Technical Paper No. 458

Subsistence Harvest and Use of Nonsalmon Fish in Coastal Yukon-Kuskokwim Delta Communities, 2017.

by

Anna R. Godduhn

Christopher R. McDevitt

Marylynne L. Kostick

Caroline L. Brown

and

David M. Runfola

January 2020

Alaska Department of Fish and Game

Division of Subsistence

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in Division of Subsistence reports. All others, including deviations from definitions listed below, are noted in the text at first mention, in the titles or footnotes of tables, and in figures 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. states	two-letter abbreviations (e.g., AK, WA)

Measures (fisheries)

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

Mathematics, statistics

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

TECHNICAL PAPER NO. 458

SUBSISTENCE HARVEST AND USE OF NONSALMON FISH IN COASTAL YUKON-KUSKOKWIM DELTA COMMUNITIES, 2017

by

Anna R. Godduhn, Christopher R. McDevitt, Caroline L. Brown, and David M. Runfola
Alaska Department of Fish and Game Division of Subsistence, Fairbanks

and

Marylynne L. Kostick
Alaska Department of Fish and Game Division of Subsistence, Anchorage

Alaska Department of Fish and Game
Division of Subsistence
1300 College Road
Fairbanks, Alaska 99701

January 2020

Development and publication of this manuscript were partially financed by U.S. Fish and Wildlife Service, Office of Subsistence Management under Project No. 16-752

The Division of Subsistence Technical Paper Series was established in 1979 and represents the most complete collection of information about customary and traditional uses of fish and wildlife resources in Alaska. The papers cover all regions of the state. Some papers were written in response to specific fish and game management issues. Others provide detailed, basic information on the subsistence uses of particular communities which pertain to a large number of scientific and policy questions.

Technical Paper series reports are available through the Alaska Resources Library and Information Services (ARLIS), the Alaska State Library and on the Internet: http://www.adfg.alaska.gov/sf/publications/. This publication has undergone editorial and professional review.

Anna R. Godduhn, Christopher R. McDevitt, Caroline L. Brown, and David M. Runfola
Alaska Department of Fish and Game Division of Subsistence
1300 College Road, Fairbanks, AK 99701-1551 USA
and
Marylynne L. Kostick
Alaska Department of Fish and Game Division of Subsistence
333 Raspberry Road, Anchorage, AK 99518-1565 USA

This document should be cited as:
Godduhn, A.R., C.R. McDevitt, M.L. Kostick, C.L. Brown, and D.M. Runfola. 2020. Subsistence harvest and use of nonsalmon fish in coastal Yukon-Kuskokwim Delta communities, 2017. Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 458, Fairbanks.

TABLE OF CONTENTS

TABLE OF CONTENTS CONTINUED

TABLE OF CONTENTS CONTINUED

TABLE OF CONTENTS CONTINUED

TABLE OF CONTENTS CONTINUED

LIST OF TABLES

LIST OF TABLES CONTINUED

LIST OF TABLES CONTINUED

Table **Page**

LIST OF FIGURES

LIST OF FIGURES CONTINUED

Figure **Page**

LIST OF FIGURES CONTINUED

LIST OF PLATES

LIST OF PLATES CONTINUED

LIST OF APPENDICES

LIST OF APPENDIX TABLES

LIST OF APPENDIX TABLES CONTINUED

Table **Page**

LIST OF APPENDIX TABLES CONTINUED

LIST OF APPENDIX FIGURES

ABSTRACT

This report documents 2017 household harvests and uses of nonsalmon fish and marine invertebrates in five coastal Yukon-Kuskokwim Delta communities: Scammon Bay, Nightmute, Kipnuk, Mekoryuk, and Quinhagak. Household survey respondents provided harvest amounts, harvest locations, assessments of the fisheries, and observations of variability and change in the conditions that affect fishing. Results of the study show that nonsalmon fishers harvested and shared substantial amounts of nonsalmon fish for subsistence use. Levels of harvest varied across communities by species, primarily depending on local availability. The fish most harvested by weight were Pacific herring *Clupea pallasi* in Scammon Bay, Nightmute, and Kipnuk; Pacific halibut *Hippoglossus stenolepis* in Mekoryuk; and chars *Salvelinus spp.* in Quinhagak. Pacific halibut was the only species ranked in the top five harvests by weight in all study communities. Bering cisco *Coregonus laurettae*, broad whitefish *C. nasus*, northern pike *Esox lucius*, smelts *Osmeridae spp.*, and saffron cod *Eleginus gracilis* were all harvested in large amounts by at least three study communities. Each community also used minor amounts of various nearshore nonsalmon resources, such as small flatfish and marine invertebrates. Ethnographic information indicates that subsistence nonsalmon fishers in the study area use long-standing traditional practices and adaptive strategies and that the fisheries provide opportunities for intergenerational transfer of knowledge and skills.

Key words: char, eastern Bering Sea, Kipnuk, Mekoryuk, Nightmute, nonsalmon fish, Pacific halibut, Pacific herring, Quinhagak, Scammon Bay, subsistence fishing.

1. INTRODUCTION

Anna R. Godduhn and Caroline L. Brown

The Bering Sea is a vast and dynamic ecosystem that links the Pacific Ocean with the Arctic Ocean. The role of climate and weather in Bering Sea ice formation and biological productivity has been recognized, if not fully understood, by western science since at least the 1990s. Reductions in sea ice in the eastern Bering Sea raise uncertainty with regard to the future of the region's coastal marine fisheries (Loughlin and Ohtani 1999; National Research Council 1996; Siddon and Zador 2018). The Bering Sea coast of the Yukon Kuskokwim Delta (YKD) region is the study area for this project. The area includes 15 permanent communities that are located outside of the Yukon River and Kuskokwim River watersheds (Figure 1-1). These communities all have fewer than 1,250 residents, most of whom are of Yup'ik descent.[1] Table 1-1 shows 2010 census counts and 2017 population estimates for each of the five communities that participated in this project. Most of the 15 communities are incorporated as municipalities; all are represented by the Association of Village Council Presidents and are members of the Calista Corporation, one of 12 regional corporations created by the Alaska Native Claims Settlement Act (ANCSA). All 15 study area communities are located within federally managed national wildlife refuges (NWR; Yukon Delta NWR and Togiak NWR).

More than 20 nonsalmon fish species are regularly used in these communities, and subsistence fishers have long utilized a wide variety of gear types and techniques to harvest nonsalmon fish during all seasons of the year (Fienup-Riordan 2007:175–189, 268–287). Although the nonsalmon subsistence fisheries in these communities have not been well quantified over time, limited harvest data and abundant ethnographic information indicate that regional harvests and uses of nonsalmon fish are substantial, diverse, and continually changing in response to multiple socioeconomic and ecological factors (Bering Sea Elders Advisory Group 2011; Drozda 2010; Fall et al. 2012:245–246; Fienup-Riordan 1982; 1986; Fienup-Riordan and Rearden 2012; Ikuta et al. 2016; Lantis 1946; Regnart et al. 1978; Stickney 1984; Wolfe et al. 1984). Although subsistence mapping data have not been systematically collected for the majority of these communities in recent years, residents have documented extensive use of the Bering Sea coast where they engage in subsistence activities, including fishing (Bering Sea Elders Advisory Group 2011:39, 41).

This research provides an initial baseline quantification of the annual subsistence harvest of nonsalmon fish and marine invertebrate resources and their patterns of use in three communities (Nightmute, Kipnuk, and Mekoryuk), and it updates limited data in two others (Scammon Bay and Quinhagak).[2] Results of this study support prior findings that a wide diversity of nonsalmon fishes are used with variation across the study area.

Beyond harvest data, extensive ethnographic information indicates that subsistence harvests of nonsalmon fish by Bering Sea coastal communities provide substantial contributions and important diversity to the food supply (Nelson 1899, Lantis 1946, Fienup-Riordan 1982). These harvests provide additional health benefits of intergenerational connection and community wellbeing (Fall et al. 2012; Fienup-Riordan 1986; Ikuta et al. 2016; La Vine et al. 2007) and demonstrate flexibility, which promotes resilience among people who depend on the resources (Fienup-Riordan 1986). This report describes quantitative subsistence nonsalmon fish harvest and use information from the 2017 study year and local assessments of the harvest as compared to other recent years. Furthermore, the report also describes observations of change over

1. Alaska Department of Commerce, Community, and Economic Development (ADCCED) Division of Community and Regional Affairs, Juneau. n.d. "Alaska Community Database Online: Community Information." Accessed October 30, 2019. https://dcra-cdo-dcced.opendata.arcgis.com/

2. Additionally, Scammon Bay and Quinhagak participate in annual postseason subsistence salmon harvest surveys that also collect information about the harvest of nonsalmon fish species (Estensen et al. 2018; Lipka and Tiernan 2018). However, because the household sample for that project is designed to target salmon fishers in the early fall, it may underestimate late fall and winter nonsalmon fishing (Runfola et al. 2018:2).

Figure 1-1.–Study communities, 2017.

Table 1-1.–Alaska Native and overall population estimates, study communities, 2010 and 2017.

	Scammon Bay		Nightmute		Kipnuk		Mekoryuk		Quinhagak	
	Census (2010)	This study (2017)	Census (2010)	This study (2017)	Census (2010)	This study (2017)	Census (2010)	This study (2017)	Census (2010)	This study (2017)
Total population										
Households	96	132.0	59	54.0	153	146.0	70	77.0	165	160.0
Population	474	576.0	280	233.5	639	654.0	191	195.6	669	665.8
Alaska Native										
Population	472	565.1	266	231.9	626	635.6	185	181.7	650	645.9
Households	99.6%	98.1%	95.0%	99.3%	98.0%	97.2%	96.9%	92.9%	97.2%	97.0%

Sources U.S. Census Bureau 2011 for 2010 estimate and ADF&G Division of Subsistence household surveys, 2018 for 2017 estimate.

Note Division of Subsistence household survey elegiblity requirements differ from those used by U.S. Census Bureau.

decades. The information discussed in this report affirms that subsistence practices constitute an enduring and adaptive, culturally rich livelihood along the Bering Sea coast of the YKD region.

Project Background

Accurate information on the harvest and use of nonsalmon fish species in YKD coastal communities is critical to informed management and the protection of subsistence fisheries in western Alaska, where harvest amounts are controlled by environmental conditions and by local need (Jack 2002). In recent times, harvest patterns have in some cases changed dramatically (Fall et al. 2012; Ikuta et al. 2016; Runfola et al. 2018). For example, in four coastal and near-coastal YKD communities (Emmonak, Mountain Village, Quinhagak, and Kwethluk) harvest estimates for Alaska blackfish showed average declines of about 80% between a study year in the 1980s and a second study year after 2000 (Ikuta et al. 2016; Ray et al. 2010).[3] Some of the reduction can be related to the decline in the use of dog teams that were essential to households across Alaska for winter transportation until snowmachines and ATVs became widely available (Andersen 1992; Andersen and Scott 2010). However, data from 2005 and 2013 for two near-coastal communities (Tuntutuliak and Eek) also show reductions (Ikuta et al. 2016; Ray et al. 2010)[4] that may be in part related to personal preferences and technological advances. However, area residents have described increasingly common negative effects of a changing climate on subsistence activities, such as broken and slushy ice that precludes the use of boats and snowmachines, flooding that distracts people from fishing and may redistribute fish, and the loss of frozen fish to spoilage in unseasonably warm winter and spring temperatures (Fienup-Riordan and Rearden 2012:300–312; Runfola et al. 2018).

Division of Subsistence staff, in collaboration with YKD coastal communities, developed this overview of area nonsalmon fisheries. The report documents contemporary information on harvest quantities and use patterns in five communities during the 2017 calendar year, including local knowledge and observations related to nonsalmon fisheries and the surrounding environment in the context of climate change over the lifespan of respondents.

Regional Background

The Bering Sea coast of the YKD region has been occupied by various groups for several thousand years, and fish have been a primary component of diets and traditions throughout that time (Britton et al. 2013; Litecky 2011; Shaw 1998). Prior to the use of fish nets, coastal settlements required access to marine mammal populations for a robust food supply; the use of fish nets around 2,400 BP is thought to have allowed a large population expansion into coastal areas with rich fish resources, including, but not limited to, Pacific salmon[5].

3. Alaska Department of Fish and Game (ADF&G) Division of Subsistence, Juneau. “Community Subsistence Information System: CSIS.” Accessed July 31, 2019. https://www.adfg.alaska.gov/sb/CSIS Hereinafter *ADF&G CSIS*.
4. ADF&G CSIS.
5. Hereinafter *salmon*.

