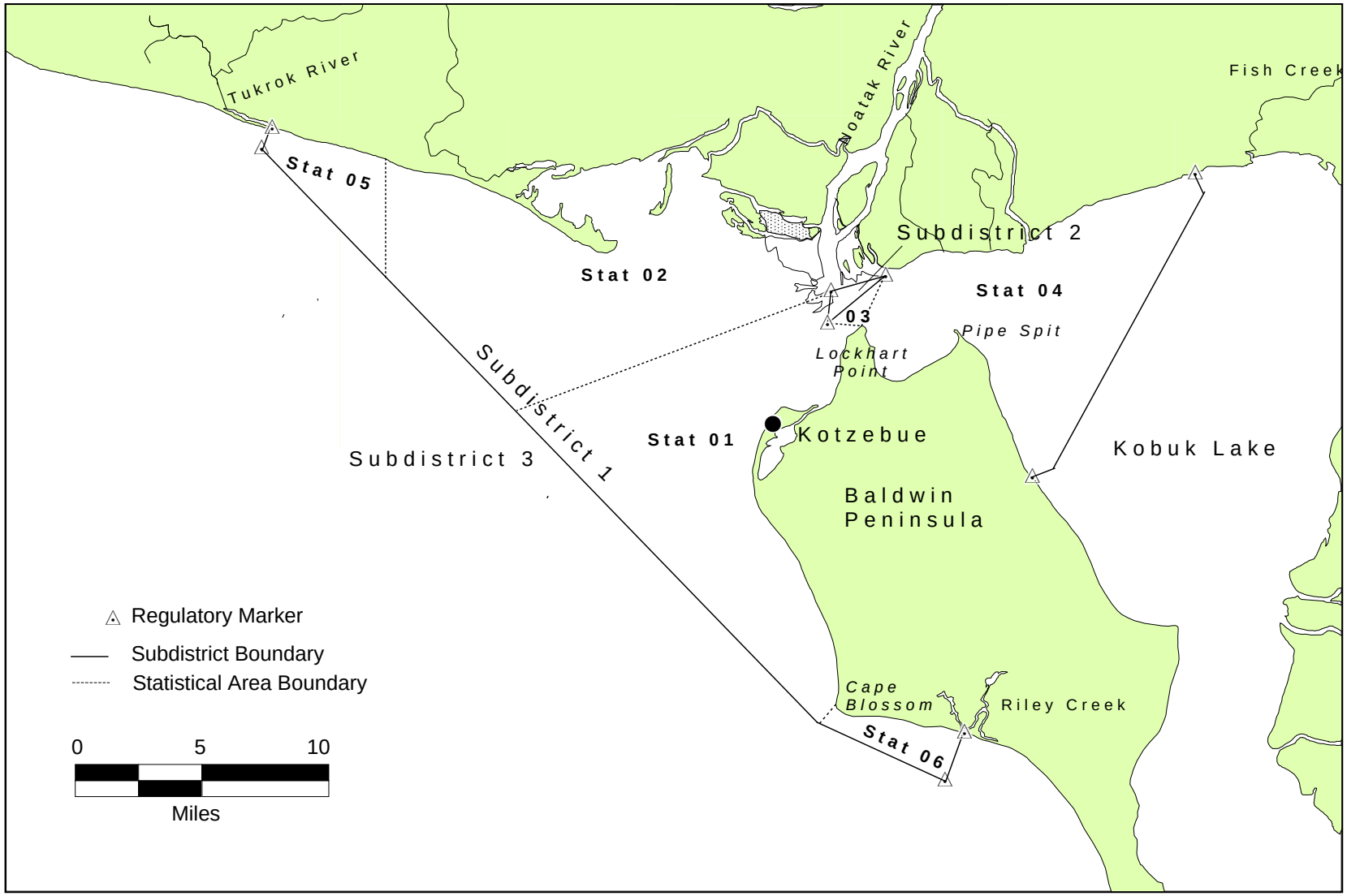

Figure 8.–Kotzebue Sound commercial salmon fishing district.