Edward Nelson, a naturalist and ethnographer based in St. Michael near the north mouth of the Yukon River from 1877 to 1881, brought the first direct recorded contact for residents in a large portion of the study area (Goldman 1935). Nelson traversed the YKD coast during the winter of 1878–1879 in a large sweep from the lower Yukon River to the mouth of the Kuskokwim River and then back north across the tundra. Nelson described a continuum of language and culture that formed the basis of his interpretation of territoriality of these subregional groups of extended families (Nelson 1983rev.:24). Villages were located along the coast in spring and summer and inland in fall and winter, always along waterways for access to food. The people moved between seasonal camps for efficiency, but a generally abundant resource base and ingenuity in the use of fish nets (eventually to include capture of birds and mammals; Shaw 1998) allowed life in this part of Alaska to become relatively settled (Fienup-Riordan and Rearden 2012:16). Boundaries of adjacent groups were not always cleanly delineated, in part due to demographic upheaval stemming both from warfare prior to contact (Fienup-Riordan and Rearden 2016) and epidemics that followed (Nord 1995). However, kinship relations, exchange of resources, and adaptive learning all continued to occur among communities in the area, which remained relatively isolated from late 19th and early 20th century activities of Euro-American settlers (Fienup-Riordan 1984; 2007). Yup'ik livelihood and disruptions brought by contact (in particular, epidemics and racism) have been broadly described in *Yuuyaraq: The Way of the Human Being* (Napoleon 1990).

Three major dialects of Central Alaska Yup'ik (General Central Yup'ik, Cup'ik, and Cup'ig) are spoken in the study area, along with multiple subdialects (Jacobson 1998:xii–xiii). Coastal Bering Sea communities share more cultural and economic characteristics with each other than with inland Yup'ik communities. In particular, coastal communities tend to harvest and use larger quantities of marine fish species and generally less salmon as compared to communities located on major river systems. Likewise, coastal fishers are more likely to have participated in commercial fishing for nonsalmon fish than for salmon when nonsalmon commercial fishing was locally active.

The Bering Sea provides millions of pounds of fish, marine mammals, and birds that are highly valued foods in coastal communities, as well as over 40% of the United States' commercial fish and shellfish landings.[6] However, the global scale of fisheries and faltering returns of salmon since the 1990s have undermined the feasibility of such small scale nearshore commercial fishing in the YKD region (Coastal Villages Region Fund 2017), and few such opportunities have been available in the study area during recent years, as described throughout this report.

Each of the study communities is located on a river; however, the surrounding landscapes and the rivers themselves differ substantially (Jorgenson 2000). Species availability in these varying habitats dictates much of the harvest variation from community to community (McPhail and Lindsey 1970; Mecklenburg et al. 2002; Stickney 1984:3–4). Coastal residents in this region harvest large quantities of subsistence fish resources from the marine environment and also make extensive use of coastal creeks and local drainages that support subsistence harvests for groups ranging from a single family to a few communities. For example, within the study area, rainbow trout (often called "rainbows") are locally available to the communities of Mekoryuk, Quinhagak, Goodnews Bay, and Platinum. Beyond variation in geography and species availability across the region, preferences and practices also vary from house to house, and often change over time.

Additionally, dialectical variation in the Yup'ik and Cup'ig names for particular species, including phrases and suffixes that describe distinct life history stages or body conditions within the same species, complicate conversations about locally important resources. Berkes (2012) and Simeone and Kari (2002) argue that the vocabulary used to identify and name species is integral to the study of traditional ecological knowledge. The lexical specialization exhibited within a community or language group is one index of the depth and complexity of knowledge about and experience with a species or group of species. The lexical variation of Native language fish inventories are often informed by a different organization of knowledge pertaining to

6. North Pacific Research Board. "Bering Sea Project." Accessed July 31, 2019. https://www.nprb.org/bering-sea-project/

a particular fish, such as life phases, body condition, or seasonality of geographic location (Andersen et al. 2004; Brown et al. 2005). As such, they often differ from Linnaean classifications. Although a comprehensive linguistic analysis of fish terminology and taxonomies is beyond the scope of this report, these differences can illuminate the rich cultural information communicated through language structure and use.

Understanding the ecological context of the study area increasingly requires consideration of changing weather and climate patterns. Local residents with expert knowledge gained over lifetimes of direct observation describe that contemporary weather patterns diverge greatly from those in the past, and also that these changes are connected to changing populations of fish important for subsistence as well as the ability to access those fish (Fienup-Riordan and Rearden 2012:300–312). Research into weather patterns and fish populations in the area along with modeling efforts designed to project potential future conditions concur with local concerns that unpredictable change in the region will continue to have effects on coastal communities and fisheries (Cheung et al. 2015; Jorgenson et al. 2018; Ravens and Allen 2012; Royer and Grosch 2006; Sheffield et al. 2014). In the context of ongoing climate change and the dearth of information about these fisheries, this documentation of contemporary subsistence patterns and local knowledge will be critical to understanding the role of changing environmental conditions in future subsistence nonsalmon fisheries.

Regulatory Context

Fisheries management has a unique and complex history in Alaska, where state and federal laws provide priorities for customary and traditional subsistence fishing over other consumptive uses, such as commercial fishing. The State of Alaska manages subsistence and commercial fisheries in state waters and in coastal waters up to three miles from shore unless superseded by a Federal Special Action within federal lands that assumes federal management, as has occurred for Kuskokwim River salmon within the Yukon Delta NWR in recent years (Lipka and Tiernan 2018:8). The federal government, through the North Pacific Fishery Management Council (NPFMC), manages fisheries in federal waters more than three miles from shore, however, nearshore and offshore Pacific halibut[7] fisheries are managed by the International Pacific Halibut Commission[8]. The Magnuson-Stevens Act (MSA; 50 CFR § 600) is the primary law governing marine fisheries conservation and management in U.S. federal waters.[9]

Multiple management plans guide fisheries in the eastern Bering Sea (halibut, groundfish, salmon, and shellfish); in 2014 the NPFMC adopted an Ecosystem Policy to recognize ecosystem connectivity and uncertainty; promote a precautionary, transparent, and inclusive process; and improve responsiveness to rapidly changing conditions. The Bering Sea Fishery Ecosystem Plan was implemented in December of 2018.[10]

The study area for this project is within the State of Alaska Department of Fish and Game's (ADF&G) Arctic-Yukon-Kuskokwim Region. One study community (Scammon Bay) is within the Yukon Area, with representation on the Coastal Lower Yukon Fish and Game Advisory Committee (AC); the four others (Nightmute, Kipnuk, Quinhagak, and Mekoryuk) are within the Kuskokwim Area, with representation

7. Hereinafter *halibut.*
8. National Oceanic and Atmospheric Administration (NOAA) Fisheries: West Coast Region, n.d. "Pacific Halibut." Accessed August 1, 2019. https://www.westcoast.fisheries.noaa.gov/fisheries/management/pacific_halibut_management.html
9. NOAA Fisheries, n.d. "Regulations, acts, treaties, and agreements for federal fisheries in Alaska." Accessed October 30, 2019. https://www.fisheries.noaa.gov/alaska/rules-and-regulations/regulations-acts-treaties-and-agreements-federal-fisheries-alaska
10. North Pacific Fishery Management Council, 2019. "Bering Sea Fishery Ecosystem Plan." Accessed October 30, 2019. https://www.npfmc.org/bsfep/

on the Central Bering Sea Fish and Game AC.[11] To support the regulatory requirements of defining and prioritizing the customary and traditional uses of fish and wildlife resources, the ADF&G Division of Subsistence conducts systematic social science research "on all aspects of the role of subsistence hunting and fishing in the lives of the residents of the state" (AS 16.05.094). The division also conducts research to contribute to the development of "statewide and regional management plans so that those plans recognize and incorporate the needs of subsistence users of fish and game" (AS 16.05.094).

Subsistence Fisheries

The Alaska Board of Fisheries (BOF) and the Federal Subsistence Board regulate Alaska subsistence fisheries through a dual management system that is administered by the State of Alaska under Title 5 of the Alaska Administrative Code and by the federal government under Title 50, parts 92 and 100, of the Code of Federal Regulations. The federal government designates the YKD as a rural subsistence region (50 CFR § 100.22 and 50 CFR § 100.23). All federal subsistence regulations apply to these regions and specify that individuals practicing subsistence harvests of fish and wildlife on federal public lands must be permanent rural residents of the area, or, in a limited number of cases, simply Alaska rural residents from across the state (50 CFR § 100.5). State of Alaska regulations provide that all Alaskans are eligible to participate in state subsistence hunting, fishing, and trapping opportunities (5 AAC 99.021). In 1993, BOF made positive determinations that all nonsalmon finfish are customarily and traditionally used for subsistence in the coastal Yukon and Kuskokwim areas. Following the determination of customary and traditional use, the BOF is responsible for establishing the amount of the harvestable portion that is reasonably necessary for subsistence uses (ANS; 5 AAC 01.236 and 5 AAC 0.286) in order to ensure that regulations provide a reasonable opportunity for success in harvesting fish or game for subsistence uses, based primarily on existing harvest information. No ANS levels have been established for these coastal nonsalmon fisheries, in part because so few harvest data are available. However, few limits are placed on subsistence nonsalmon fishing in the study area (5 AAC 01.220; 5 AAC 01.234; 5 AAC 01.270; 5 AAC 01.284). Management regulations include periods of subsistence closure surrounding commercial fishing, such as in the Kanektok and Arolik rivers at Quinhagak (5 AAC 01.275). However, neither commercial fishing nor subsistence fishery closures occurred in 2017. Additionally, ADF&G managers (or federal managers, if they have superseded state authority) may issue emergency orders with respect to conservation concerns, which they have primarily for Chinook salmon. The NPFMC adopted regulations recognizing subsistence harvests of Pacific halibut by eligible members of Alaska Native tribes and eligible residents of rural Alaska coastal communities in 2003 (68 CFR § 18145 and 50 CFR § 300). Administration of the halibut fishery includes the only required registration for subsistence fishing in the study area through a Subsistence Halibut Registration Certificate (Fall and Koster 2018).

Commercial and Sport Fisheries

A general history of the development and demise of local nearshore commercial fisheries in the YKD region of the eastern Bering Sea is briefly described here because local fishers participated in them, and because income from commercial fishing supported subsistence living, often quite directly. Additionally, sport fisheries occur within the study area, particularly around Quinhagak.

Commercial Fisheries: The first documented commercial fishery in the eastern Bering Sea was for Pacific cod in the late 1800s (National Research Council 1996:157–195). Commercial development was slow in the isolated region, but since early in the 20th century, commercial takes of nonsalmon marine fish such as Pacific cod, Pacific herring[12], and halibut by U.S. and foreign fishers have dwarfed subsistence harvests of these species. Heavy foreign fishing in the eastern Bering Sea in the 1950s–1970s was curtailed by enactment of the MSA and the adoption of the U.S. Exclusive Economic Zone (Reagan 1983), as well as

11. ADF&G Fish and Game Advisory Committees provide a forum for discussion among stakeholders; ACs develop, evaluate, and make recommendations regarding proposals to the Alaska boards of Fisheries and Game. ADF&G, n.d. "Advisory Committees." Accessed October 30, 2019. http://www.adfg.alaska.gov/index.cfm?adfg=process.advisory

12. Hereinafter *herring.*

international law to protect coastal stocks for the continued benefit of people along their migratory paths who had been using them as critical foods for generations (National Research Council 1996).

Following statehood, commercial fisheries for salmon and nonsalmon fishes provided an avenue of development for the remote region. Early in the 21st century, of some 250 species of finfish and marine invertebrates in the Bering Sea, about 25 species were commercially valuable (Woodby et al. 2005); some of these are also important to the subsistence fisheries of the region. ADF&G developed commercial fisheries in the study region for salmon in the 1960s and for halibut, herring and herring sac roe in the 1980s. Commercial fishing for salmon occurred primarily in and around the Kuskokwim and Yukon rivers as well as the Kanektok River at Quinhagak, and herring fishing occurred along the coast between the main rivers; halibut permits were statewide but area fishers generally fished around Nelson Island (Pete 1984:7). Subsistence uses of fish were locally held as paramount and the commodification of herring in particular was resisted, primarily by Nelson Island residents, because of the critical nature of the herring run to food security (Hemming et al. 1978; Pete 1984). Ultimately, the activity was accepted with local stipulations that favored local fishers codified into regulations, in part because local people were told that commodification was inevitable (Pete 1984:19–20). Commercial fishing for herring commenced in the study area in the mid-1980s, including four districts: Nelson Island, Nunivak Island, Cape Romanzof, and Cape Avinof near Kipnuk (Pete 1990:604). Ultimately, commercial fishing, first for herring and later for halibut, was deeply integrated with subsistence pursuits for these coastal communities.

Small-scale, nearshore commercial fisheries exploited a fraction of Bering Sea productivity and provided vital income to household and community economies. Incidental and target species alike could be retained for subsistence use, and the income from fish sold was often used to support subsistence activities (Wolfe et al. 1984). Data since 1980 show that coastal fishers have participated in commercial fisheries with variable intensity across the region and over time.[13] Among the study communities, Quinhagak had the most commercial salmon fishers until 2015; Kipnuk had the most commercial herring fishers, especially in the 1990s; and Mekoryuk had the most commercial halibut fishers from the 1990s through 2015.

The NPFMC manages U.S. fisheries in the Bering Sea through the Community Development Quota (CDQ) Program.[14] The program was designed to provide economic opportunities for Alaska's coastal communities by allocating harvestable surpluses of seafood to six CDQ groups across the region. The NPFMC, under the National Oceanic and Atmospheric Administration (NOAA), issues allocations of fish to CDQ groups but may not direct the use of the allocations or any income generated from them, except as specifically authorized under the MSA.[15] All of the study area communities are within the Coastal Villages Region Fund (CVRF) CDQ group.[16]

Beginning in the 1990s, nearshore commercial fisheries development involved establishing fish processing plants throughout the region, including in all of the study communities except Nightmute. However, although local interest in commercial fishing was very high, by 2005, the CVRF sought to consolidate operations and began to close processing plants (Woodby et al. 2005). By 2013, a fish plant in Platinum was the only operating facility but also was ultimately closed as CVRF recognized "…that industrial fishing—for pollock, cod and crab—would be the most profitable and effective way to grow the company sustainably"

13. Alaska Commercial Fisheries Entry Commission. "Fishery Statistics—Participation and Earnings." Accessed July 31, 2019. https://www.cfec.state.ak.us/fishery_statistics/earnings.htm

14. NOAA Fisheries. "The Western Alaska Community Development Quota Program." Accessed August 2, 2019. https://www.fisheries.noaa.gov/resource/document/western-alaska-community-development-quota-program

15. Each CDQ group, in this case Coastal Villages Region Fund, is responsible for managing its allocation and deciding how to use the allocation to the benefit of member communities subject to the fishery-related investment limitations of the MSA. Sally Bibb, Director, NOAA Sustainable Fisheries Division, Personal communication, April 17, 2019.

16. Coastal Villages Region Fund, 2019. "About us: locations." Accessed October 30, 2019. http://www.coastalvillages.org

(Coastal Villages Region Fund 2017:4). Thus, CVRF has focused their investments on large vessels fishing in deeper water, upon which their shareholders are invited to work.

Commercial fishery quotas are established for halibut and herring sac roe in the Bering Sea with restrictions for herring operations that occur nearshore in proximity to subsistence fisheries. However, in the years immediately prior to the study year, local commercial fisheries were limited to whitefishes in the lower Yukon River and salmon at Quinhagak, Goodnews Bay, and Platinum. During the study year (2017), commercial fishing opportunities were not available in the Kuskokwim Bay and along the southern YKD coast.

Sport Fisheries: Rod and reel gear (generally considered by the state as a sport fishing gear type) is legal subsistence gear in the Kuskokwim Management Area. Sport fishing by nonlocal Alaska residents is rare in most of the study area (Chythlook 2018); however, the Kanektok, Arolik, and Goodnews rivers support regular fly-in and guided sport fishing (often catch and release) for salmon species, rainbow trout, chars, and Arctic grayling. Guided sport fishing on Nunivak Island is less active, but available.

Study Objectives

The project had the following objectives:

1. Use household surveys, key respondent interviews, and participant observation to quantify the harvest and use of subsistence nonsalmon fish during a single study year within a qualitative context for five coastal Bering Sea communities across the Central Bering Sea Coast region.
    a. Document key aspects of nonsalmon fishing patterns for YKD coastal communities, including harvest areas, gear types used, harvest methods, processing methods, local terminology, influence of weather, and seasonality of harvests through key respondent interviews and participant observation.
    b. Record key respondent observations of changes in subsistence harvest and use patterns over time in the context of climate change.
    c. Collect information on local nonsalmon fish taxonomies and use this information to develop an identification guide that will be used in harvest surveys (Objective 2).
    d. Strengthen relationships between agencies and local governments. Specifically, identify and address community concerns related to subsistence harvest surveys and other aspects of fisheries management.
2. Collect updated quantitative subsistence harvest and use information for nonsalmon fish by species for one community in each of five YKD coastal subregions.
    a. Estimate annual community harvest use levels of nonsalmon fish by species for Scammon Bay, Nightmute[17], Kipnuk, Mekoryuk, and Quinhagak. Assess whether subsistence needs for nonsalmon fish species are being met and impacts to households when needs are not met.
    b. Systematically record household estimates of changes in subsistence harvest and use patterns over time for nonsalmon fisheries by species in study communities listed above. Collect contextual information on factors that have influenced changes in harvest and use patterns, including climate change, resource population levels, health of resources, and changing food preferences.
3. Develop and publish an overview of the nonsalmon subsistence fisheries of coastal YKD communities that provides a synthesis of previous harvest and use information, updated subsistence harvest and use estimates by species for surveyed communities, a summary and analysis of local observations of changes in the fisheries over time, an overview of local knowledge provided by key

17. Toksook Bay was originally listed in the project proposal but declined the invitation to participate. Nightmute, also on Nelson Island and subsequently invited, approved the project and participated.

respondents, and, when possible, an analysis of the differences between multiple years of survey data (Quinhagak and Scammon Bay).

4. Provide research tools and recommendations for developing ongoing fishery monitoring plan.

Research Methods

Ethical Principles for the Conduct of Research

The project was guided by the research principles outlined in the Alaska Federation of Natives Guidelines for Research[18] and by the National Science Foundation, Office of Polar Programs in its Principles for the Conduct of Research in the Arctic[19], the Ethical Principles for the Conduct of Research in the North (Association of Canadian Universities for Northern Studies 2003), as well as the Alaska confidentiality statute (AS 16.05.815). These principles stress community approval of research designs, informed consent, anonymity or confidentiality of study participants, community review of draft study findings, and the provision of study findings to each study community upon completion of the research.

Project Planning and Approvals

Researchers initially approached five coastal Bering Sea communities within the YKD region: Scammon Bay, Toksook Bay, Kipnuk, Quinhagak, and Mekoryuk. This set of communities was selected to represent the diverse portions of the study region. The communities of Scammon Bay and Quinhagak were invited due to their recent subsistence harvest estimates for nonsalmon fish (Ikuta et al. 2016), which enable analysis of dynamic nonsalmon fish harvests in the context of the total food supply. In the winter and spring of 2016–2017, a Division of Subsistence researcher traveled to each community to consult with local tribal governments and to seek approval and feedback (Table 1-2). Of the five initially selected study communities, all but Toksook Bay agreed to participate in the research; the neighboring Nelson Island community of Nightmute was invited and agreed to participate in the project. Following tribal council approval of the project in each community, investigators consulted with council members and other residents to develop community-specific research plans; researchers either stayed or planned to return for initial interviews and participant observation.

Key Respondent Interviews and Participant Observation

Researchers consulted with tribal councils to identify local residents who were knowledgeable about past and more recent nonsalmon fishing practices in their communities; these key respondents also sometimes identified additional experts for interviews in a snowball method of recruitment. Key respondent interviews enabled researchers to learn about current harvest and use patterns in the subsistence fisheries, including

Table 1-2.–Community meetings and fieldwork dates, study communities, 2017–2019.

Community	Community approval meeting	Fieldwork	Community data review meeting
Scammon Bay	November 8 2016	March 24–27, 2017; March 24–31, 2018	February 12 2019
Nightmute	May 9 2017	November 4–7, 2018; March 10–17, 2018	November 5 2018
Kipnuk	April 11, 2017	April 10–16, 2017; March 6–15, 2018	January 29, 2019
Mekoryuk	May 11, 2017	May 5–16, 2017; January 22–30, 2018; January 9–15, 2019	January 10, 2019
Quinhagak	February 11, 2017	February 10–16, 2017; February 1–7, 2018; November 1–7, 2018	November 1, 2018

Source ADF&G Division of Subsistence, 2019.

18. Alaska Federation of Natives. 2013. "Alaska Federation of Natives Guidelines for Research." Alaska Native Knowledge Network. Accessed July 10, 2019. http://www.ankn.uaf.edu/IKS/afnguide.html

19. National Science Foundation Interagency Social Science Task Force. 2012. "Principles for the Conduct of Research in the Arctic." Accessed July 10, 2019. http://www.nsf.gov/od/opp/arctic/conduct.jsp

changes in harvest and use patterns, and, in particular, effects of climate change on fish and fishing practices. Context for the quantitative data is vital to each community's fishery overview and to the regional discussion of continuity and change. Elements of context include details of each community's background, variations in the seasonal round, species identification and local taxonomies, community concerns, and others. During the first year of the project, ADF&G staff, sometimes accompanied by local research assistants, completed five to ten interviews in each community. A key respondent interview guide was developed by ADF&G staff and approved by the local governments in each study community (Appendix A). The guide utilized a semi-structured approach for the interviews rather than a strict set of questions to allow for each respondent's experiential and specialized knowledge. Prior to conducting interviews, researchers also provided information about the project intentions and confirmed consent to conduct and record the interview with each key respondent. Researchers described the project, including their plan to return a transcript of each interview to the respondents, and they requested permission to include his or her name in the Acknowledgments section of the community chapters. Respondents were compensated for sharing their time and knowledge. Researchers attempted to audio-record all interviews. There were occasional technical equipment failures, and some key respondents declined to have their interviews recorded. In these rare instances, interviewers took careful notes. Interviews conducted in Central Yup'ik/Cu'pig included an English-speaking interviewer and a bilingual English-Central Yup'ik/Cup'ig translator. For efficiency of time, translators did not consistently translate key respondent speech verbatim; however, recorded interviews in Central Yup'ik/Cup'ig were also translated and transcribed into English following fieldwork.

Researchers also participated in fishing activities to experience fishing in each region and community; these events often included traveling with fishers and their families. Participant observation is a widely used ethnographic method in human-environment research and is one of the standard methods used by the Division of Subsistence in researching customary and traditional practices (e.g., Fall et al. 2010; Georgette and Shiedt 2005).

Systematic Household Surveys

The primary method for collecting quantitative subsistence harvest and use information for nonsalmon fish species in this project was a systematic household survey. The survey instrument recorded harvest numbers, locations, and harvest timing of nonsalmon fish by species such that the data are comparable with information collected in other household surveys in the study communities and with data in the CSIS. Surveys also included questions designed to assess whether subsistence needs are being met, capture household descriptions of changes that have occurred in subsistence harvest and use patterns over time, and identify factors influencing such changes including climate change, resource population levels, health of resources, changing food preferences, and effects of current management or resource allocation practices, among others. Appendix B is an example of the survey instrument used in this project. Survey implementation varied slightly in regards to retained commercial fish: in Scammon Bay and Nightmute, which were closer to commercial fishing opportunities for both salmon and whitefishes in 2017, retained salmon were often but not always recorded, whereas in the other communities only retained nonsalmon fish were recorded.

Surveys to document the 2017 nonsalmon fish harvest were conducted in each community early in 2018, after the first round of ethnographic interviews. This approach enabled investigators to incorporate information collected during the initial ethnographic interviews into survey design and staff preparation. Survey samples were based on community size. Investigators hired two to six community residents as local research assistants and Yup'ik-English interpreters for survey administration (Table 1-3). Researchers attempted to administer surveys to a 60% random sample of households in study communities greater than 100 households; in communities with fewer than 100 households, researchers attempted to survey all households (Table 1-4). This approach of census and random samples (as opposed to stratified samples) achieves a representative cross-section of households, including both harvesting and non- or low-harvesting households, that is consistent with and comparable to Division of Subsistence harvest data for other communities in the region. Variable participation rates in different nonsalmon fisheries make such a cross section critical. For example, households that might be included in lower harvesting strata in other subsistence fishing surveys (e.g., elder

Table 1-3.–Project staff.

Task	Name	Organization
Northern Regional Program Manager	Caroline Brown	ADF&G Division of Subsistence
Principal Investigator	David Runfola	ADF&G Division of Subsistence
Administrative support	Pam Amundson	ADF&G Division of Subsistence
	Tamsen Coursey-Willis	ADF&G Division of Subsistence
	Deanne Lincoln	ADF&G Division of Subsistence
Data Management Lead	Marylynne L. Kostick	ADF&G Division of Subsistence
Programmer	Margaret Cunningham	ADF&G Division of Subsistence
	David Koster	ADF&G Division of Subsistence
Data Entry	Alex Depue	ADF&G Division of Subsistence
	Anna Petersen	ADF&G Division of Subsistence
	Halia Janssen	ADF&G Division of Subsistence
	Alea Robinson	ADF&G Division of Subsistence
Data Cleaning/Validation	Marylynne Kostick	ADF&G Division of Subsistence
Data Analysis	Marylynne Kostick	ADF&G Division of Subsistence
Cartography	Margaret Cunningham	ADF&G Division of Subsistence
Editorial Review Lead	Rebecca Dunne	ADF&G Division of Subsistence
Production Lead	Rebecca Dunne	ADF&G Division of Subsistence
Transcription Services	Muriel Amos	Mekoryuk
Field Research Staff	Anna Godduhn	ADF&G Division of Subsistence
	Chris McDevitt	ADF&G Division of Subsistence
	Jeffrey Park	ADF&G Division of Subsistence
	Kathleen Roush	ADF&G Division of Subsistence
	Seth Wilson	ADF&G Division of Subsistence
Local Research Assistant	Seth Aguchak	Scammon Bay
	Hazel Kaganak	Scammon Bay
	Brian Morgan	Scammon Bay
	MaryAnne Prunes	Scammon Bay
	John George	Nightmute
	David Tulik	Nightmute
	Janelle Carl	Kipnuk
	Shelia Carl	Kipnuk
	Andrea Dock	Kipnuk
	Daniel Mann	Kipnuk
	George Christmas	Mekoryuk
	Debbie David	Mekoryuk
	Russell Float	Mekoryuk
	William Kiokan	Mekoryuk
	Linda Weston	Mekoryuk
	Albert Cleveland	Quinhagak
	Thaddeus Foster	Quinhagak
	Louisa Kuku	Quinhagak
	Charlene Nicori	Quinhagak
	Jessica Simon	Quinhagak
	Jamie Small	Quinhagak

Source ADF&G Division of Subsistence, 2019.