APPENDIX A: SPORT FISH EMERGENCY ORDERS ISSUED DURING 2017

Appendix A1.–NW/NSMA sport fish emergency orders issued during 2017 and 2018.

EO Number	Effective Dates	Action
3-KS-W-04-17	May 1–August 15	Prohibits sport fishing for king salmon in all fresh waters from Bald Head to Point Romanof, and prohibits the use of bait while sport fishing in these waters
3-KS-W-07-17	July 9–August 15	Rescinds 3-KS-W-04-17 and opens sport fishing for king salmon in all waters from Bald Head to Point Romanof with a bag and possession limit of one fish, with no size limit, and an annual limit for king salmon of one fish
3-KS-W-02-18	May 14–August 15	Prohibits sport fishing for king salmon in all fresh waters from Bald Head to Point Romanof, and prohibits the use of bait while sport fishing in these waters
3-KS-W-05-18	July 9–August 15	Rescinds 3-KS-W-02-18 and opens sport fishing for king salmon in all waters from Bald Head to Point Romanof with a bag and possession limit of one fish, with no size limit, and an annual limit for king salmon of one fish
3-PS-W-01-18	May 1–August 15	Increases the bag and possession limit for pink salmon to twenty (20) fish in Northern Norton Sound from Cape Darby to Cape Prince of Wales, and the Unalakleet Drainage
3-SS-W-01-18	August 17–October 15	Increases the bag and possession limit for coho salmon to ten (10) fish in the Unalakleet River drainage

APPENDIX B: ADDRESSES AND CONTACT NUMBERS FOR INFORMATION SOURCES REGARDING NW/NSMA

Appendix B1.–Addresses and contact numbers for information sources regarding NW/NSMA.

Organization	Address	Phone	Internet address
Alaska Department of Fish and Game, Nome Area office	PO Box 1148 Nome, AK 99762	(800) 443-5167	www.adfg.alaska.gov
ADF&G Fairbanks Regional office	1300 College Road Fairbanks, AK 99701-1599	(907) 459-7207	www.adfg.alaska.gov
Gates of the Arctic National Park and Preserve	PO Box 30 Bettles, AK 99726	(907) 692-5494	www.nps.gov/gaar/
Arctic National Wildlife Refuge	101 12th Avenue, Room 236 Fairbanks, AK 99701	(907) 456-0250	arctic.fws.gov/
Bering Land Bridge National Preserve	PO Box 220 Nome, AK 99762	(907) 443-2522	www.nps.gov/bela/
Noatak National Preserve	PO Box 1029 Kotzebue, AK 99752	(907) 442-3890	www.nps.gov/noat/
Kobuk Valley National Park	PO Box 1029 Kotzebue, AK 99752	(907) 442-3890	www.nps.gov/kova/
Selawik National Wildlife Refuge	PO Box 270 MS 565 Kotzebue, Alaska 99752	(907) 442-3799	selawik.fws.gov/
Cape Krusenstern National Monument	PO Box 1029 Kotzebue, AK 99752	(907) 442-3890	www.nps.gov/cakr
Unalakleet National Wild and Scenic River	222 West 7th Avenue, #13 Anchorage, AK 99513	(907) 271-5477	www.blm.gov/ak/ado/unkriver.html
NANA Regional Corporation	PO Box 49 Kotzebue, AK 99752	(800) 478-3301	www.nana.com
Nome Eskimo Community	PO Box 1090 Nome, Alaska 99762	(907) 443-2246	www.necalaska.org/
Unalakleet IRA Council	PO Box 270 Unalakleet, Alaska 99684	(907) 624-3622	http://www.kawerak.org/communities/unalakleet.html
Norton Sound Economic Development Corporation	PO Box 358 Nome, AK 99762	(888) 650-2477	www.nsedc.com