Table 1-4.–Sample achievement, study communities, 2017.

Sample information	Study community: Scammon Bay	Nightmute	Kipnuk	Mekoryuk	Quinhagak
Number of dwelling units	113	56	150	79	161
Interview goal	60%	100%	100%	100%	60%
Households surveyed	88	34	98	50	93
Households failed to be contacted	16	6	13	13	7
Households declined to be surveyed	24	14	35	14	11
Households moved or occupied by nonresident	4	2	11	2	1
Total households attempted to be surveyed	128	54	146	77	111
Refusal rate	21.4%	29.2%	26.3%	21.9%	10.6%
Final estimate of permanent households	132	54	146	77	160
Percentage of total households surveyed	66.7%	63.0%	67.1%	64.9%	58.1%
Survey weighting factor	1.50	1.59	1.49	1.54	1.72
Sampled population	384	147	439	127	387
Estimated population	576.0	233.5	654.0	195.6	665.8

Source ADF&G Division of Subsistence household surveys, 2018.

households that might have difficulty harvesting halibut) are sometimes among the most persistent and highest harvesting households in hook and line under-ice fisheries for saffron cod or rainbow smelt.[20]

For each survey, one ADF&G staff member and one local research assistant (LRA) used a standardized form to collect harvest data during face-to-face surveys (Appendix B); the surveys generally lasted approximately 20 minutes, depending on the nature of a particular household's experience with subsistence fishing-related activities (Table 1-5). Respondents were asked to provide specific information on numbers and species harvested during the 2017 calendar year. LRAs were compensated for each completed survey form. Survey participation was voluntary, and confidentiality was maintained through the use of identification codes instead of residents' names or addresses. Households and individuals were assigned random numerical codes before the surveys began. The household code sheet was maintained by the lead researcher during survey administration and remained in his or her custody after survey completion. Results are reported at the community level; household harvest levels remain confidential.

Following data collection, surveyors reviewed forms for completeness and accuracy. Responses were coded following standard conventions used by Division of Subsistence to facilitate data entry and reviewed again prior to transfer to the Information Management Section of the Division of Subsistence.

Table 1-5.–Survey length, study communities, 2017.

Study community	Survey length (in minutes): Average	Minimum	Maximum
Scammon Bay	22	2	75
Nightmute	29	5	75
Kipnuk	21	2	75
Mekoryuk	32	5	75
Quinhagak	23	3	75

Source ADF&G Division of Subsistence household surveys, 2018.

20. A. Brenner field notes, Quinhagak, April 2014.

Mapping Locations of Subsistence Hunting, Fishing, and Gathering Activities

During household surveys, researchers asked respondents to indicate the locations of their nonsalmon fishing activities during the study year (2017). Most harvest locations were documented using an application designed on the ArcGIS Runtime SDK for iOS platform; a task-specific mapping data collection application for iPad.[21] Paper maps were available to be used as a reference or in case of preference or technical difficulties. The 11x17-inch maps showed a variety of scales (1:24,000 to 1:500:000) to display the local vicinity in the greatest detail as well as larger areas. The paper maps were rarely used instead of the iPad during survey administration; research staff later digitized markings on paper maps using the iPad application. Generally, points were used to mark locations of stationary fishing that occurred in the same place each time, such as setnets, jigging through ice, rod and reel, or fish traps; lines were used for discrete mobile efforts, such as drift netting, or for stationary efforts that occurred in different places along a line, such as jigging from adjacent locations along a river; and polygons (circled areas) were used to indicate fishing that happened at a few places in a general area, such as a creek system where a fisher used a blackfish trap, or a lake where a fisher used a net. The point, line, or polygon was drawn on a U.S. Geological Survey topographic relief map downloaded to the iPad. The iPad allowed users to zoom in and out to the appropriate scale and document search and harvest activities wherever they occurred in the state of Alaska. Once a feature was accepted, the researcher filled out an attribute box to record details of the effort, such as the species harvested, amount, method of access to the resource, and month(s) of harvest. The data were uploaded via Wi-Fi to a server. Once data collection was complete, the data were downloaded into an ArcGIS file geodatabase.

When a survey was complete, researchers conducted a quality control exercise by matching the map data to the survey form to ensure that all map data had been documented. This was completed in the field. Location data were digitized using a geographic information system (GIS) platform to produce maps that provide visual records of harvest areas for inclusion in the results chapters of this report.

Data Analysis and Review

Ethnographic Data

Subsequent to key respondent interview transcription and transcript review, ADF&G staff identified themes of information from broad categories (for example, seasonality of harvest and gear types) to more detailed information (for example, relationships between harvests and fall water levels), with sensitivity to important relationships within the data, such as the co-occurrences of particular themes. Information documented in the interviews was analyzed alongside the harvest survey data to identify convergences and divergences in the individual pictures each method presents. Access to harvest areas, gear types used, harvest and processing methods, local fisheries terminology, and influence of weather patterns on harvests are all better understood when experienced firsthand. In particular, participant observation helped reduce confusion resulting from language barriers, such as complex and often community-specific fish taxonomies.

Survey Data

Surveys were coded for data entry by research staff and reviewed by the project leads in each community for consistency. Responses were coded following standardized conventions used by the Division of Subsistence to facilitate data entry. Information Management staff within the Division of Subsistence set up database structures within Microsoft SQL Server at ADF&G in Anchorage to hold the survey data. The database structures included rules, constraints, and referential integrity to ensure that data were entered completely and accurately. Data entry screens were available on a secured internet site. Daily incremental backups of the database occurred, and transaction logs were backed up hourly. Full backups of the database occurred twice weekly. This ensured that no more than one hour of data entry would be lost in the unlikely event of a catastrophic failure. All survey data were entered twice and each set compared in order to minimize data entry errors.

---

21 . Product names are given because they are established standards for the State of Alaska or for scientific completeness; they do not constitute product endorsement. The application was developed by HDR, Inc., an environmental research firm located in Anchorage.

Once data were entered and confirmed, information was processed with the use of Statistical Package for the Social Sciences (SPSS) software, version 21. Initial processing included the performance of standardized logic checks of the data. Logic checks are often needed in complex data sets where rules, constraints, and referential integrity do not capture all of the possible inconsistencies that may appear. Harvest data collected as numbers of animals, or in gallons or buckets, were converted to pounds usable weight using standard factors (see Appendix C for conversion factors).

ADF&G staff also used SPSS for analyzing the survey information. Analyses included review of raw data frequencies, cross tabulations, table generation, estimation of population parameters, and calculation of confidence intervals for the estimates. Missing information was dealt with on a case-by-case basis according to standardized practices, such as minimal value substitution or using an averaged response for similarly-characterized households. Typically, missing data are an uncommon, randomly-occurring phenomenon in household surveys conducted by the division. In unusual cases where a substantial amount of survey information was missing, the household survey was treated as a "nonresponse" and not included in community estimates. ADF&G researchers documented all adjustments.

Harvest estimates and responses to all questions were calculated based upon the application of weighted means (Cochran 1977). These calculations are standard methods for extrapolating sampled data. As an example, the formula for harvest expansion is:

$$H_i = \overline{h}_i S_i \tag{1}$$

$$\overline{h}_i = \frac{h_i}{n_i} \tag{2}$$

where:

H_i = the total estimated harvest (numbers of resource or pounds) for the community i,

$\overline{h}_i$ = the mean harvest of returned surveys,

h_i = the total harvest reported in returned surveys,

n_i = the number of returned surveys, and

S_i = the number of households in a community.

As an interim step, the standard deviation (SD) (or variance [V], which is the SD squared) was also calculated with the raw, unexpanded data. The standard error (SE), or SD of the mean, was also calculated for each community. This was used to estimate the relative precision of the mean, or the likelihood that an unknown value would fall within a certain distance from the mean. In this study, the relative precision of the mean is shown in the tables as a confidence limit (CL), expressed as a percentage. Once SE was calculated, the CL was determined by multiplying the SE by a constant that reflected the level of significance desired, based on a normal distribution. The value of the constant is derived from student's *t* distribution and varies slightly depending upon the size of the community. Though there are numerous ways to express the formula below, it contains the components of a SD, V, and SE:

$$CL\%(\pm) = \frac{t_{(\alpha/2)} \times \frac{s}{\sqrt{n}} \times \sqrt{\frac{N-n}{N-1}}}{\bar{h}} \quad (3)$$

where:

s = sample standard deviation,

n = sample size,

$\bar{h}$ = mean harvest of returned surveys,

N = population size, and

$t_{\alpha/2}$ = student's t statistic for alpha level ($\alpha = 0.95$) with n–1 degrees of freedom.

Small CL percentages indicate that an estimate is likely to be very close to the actual mean of the sample. Larger percentages mean that estimates could be further from the mean of the sample.

The corrected final data from the household survey has been added to the Division of Subsistence Community Subsistence Information System (CSIS).[22] This publicly-accessible database includes community-level study findings and is available online.

Population Estimates and Other Demographic Information

Demographic information was collected for surveyed households in each study community. For this study, household eligibility was determined by permanent, "year-round" presence, defined as being domiciled in the community for at least six months during the study year 2017; such households were identified by Division of Subsistence researchers in consultation with LRAs, community officials, and other knowledgeable respondents. Because not all households were interviewed, population estimates for each community were calculated by multiplying the average household size of surveyed households by the total number of permanent households. The expanded data were used to describe average household characteristics in each community, and to calculate average per capita harvests.

There may be several reasons for the differences between population estimates for each community generated from division surveys and other demographic data developed by the 2010 federal census (U.S. Census Bureau 2011), the U.S. Census Bureau American Community Survey (U.S. Census Bureau n.d.), and the Alaska Department of Labor and Workforce Development (ADLWD n.d.). Sampling of households, (e.g., timing of surveys or eligibility criteria for inclusion) can usually explain differences in the population estimates. The most common deficiency in the demographic data collected for this project is the absence of ages for all household members. This was particularly problematic in large households where it was too time consuming or confusing for respondents to delineate the exact ages of children.

Map Data Entry and Analysis

As described above, maps were generated based on data collected using an iPad or 11x17-inch paper maps. All data were entered on the iPad in the field, whether during interviews or by ADF&G research staff while coding survey data. Map features were matched to the survey form to ensure that all harvest data were recorded accurately. Once all data were entered, an ArcGIS file geodatabase was downloaded by ADF&G

22. ADF&G CSIS.

researchers from the server and maps showing harvest locations for each species created in ArcGIS 10.2 using a standard template for reports. Maps were reviewed at a community review meeting to ensure accuracy as well identify any data the community would like to keep confidential.

Community Review Meetings

ADF&G staff presented survey findings and associated fishing maps at a meeting in each community. These meetings served as important opportunities to clarify confusing issues, confirm local terminology, and receive feedback to preliminary interpretations of the data. Table 1-2 shows the dates of community review meetings in each study community.

Final Report Organization

This report summarizes the results of systematic household surveys related to the harvest and use of nonsalmon fish during 2017; it includes information provided by key respondents as well as traditional council members and other residents at community approval and review meetings. Study results are organized by community. Each chapter includes tables and figures that report community demographics, harvest and use trends over time, and areas used for fishing. With regard to the 2017 harvest and use data, the content is consistent in each chapter because the data are based on the survey instrument; sections that rely on preexisting information, such as community background and historical harvest data vary in depth.

ADF&G provided a draft report to each traditional council and interested persons in each study community for review and comment. After receipt of comments, the report was finalized. ADF&G mailed a short (four-page) summary of the study findings to each household in the five study communities.

Plate 2-1.–Looking east towards the community of Scammon Bay, the Kun River, and the Bering Sea.

2. SCAMMON BAY

Christopher R. McDevitt

In the spring of 2018, three Division of Subsistence staff worked with four local research assistants to conduct nonsalmon subsistence harvest surveys with households in the community of Scammon Bay (Plate 2-1). Researchers surveyed 88 of 113 (67%) randomly selected households that spring (Table 1-7), and surveys took an average of 22 minutes (Table 1-8). The 2017 total estimated nonsalmon fish and marine invertebrate harvest for the community of Scammon Bay translated to about 126 lb per capita (Appendix D, Table D2-1).

In addition to the household surveys, ADF&G researchers conducted five key respondent interviews with seven lifelong Scammon Bay subsistence fishers. Key respondents shared their knowledge, experiences, comments, and concerns, and they provided researchers with invaluable information regarding subsistence activities associated with nonsalmon fish, including seasonal harvest patterns and changes in fishing over time. This information helped to contextualize the quantitative harvest and use data collected in the surveys.

Community Background

The community of Scammon Bay is located in western Alaska near the Bering Sea coast (Figure 1-1). It is situated slightly above sea level on the north side of the Askinuk Mountains approximately one mile upstream from the mouth of the 70-mile-long Kun River.[1] Nearby communities include Chevak and Hooper Bay, which lie to the south and southwest of the community, respectively, nearly 30 miles away. The Central Yup’ik word for the community is *Marayaaq* which translates to “mud” in English (Jacobson 2012:496).

1. Google Earth Pro V 7.3.2.5487. “Scammon Bay.” 61º50’11.72” N, 165º30’52.80” W. CNES/Airbus and Landsat/Copernicus. 2018. Accessed August 5, 2019.

Plate 2-2.–Looking east from the community of Scammon bay towards Castle Rocks. The Kusilvak Mountains are visible in the distance.

Historically, families who occupied this area were referred to as the *Marayaarmiut*, or “people of the little mudflats” (Himes-Cornell et al. 2013).[2]

The Askinuk Mountains provide the backdrop to this vibrant coastal community and extend roughly 32 miles from west to east. The far western end of the range terminates at the Bering Sea at Cape Romanzof, a promontory that includes the highest elevation within the range, nearly 2,300 feet. To the east, the range extends as far as Kingokakthluk Lake; at this point, the mountainous terrain abruptly stops and the expansive wetlands network of the Yukon-Kuskokwim Delta (YKD) begins. The Askinuk Mountains are the only area of the delta that experienced glaciation (Yukon Delta National Wildlife Refuge 1988). Beyond the mountains, the landscape is typical of the nearly 20 million acre YKD and includes subarctic tundra dominated by expansive wetlands networks amid a variety of dwarf shrubbery, sedges, and grasses.

Historical habitation in the area included over two dozen documented traditional seasonal camps all within close proximity to the community (Fienup-Riordan 1986). These sites were occupied by the *Asquinurmiut*, a group believed to be the ancestors of present-day Scammon Bay residents. According to one longtime resident, the area locally known as “Castle Rocks” or *Keggatmiut*, roughly two miles east of the community, was the site of one of these traditional camps (Plate 2-2).

> See Castle Rocks? It’s the oldest first establishment of where people lived, gathered there. It’s Castle Rocks that you saw over here. That was the main area, where they had lived a long time ago. (033018SCM01)

The camps were spread across a 196 square mile area known as the “Triangle.” The origin of the name is attributed to the orientation of the three primary seasonal settlements in the area, each of which represented one vertex of the “Triangle:” Scammon Bay to the north, Hooper Bay to the southwest, and Chevak to the southeast. Within and to the north of the “Triangle,” the *Asquinurmiut* engaged in the centuries-long conflict

2. C. McDevitt field notes, November 2016.

commonly referred to as the "Bow and Arrow Wars" with people from the lower Yukon River (Himes-Cornell et al. 2013).

Families began to settle in the current location of the community in the 1930s to avoid seasonal flooding as well as to be closer to commercial services such as a local trading post and church, the latter of which was established in 1932 (Ikuta et al. 2016). An elementary school was built in 1949 and a post office opened two years later. Scammon Bay was incorporated as a second-class city in 1967 and has undergone substantial infrastructural development over the course of the past several decades. Today, the community hosts a kindergarten–grade 12 school, grocery stores, a gas station, a health clinic, and a water treatment facility. Scammon Bay is also home to a local chapter of the nonprofit Coastal Villages Region Fund (CVRF), a Community Development Quota (CDQ) program established by the U.S. Magnuson-Stevens Fishery Conservation and Management Act. Local governance is provided through the Native Village of Scammon Bay Traditional Council and the City of Scammon Bay.

Seasonal Round

Scammon Bay fishers harvest nonsalmon resources year-round. Typically, certain months of the year are devoted to the search and harvest of specific nonsalmon resources. One elder explained that the seasonal round as it relates to fisher activity, nonsalmon species behavior, abundance, movement, and distribution was wholly dependent on the intensity of winter weather. According to the respondent, close and consistent observation of winter weather patterns remain a critical component in understanding nonsalmon fish behavior. As the elder explained at length through a translator:

> [Fish abundance] is always fluctuating, it always changes with the seasons, the year…peak here, high, low, lenient or scarce…it all depends on the season, year by year. The main thing is how much snow we have accumulated and how much water flows out. He's just stating, you know, it all depends on the water level too. If the water level's low, like the common fish we get…[we] rarely get 'em because of the water level. Versus when you get peak, high water, they're more abundant, they're more closer to shoreline. You know, it all fluctuates depending on the weather and water. That's the main thing through his experience. It all depends on the weather. And all the fish that come inland, from mainly the coast, from our area all the way up this area, it all depends on the wind. The part he's experienced, effects of the wind, how the fish will, how close to shore they will be. They're very sensitive to the wind during the winter, that's what he's stating. Along the coast, shoreline, waterways to their destination. It varies, how the wind blows through winter. Some certain winds, you know, that's blowing more, [people] are very thankful because they know after breakup, these species will be closer to shoreline versus another type of wind. Where they're sensitive…they have the tendency to swim further out to their destination. He says all the species…varies depending on our winter weather. And it, some certain weather, like in the winters, happening, and then spring breakup comes around, these species also make preparations for themselves. They eat more. You know, what they need they prepare themselves before we go out and get 'em. And they swim upstream to where they won't be affected so much by the weather and the water. I think that's why he tells you and I it depends year by year. From one generation to the next, it's the same thing. Weather affects all species. You know, if you had anticipating a bad summer, they [fish] already had prepared and they would be scarce to get along the coastline and inland. Because [the fish will find] other waterways where it's much calmer and settle around there for that time. And in some areas, some of them [fish] move away from their natural habitat. It all depends on the winter, how the wind's blowing. And you know, our elders foretell what the fishing season's going to be like. They know how the entire winter was, and they know what the summer season will be like for the water, for the fish, that will be around this [area]. (033018SCM01)

Plate 2-3.–Fishing through the ice for saffron cod on a beautiful spring day at Smith Point.

As spring approaches, warmer temperatures and increasing daylight offer more desirable fishing and traveling conditions. During this time, Scammon Bay fishers focus on rainbow smelt and saffron cod (locally known as "tomcod") that they harvest through the ice. "Smelting"[3] generally occurs directly in front of the community along the south bank of the Kun River. Saffron cod are harvested from the Bering Sea near Smith Point, approximately 12 miles west of the community (Plate 2-3).

Late February, March, and early April are also popular times for northern pike[4] fishing. Many families travel 30 to 40 miles northeast of the community to Black River near the base of the Kusilvak Mountains, where they jig or set nets through the ice for pike and other nonsalmon species such as burbot. Other fishers concentrate on pike and burbot fishing locations on the south side of the Askinuk Mountains, closer to the community (Plate 2-4).

Some fishers deploy under-ice nets during the late spring for various species of whitefish. As the ice recedes, residents harvest different varieties of marine invertebrates as well (Ikuta et al. 2016:27). Pacific herring[5] arrive in the Scammon Bay area in mid- to late May after the ice recedes in the Bering Sea. During this time, fishers harvest thousands of pounds of herring and hundreds of gallons herring roe in coastal waters near the community.

The summer months are typically devoted to salmon and Pacific halibut[6] fishing, the latter of which is a relatively new activity for Scammon Bay residents:

> For this species [halibut] at their age, the older did not know if these were available out here. Because back then—100, 80, 150 years, 200—we didn't have the proper

3. Local fishers commonly refer to smelt fishing as "smelting." C. McDevitt field notes, March 2017.
4. Hereinafter *pike*.
5. Hereinafter *herring*.
6. Hereinafter *halibut*.

Plate 2-4.–Pike fishing location at Black River on the southwest side of the Kusilvak Mountains.

> equipment to try and fish for these so they, it wasn't known until just recently that they were available out here, and we can get 'em. Yeah, I was one of the folks who catch one to bring home and have everyone go out and enjoy those. (033018SCM01)

The same fisher indicated that halibut fishing began to gain popularity among Scammon Bay fishers roughly 12 years ago.[7] During the summer months, fishers also deploy setnets for larger whitefish species such as broad and humpback whitefishes and sheefish.

Fishers continue to harvest various species of whitefish throughout the fall months prior to freeze-up. The same elder quoted above described nonsalmon fish fall migratory patterns and explained why the fall months were an optimal harvest time for a variety of nonsalmon fish. As one key respondent explained through a translator:

> Yeah, like all what he's stating, all this species, you know, migrate. The young, as they grow up along the coastline and ocean, but every fall they move back upstream to any stream, as far as the eyes can see. And during the summer season you can catch any one of these, all this. Yeah, saying that all these species here go out to feed. Just like you and I, we go to a restaurant or a place to eat, we're full enough and we go back. You know, these waterways that we fish, they return to in the fall. And he said in ginormous, big numbers. And he's saying that all this, it's the best to get 'em is in the fall time. (033018SCM01)

Fishers refocus their efforts on smelt and saffron cod during the fall time, too. Moving into winter, some fishers maintain under-ice nets for various nonsalmon fish species, and others deploy Alaska blackfish traps in nearby lake inlets and outlets.[8]

---

7. C. McDevitt field notes, March 2018. Confirmed by 111016SCM03.
8. See Ikuta et al. (2016) for a more detailed summary of the Scammon Bay seasonal round.

Population Estimates and Demographic Information

Surveys conducted in March of 2018 for the 2017 study year recorded demographic and nonsalmon fish harvest and use information from a sample of all Scammon Bay households that were residing in the community for at least six months of the study year. Surveyors attempted a census of all households and achieved a sample of 69% (Table 1-7); demographic data were expanded to estimate a total population for the community. Based on survey results, ADF&G estimated a total population of 576 individuals residing in 132 households in 2017 (Table 2-1, Figure 2-1). U.S. decennial census population counts increased from 115 people in 1960 to 474 people in 2010 (Figure 2-2). Historical census data for Scammon Bay indicated that the community experienced substantial population growth beginning in the middle part of the 20th century. The most significant growth occurred between 1970 and 1980, when the total population increased by 51%, from 166 to 250 residents.

The U.S. Census Bureau identified 96 households in Scammon Bay in the 2010 decennial census with a total population of 474 (Table 2-1; Figure 2-1). In 2016, the U.S. Census Bureau American Community Survey (ACS) estimated a five-year (2013–2017) average number of occupied households of 114 and a five-year average population of 537. Average household demographic characteristics were also calculated from the data, as shown in Table 2-2.[9] Scammon Bay is a predominantly Alaska Native community, primarily Central Yup'ik. According to 2017 estimates, Alaska Native people made up 98% of the population (Table 2-1; Figure 2-1).

In 2017, male residents outnumbered female residents by 17%, or 313 males to 263 females (Figure 2-3; Table D2-2). In regards to age cohorts, the male and female populations were proportional in some respects. For example, approximately 43% of males (133 individuals) fell with the 0–19 age range; the highest percentage (13% or 40 individuals) was in the 5–9 cohort. Similarly, the 0–19 age range contained 40% of female residents (105 individuals). Within this range, the greatest percentage (12%) of females fell in within the 0–4 age cohort. The majority of males and females fell within the 0–39 age range. This range included 197 males and 173 females, or 64% of the total population.

Table 2-1.–Population estimates, Scammon Bay, 2010, 2013–2017, and 2017.

	Census	5-year American Community Survey (2013–2017)		This study (2017)	
	(2010)	Estimate	Range[a]	Estimate	Range[b]
Total population					
Households	96	114.0	103 – 125	132.0	
Population	474	537.0	484 – 590	576.0	538 – 614
Alaska Native					
Population	472	533.0	480 – 586	565.1	525 – 605
Percentage	99.6%	99.3%	90.4% – 100.0%	98.1%	91.1% – 100.0%

Sources U.S. Census Bureau (2011) for 2010 estimate; U.S. Census Bureau for American Community Survey (ACS) 2017 estimate (5-year average); and ADF&G Division of Subsistence household surveys, 2018 for 2017 estimate.
Note Division of Subsistence household survey elegiblity requirements differ from those used by ACS.
a. ACS data range is the reported margin of error.
b. No range of households is estimated for division surveys.

9. Differences between population estimates and counts by the Division of Subsistence, U.S. Census Bureau decennial census, American Community Survey, and the Alaska Department of Labor and Workforce Development are likely due to differences in sample sizes and variations in methods of expansion from sampled to unsampled households. Different population estimates are considered to be significantly similar if one estimate falls within the range of error calculated for another estimate.

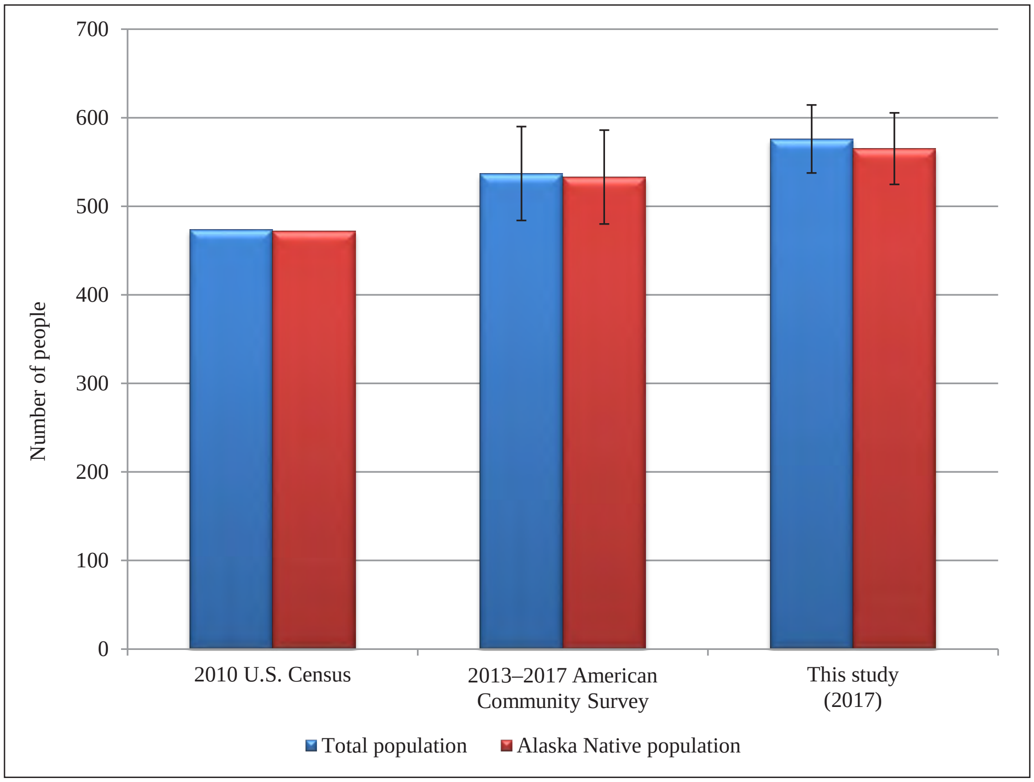


Figure 2-1.–Alaska Native and overall population estimates, Scammon Bay, 2010, 2013–2017, and 2017.

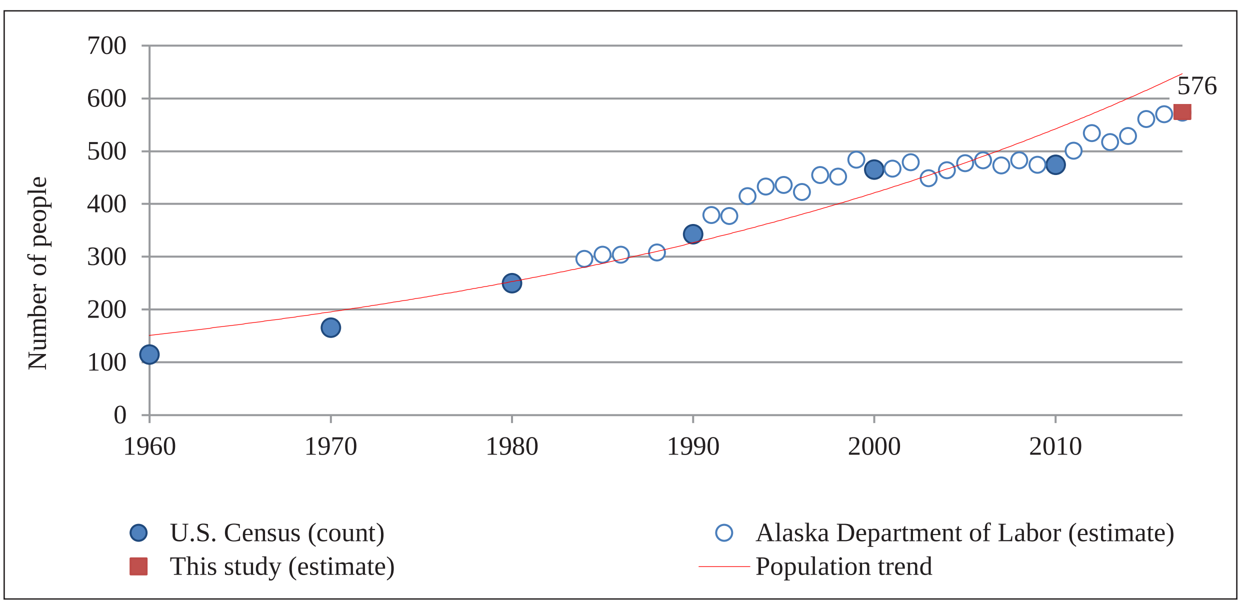


Figure 2-2.–Population estimates, Scammon Bay, 1960–2017.

Table 2-2.–Sample and demographic characteristics, Scammon Bay, 2017.

Characteristics	Community Scammon Bay
Sampled households	88
Eligible households	132
Percentage sampled	66.7%
Sampled population	384
Estimated community population	576.0
Household size	
Mean	4.4
Minimum	1.0
Maximum	12.0
Age	
Mean	23.8
Minimum[a]	0
Maximum	87
Median	21.0
Length of residency	
Total population	
Mean	20.5
Minimum[a]	0
Maximum	84
Heads of household	
Mean	37.4
Minimum[a]	2
Maximum	82
Alaska Native	
Estimated households[b]	
Number	125.9
Percentage	95.4%
Estimated population	
Number	565.1
Percentage	98.1%

Source ADF&G Division of Subsistence household surveys, 2018.

a. A minimum age of 0 (zero) is used for infants who are less than 1 year of age.

b. The estimated number of households in which at least 1 head of household is Alaska Native.

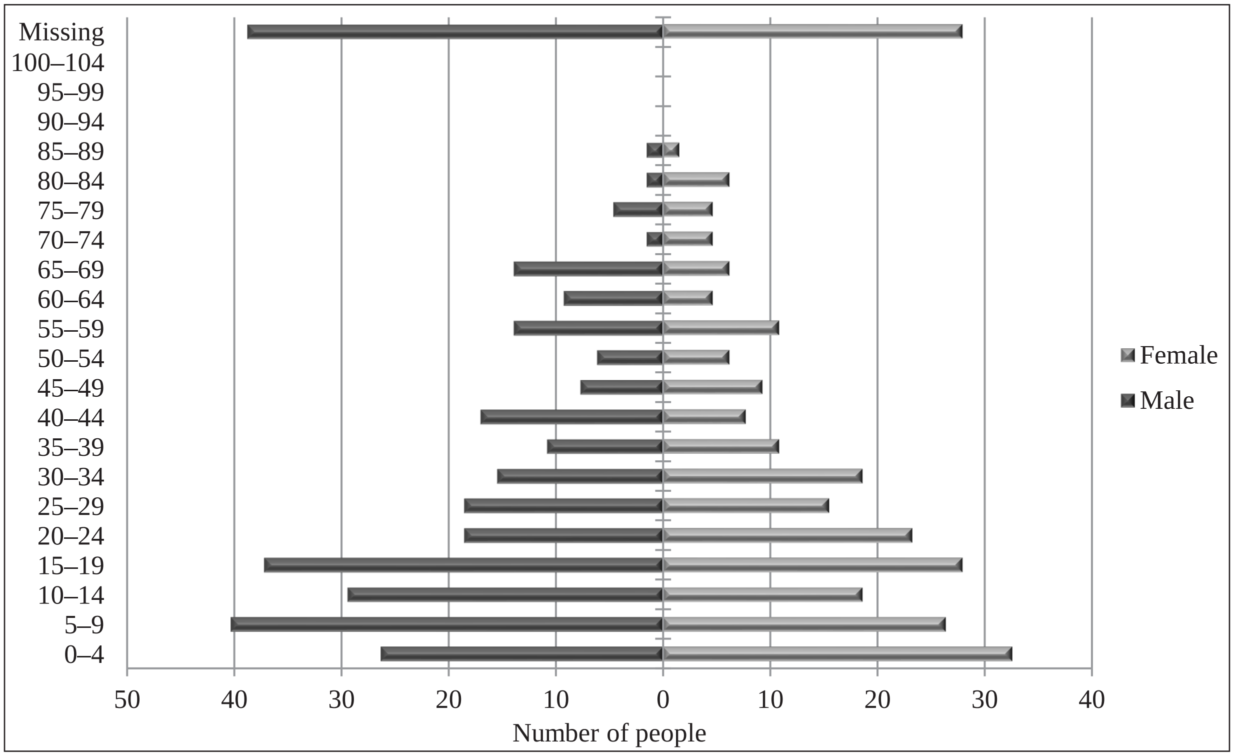


Figure 2-3.–Population profile, Scammon Bay, 2017.

About three-quarters of Scammon Bay household heads (74%) were born to parents living in the community or in the immediate vicinity (Table D2-3). The majority of remaining household heads identified their birthplace as one of nine other YKD communities, especially Hooper Bay; a small number of household heads were born in northwest Alaska or other parts of the United States. In terms of the total population, 81% of residents were born to parents who lived in the community (Table D2-4). As with household heads, the remaining population was born elsewhere in the YKD or other parts of the United States.

Summary of Harvest and Use Patterns

Harvest and Use of Nonsalmon Resources at the Household Level

Figure 2-4 shows the percentages of households that attempted to harvest, successfully harvested, and used nonsalmon fish and marine invertebrates in 2017. Nearly the entire community of Scammon Bay (99%) used nonsalmon resources in 2017. For the 91% of the community who attempted to harvest nonsalmon and marine invertebrate resources, all were successful in their efforts.

Table 2-3 summarizes nonsalmon fish and marine invertebrate harvest and use characteristics for Scammon Bay in 2017 at the household level. The average harvest was 549 pounds usable weight (lb) per household. Community households harvested an average of six different kinds of nonsalmon fish and marine invertebrate resources and used an average of nine kinds of resources. The maximum number of resources used by any household was 18. In addition, households gave away an average of three kinds of fish. Overall, at least 27 types of fish and marine invertebrates were used by Scammon Bay households (Table D2-5).

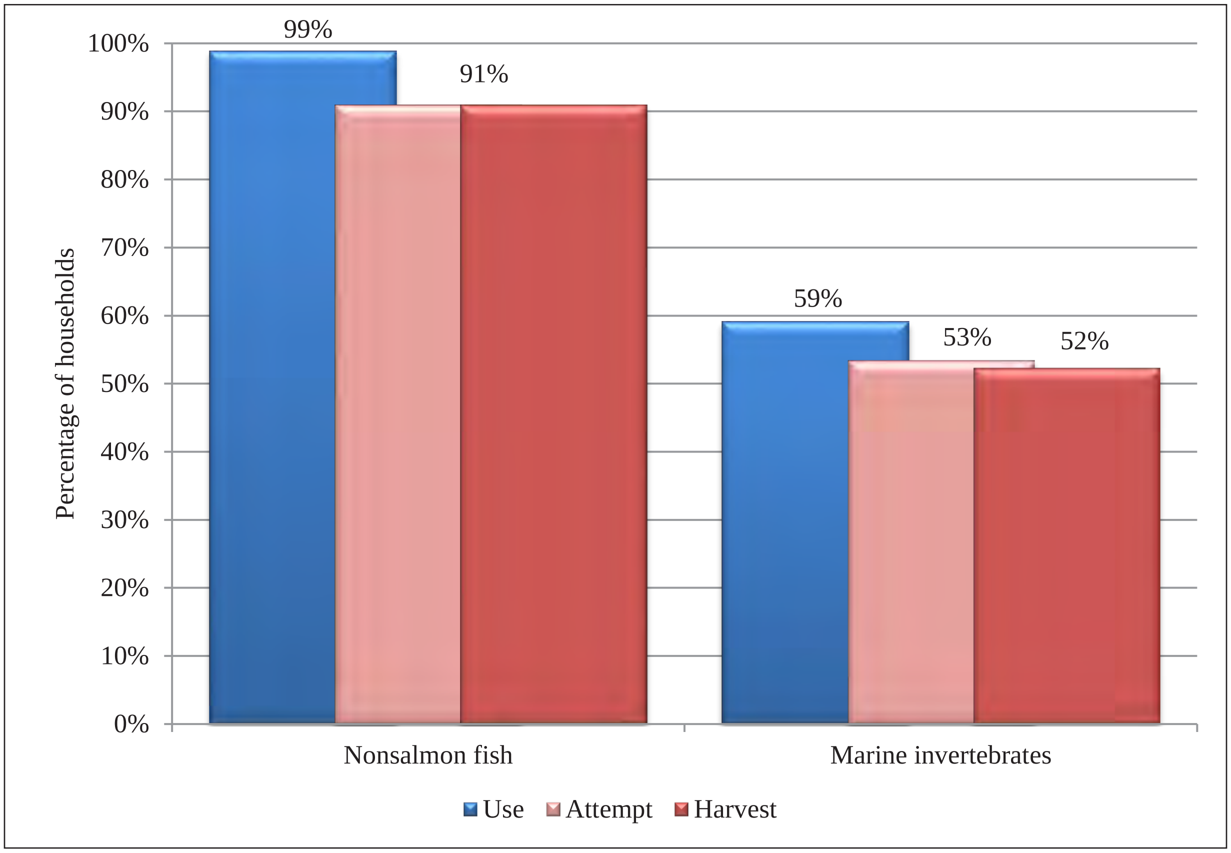


Figure 2-4.–Percentages of households using, attempting to harvest, and harvesting nonsalmon fish and marine invertebrates, Scammon Bay, 2017.

Harvest Quantities and Composition of Nonsalmon Fish

In 2018, surveyors recorded the nonsalmon fish and marine invertebrate resources harvested and used by members of responding households in 2017, and the data were expanded to estimate harvests and uses for the whole community. Table 2-4 lists the nonsalmon fish used by the highest percentages of households, and Figure 2-5 shows the species with the highest harvests during the study year. Scammon Bay residents used a wide variety of nonsalmon resources in 2017. According to one lifelong fisher, "there's a whole lot more to fishing in our culture than just the salmon. It's all species and each one is important" (110916SCM05). The top ten most used nonsalmon resources included three species of whitefish as well as several species of marine fish and one marine invertebrate (Table 2-4). The three most widely used resources were pike, Bering cisco, and rainbow smelt.[10]

Pike and herring each accounted for nearly one-quarter of the total nonsalmon fish and marine invertebrate harvest by usable weight (Figure 2-5). Other notable contributions came from smelt (11%), halibut (7%), and Bering cisco (7%). The remaining contributors included three additional whitefish species as well as lesser amounts of other nonsalmon fish species (Figure D3-1).

Table 2-5 reports estimated subsistence nonsalmon fish and marine invertebrate harvests and uses by Scammon Bay residents in 2017. All edible resources are presented in pounds usable weight (see Appendix C for conversion factors), and results are organized first by general category and then by species. The harvest column shows percentages of households in which any member of the surveyed household harvested a resource during the study year. The use column shows percentages of households that used a resource, including resources acquired from other harvesters or given away. Purchased foods are not included, but fish

10. Hereinafter *smelt*.

Table 2-3.–Nonsalmon fish and marine invertebrate harvest and use characteristics, Scammon Bay, 2017.

Characteristic	
Mean number of resources used per household	**8.9**
Minimum	0
Maximum	18
95% confidence limit (±)	5.8%
Median	8.5
Mean number of resources attempted to harvest per household	**6.1**
Minimum	0
Maximum	17
95% confidence limit (±)	8.9%
Median	5.0
Mean number of resources harvested per household	**5.9**
Minimum	0
Maximum	16
95% confidence limit (±)	8.9%
Median	5.0
Mean number of resources received per household	**3.5**
Minimum	0
Maximum	17
95% confidence limit (±)	12.5%
Median	3.0
Mean number of resources given away per household	**3.1**
Minimum	0
Maximum	15
95% confidence limit (±)	14.3%
Median	1.0
Household harvest (pounds)	
Minimum	0
Maximum	4,438
Mean	549.2
Median	289.1
Total harvest weight (lb)	72,496.2
Community per capita harvest (lb)	125.9
Percentage using any resource	99%
Percentage attempting to harvest any resource	91%
Percentage harvesting any resource	91%
Percentage receiving any resource	78%
Percentage giving away any resource	65%
Number of households in sample	88
Number of resources asked about and identified voluntarily by respondents	33

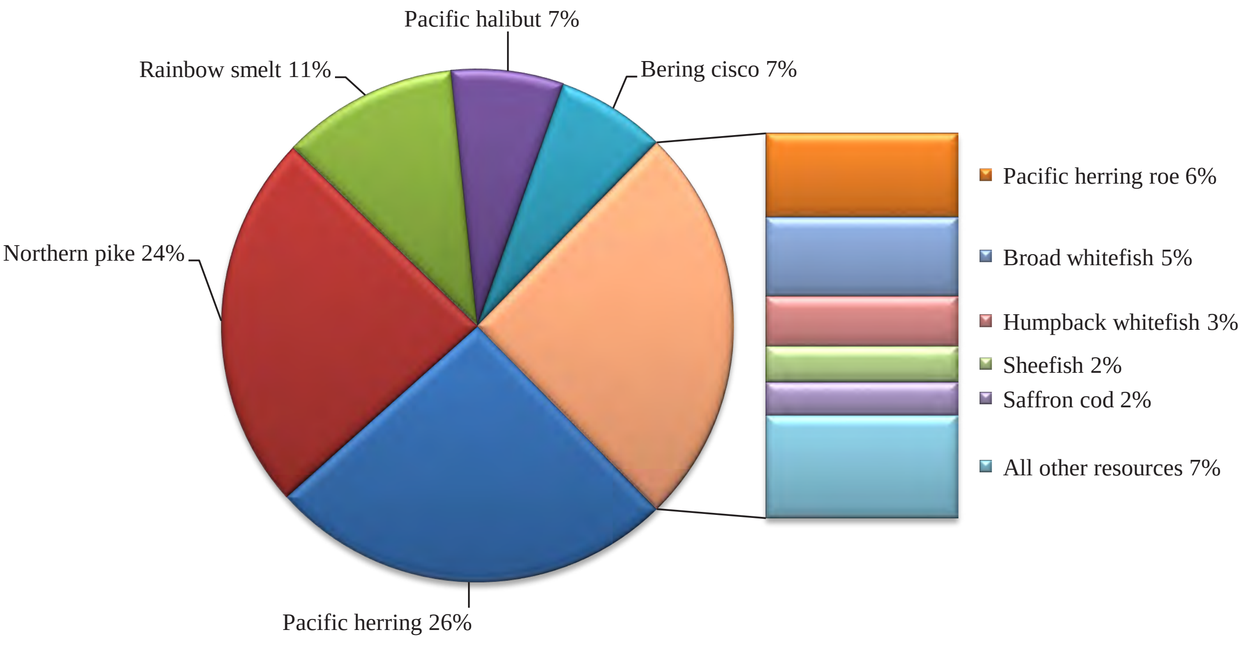
Source ADF&G Division of Subsistence household surveys, 2018.

Table 2-4.–Top ranked nonsalmon fish and marine invertebrates used by households, Scammon Bay, 2017.

Rank[a]	Resource	Percentage of households using
1.	Northern pike	73.9%
2.	Bering cisco	70.5%
3.	Rainbow smelt	67.0%
3.	Broad whitefish	67.0%
5.	Pacific herring	64.8%
6.	Humpback whitefish	63.6%
7.	Saffron cod	61.4%
8.	Pacific herring roe	56.8%
9.	Pacific halibut	55.7%
10.	Unknown mussels	48.3%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Resources used by the same percentage of households share the lowest rank value instead of having sequential



Note The "all other resources" category represents all species that contributed less than 1% to the total harvest.

Figure 2-5.–Top nonsalmon fish and marine invertebrates harvested by percentage of total harvest weight, Scammon Bay, 2017.

Table 2-5.–Estimated harvest and use of nonsalmon fish and marine invertebrates, Scammon Bay, 2017.

Resource	Percentage of households					Harvest weight (lb)			Harvest amount			95% confidence limit (±) harvest
	Using	Attempting harvest	Harvesting	Receiving	Giving away	Total	Mean per household	Per capita	Total	Unit	Mean per household	
All surveyed resources	**98.9**	**90.9**	**90.9**	**78.4**	**64.8**	**72,496.2**	**549.2**	**125.9**	**72,496.2**	**lb**	**549.2**	**15.8**
Nonsalmon fish	**98.9**	**90.9**	**90.9**	**77.3**	**63.6**	**71,144.0**	**539.0**	**123.5**	**71,144.0**	**lb**	**539.0**	**16.0**
Pacific herring	64.8	44.3	42.0	25.0	25.0	18,649.1	141.3	32.4	3,108.2	gal	23.5	40.6
Pacific herring roe	56.8	38.6	38.6	20.5	25.0	3,990.1	30.2	6.9	665.0	gal	5.0	26.7
Capelin (grunion)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	gal	0.0	0.0
Rainbow smelt	67.0	55.7	53.4	18.2	27.3	8,070.4	61.1	14.0	1,345.1	gal	10.2	53.5
Pacific (gray) cod	22.7	13.6	13.6	9.1	5.7	504.0	3.8	0.9	157.5	ind	1.2	37.9
Saffron cod	61.4	56.8	55.7	6.8	22.7	1,593.1	12.1	2.8	265.5	gal	2.0	19.4
Walleye pollock (whiting)	5.7	5.7	5.7	0.0	2.3	42.0	0.3	0.1	30.0	ind	0.2	58.1
Unknown flounders	3.4	2.3	2.3	1.1	0.0	38.0	0.3	0.1	34.5	ind	0.3	89.6
Pacific halibut	55.7	39.8	34.1	23.9	20.5	5,131.9	38.9	8.9	5,131.9	lb	38.9	24.7
Unknown sculpins	8.0	5.7	5.7	2.3	1.1	36.0	0.3	0.1	36.0	ind	0.3	53.0
Sticklebacks (needlefish)	2.3	1.1	1.1	2.3	0.0	180.0	1.4	0.3	30.0	gal	0.2	114.8
Alaska blackfish	43.2	17.0	15.9	29.1	7.0	1,334.6	10.1	2.3	222.4	gal	1.7	49.9
Burbot	38.6	19.3	17.0	23.9	9.1	786.8	6.0	1.4	187.3	ind	1.4	42.3
Unknown chars	3.4	3.4	3.4	0.0	0.0	113.9	0.9	0.2	34.5	ind	0.3	71.5
Arctic grayling	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Northern pike	73.9	56.8	55.7	20.5	33.0	17,270.6	130.8	30.0	5,233.5	ind	39.6	17.1
Sheefish	39.8	22.7	22.7	20.5	8.0	1,713.1	13.0	3.0	311.5	ind	2.4	34.9
Broad whitefish	67.0	40.9	39.8	38.6	25.0	3,797.9	28.8	6.6	949.5	ind	7.2	23.0
Bering cisco	70.5	38.6	38.6	37.5	26.1	4,998.9	37.9	8.7	3,570.6	ind	27.1	27.6
Least cisco	17.0	9.1	9.1	9.1	8.0	315.7	2.4	0.5	451.1	ind	3.4	43.9
Humpback whitefish	63.6	35.2	35.2	34.1	22.7	2,379.0	18.0	4.1	1,359.4	ind	10.3	26.4
Round whitefish	10.2	5.7	5.7	6.8	5.7	185.6	1.4	0.3	185.6	ind	1.4	52.7
Unknown whitefishes	3.4	1.1	1.1	2.3	0.0	13.4	0.1	0.0	7.5	ind	0.1	114.8
Unknown nonsalmon fish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Marine invertebrates	**59.1**	**53.4**	**52.3**	**11.4**	**22.7**	**1,352.2**	**10.2**	**2.3**	**1,352.2**	**lb**	**10.2**	**21.9**
Chitons (bidarkis, gumboots)	1.1	1.1	1.1	0.0	0.0	4.5	0.0	0.0	1.5	gal	0.0	114.8
Butter clams	12.5	11.4	11.4	2.3	6.8	168.0	1.3	0.3	56.0	gal	0.4	40.5

-continued-

Table 2-5.–Continued.

Resource	Percentage of households: Using	Attempting harvest	Harvesting	Receiving	Giving away	Harvest weight (lb): Total	Mean per household	Per capita	Harvest amount: Total	Unit	Mean per household	95% confidence limit (±) harvest
Marine invertebrates, continued												
Razor clams	4.5	2.3	2.3	2.3	1.1	49.5	0.4	0.1	16.5	gal	0.1	88.8
Unknown clams	27.3	23.9	22.7	4.5	6.8	514.3	3.9	0.9	171.4	gal	1.3	35.2
Unknown cockles	13.6	11.4	11.4	3.4	5.7	312.8	2.4	0.5	104.3	gal	0.8	51.2
Red king crab	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Unknown mussels	48.3	42.5	42.5	6.9	16.1	279.9	2.1	0.5	186.6	gal	1.4	22.1
Shrimps	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	gal	0.0	0.0
Unknown marine invertebrates	4.5	2.3	2.3	2.3	0.0	23.2	0.2	0.0	9.2	gal	0.1	112.4

Source ADF&G Division of Subsistence household surveys, 2018.

Note Resources where the percentage using is greater than the combined received and harvest indicate use from resources obtained during a previous year.

retained from commercial fishing are included, whether they were the target species or caught incidentally. Differences between harvest and use percentages reflect sharing among households, which results in a wider distribution of wild foods.

Almost half of the total 2017 nonsalmon resource harvest was composed of two nonsalmon fish species: Pacific herring[11] and pike. Combined, the two species provided nearly 18 tons of food to the community (Table 2-5).

Approximately 65% of the community used herring in 2017. Forty-four percent of households attempted to harvest herring, and 42% were successful in their efforts. In all, Scammon Bay fishers harvested 18,649 lb of herring in 2017. This equated to 141 lb per household. All herring were harvested through the use of set gillnets (Figure 2-6; Table 2-6). One elder described the physical differences between early and late run herring: "The first bunch that comes in is bigger herring, they fat. Those are the ones we don't hardly dry 'cause they hard to dry up. But the second one comes in is skinnier, it dry up fast" (111016SCM04).

In addition to the herring harvest, fishers collected 665 gallons (3,990 lb) of herring roe (Table 2-5). Approximately 57% of the community used herring roe in 2017. All of the 39% of households that attempted to collect herring roe were successful in their efforts. Roe was both gathered from kelp as well as removed from harvested herring (Figure 2-6; Table 2-6).[12]

Nearly three quarters of the community used pike in 2017. Fifty-seven percent of households attempted to harvest pike, and 56% were successful in their efforts. Over 17,000 lb of pike were harvested in 2017, which equated to 131 lb per household. The vast majority of pike (99%) was harvested through the use of hook and line through the ice (Figure 2-6; tables 2-6 and 2-7; Plate 2-5).

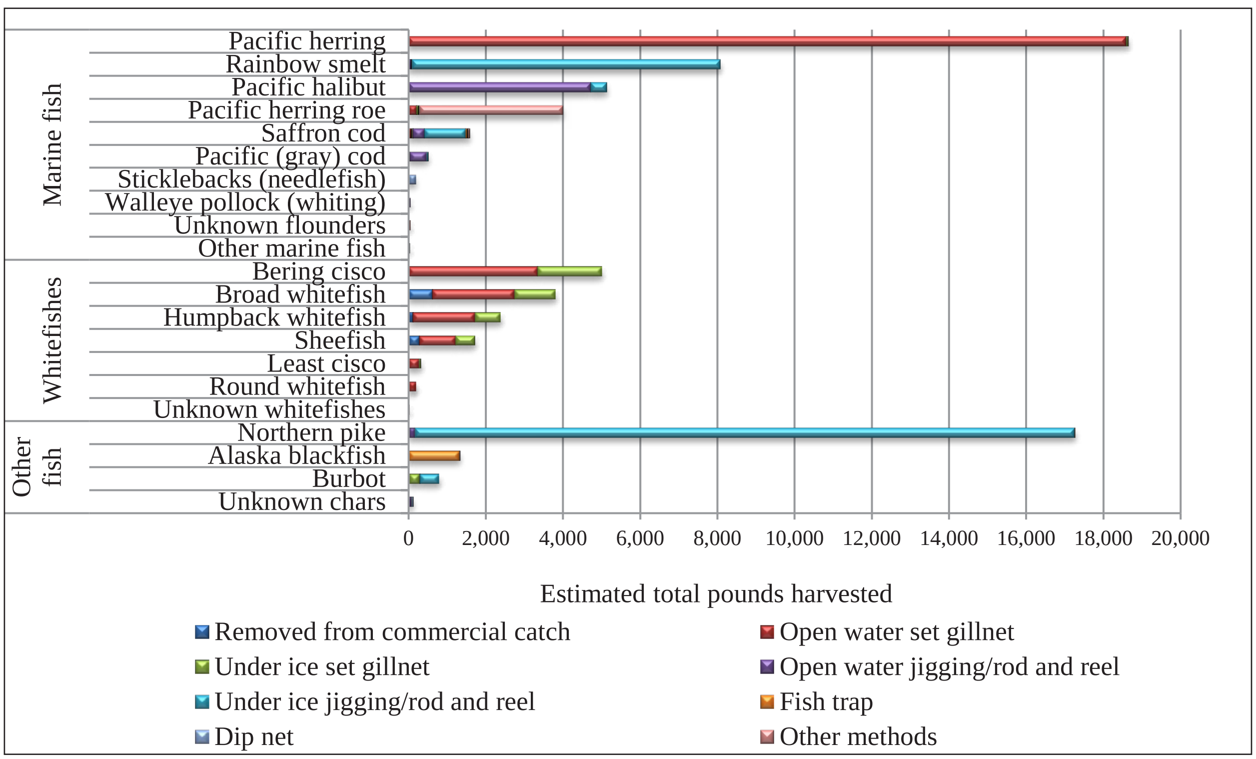


Figure 2-6.–Estimated harvest of nonsalmon fish by gear type, Scammon Bay, 2017.

11. Hereinafter *herring*.

12. C. McDevitt field notes March 2017 and March 2018.

Table 2-6.–Estimated harvest of nonsalmon fish by gear type, Scammon Bay, 2017.

		Removed from commercial catch		Subsistence methods: Open water set gillnet		Under ice set gillnet		Open water jigging/ rod and reel		Under ice jigging/ rod and reel		Fish trap		Dip net		Other method		Subsistence gear, any method		Any method	
Resource	Units	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds
Nonsalmon fish			**1,017.4**		**27,409.8**		**4,415.4**		**5,782.0**		**27,101.4**		**1,394.9**		**229.5**		**3,793.6**		**70,126.6**		**71,144.0**
Pacific herring	gal	0.0	0.0	3,097.7	18,586.1	9.0	54.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	9.0	3,108.2	18,649.1	3,108.2	18,649.1
Pacific herring roe	gal	0.0	0.0	35.0	210.0	12.0	72.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	618.0	3,708.1	665.0	3,990.1	665.0	3,990.1
Capelin (grunion)	gal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rainbow smelt	gal	0.0	0.0	0.0	0.0	0.0	0.0	13.9	83.5	1,331.1	7,986.9	0.0	0.0	0.0	0.0	0.0	0.0	1,345.1	8,070.4	1,345.1	8,070.4
Pacific (gray) cod	ind	0.0	0.0	0.0	0.0	9.0	28.8	133.5	427.2	15.0	48.0	0.0	0.0	0.0	0.0	0.0	0.0	157.5	504.0	157.5	504.0
Saffron cod	gal	0.0	0.0	14.0	84.0	5.3	31.5	47.9	287.7	178.8	1,072.9	10.5	63.0	0.0	0.0	9.0	54.0	265.5	1,593.1	265.5	1,593.1
Walleye pollock (whiting)	ind	0.0	0.0	0.0	0.0	3.0	4.2	27.0	37.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.0	42.0	30.0	42.0
Unknown flounders	ind	0.0	0.0	34.5	38.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.5	38.0	34.5	38.0
Pacific halibut	lb	0.0	0.0	0.0	0.0	0.0	0.0	4,720.4	4,720.4	411.5	411.5	0.0	0.0	0.0	0.0	0.0	0.0	5,131.9	5,131.9	5,131.9	5,131.9
Unknown sculpins	ind	0.0	0.0	18.0	18.0	9.0	9.0	0.0	0.0	9.0	9.0	0.0	0.0	0.0	0.0	0.0	0.0	36.0	36.0	36.0	36.0
Sticklebacks (needlefish)	gal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.0	180.0	0.0	0.0	30.0	180.0	30.0	180.0
Alaska blackfish	gal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	218.7	1,312.1	0.0	0.0	3.8	22.5	222.4	1,334.6	222.4	1,334.6
Burbot	ind	0.0	0.0	3.0	12.6	64.5	270.9	3.0	12.6	116.8	490.7	0.0	0.0	0.0	0.0	0.0	0.0	187.3	786.8	187.3	786.8
Unknown chars	ind	0.0	0.0	0.0	0.0	0.0	0.0	19.5	64.4	0.0	0.0	0.0	0.0	15.0	49.5	0.0	0.0	34.5	113.9	34.5	113.9
Arctic grayling	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Northern pike	ind	0.0	0.0	6.0	19.8	0.0	0.0	45.0	148.5	5,176.5	17,082.5	6.0	19.8	0.0	0.0	0.0	0.0	5,233.5	17,270.6	5,233.5	17,270.6
Sheefish	ind	51.0	280.5	169.9	934.6	90.5	498.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	260.5	1,432.6	311.5	1,713.1
Broad whitefish	ind	156.0	624.0	527.2	2,108.9	266.3	1,065.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	793.5	3,173.9	949.5	3,797.9
Bering cisco	ind	0.0	0.0	2,382.4	3,335.4	1,188.2	1,663.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3,570.6	4,998.9	3,570.6	4,998.9
Least cisco	ind	0.0	0.0	376.1	263.2	75.0	52.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	451.1	315.7	451.1	315.7
Humpback whitefish	ind	64.5	112.9	914.4	1,600.1	380.6	666.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,294.9	2,266.1	1,359.4	2,379.0
Round whitefish	ind	0.0	0.0	185.6	185.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	185.6	185.6	185.6	185.6
Unknown whitefishes	ind	0.0	0.0	7.5	13.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.5	13.4	7.5	13.4
Unknown nonsalmon fish	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source ADF&G Division of Subsistence household surveys, 2018.

a. The harvested number of each resource is measured by the unit in which the resource harvest information was collected; the unit of measurement is provided for each resource.

Table 2-7.–Estimated percentages of nonsalmon fish harvest weight by gear type, Scammon Bay, 2017.

Resource	Percentage base	Removed from commercial catch	Subsistence methods: Open water set gillnet	Under ice set gillnet	Open water jigging/rod and reel	Under ice jigging/rod and reel	Fish trap	Dip net	Other method	Subsistence gear, any method	Any method
Nonsalmon fish	**Gear type**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
	Resource	**1.4%**	**38.5%**	**6.2%**	**8.1%**	**38.1%**	**2.0%**	**0.3%**	**5.3%**	**98.6%**	**100.0%**
	Total	**1.4%**	**38.5%**	**6.2%**	**8.1%**	**38.1%**	**2.0%**	**0.3%**	**5.3%**	**98.6%**	**100.0%**
Pacific herring	Gear type	0.0%	67.8%	1.2%	0.0%	0.0%	0.0%	0.0%	0.2%	26.6%	26.2%
	Resource	0.0%	99.7%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	26.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	26.2%	26.2%
Pacific herring roe	Gear type	0.0%	0.8%	1.6%	0.0%	0.0%	0.0%	0.0%	97.7%	5.7%	5.6%
	Resource	0.0%	5.3%	1.8%	0.0%	0.0%	0.0%	0.0%	92.9%	100.0%	100.0%
	Total	0.0%	0.3%	0.1%	0.0%	0.0%	0.0%	0.0%	5.2%	5.6%	5.6%
Capelin (grunion)	Gear type	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Resource	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Rainbow smelt	Gear type	0.0%	0.0%	0.0%	1.4%	29.5%	0.0%	0.0%	0.0%	11.5%	11.3%
	Resource	0.0%	0.0%	0.0%	1.0%	99.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.1%	11.2%	0.0%	0.0%	0.0%	11.3%	11.3%
Pacific (gray) cod	Gear type	0.0%	0.0%	0.7%	7.4%	0.2%	0.0%	0.0%	0.0%	0.7%	0.7%
	Resource	0.0%	0.0%	5.7%	84.8%	9.5%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.6%	0.1%	0.0%	0.0%	0.0%	0.7%	0.7%
Saffron cod	Gear type	0.0%	0.3%	0.7%	5.0%	4.0%	4.5%	0.0%	1.4%	2.3%	2.2%
	Resource	0.0%	5.3%	2.0%	18.1%	67.3%	4.0%	0.0%	3.4%	100.0%	100.0%
	Total	0.0%	0.1%	0.0%	0.4%	1.5%	0.1%	0.0%	0.1%	2.2%	2.2%
Walleye pollock (whiting)	Gear type	0.0%	0.0%	0.1%	0.7%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
	Resource	0.0%	0.0%	10.0%	90.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
Unknown flounders	Gear type	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
	Resource	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
Pacific halibut	Gear type	0.0%	0.0%	0.0%	81.6%	1.5%	0.0%	0.0%	0.0%	7.3%	7.2%
	Resource	0.0%	0.0%	0.0%	92.0%	8.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	6.6%	0.6%	0.0%	0.0%	0.0%	7.2%	7.2%
Unknown sculpins	Gear type	0.0%	0.1%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
	Resource	0.0%	50.0%	25.0%	0.0%	25.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
Sticklebacks (needlefish)	Gear type	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	78.4%	0.0%	0.3%	0.3%
	Resource	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.3%	0.3%

-continued-

Table 2-7.–Continued.

Resource	Percentage base	Removed from commercial catch	Subsistence methods: Open water set gillnet	Under ice set gillnet	Open water jigging/rod and reel	Under ice jigging/rod and reel	Fish trap	Dip net	Other method	Subsistence gear, any method	Any method
Alaska blackfish	Gear type	0.0%	0.0%	0.0%	0.0%	0.0%	94.1%	0.0%	0.6%	1.9%	1.9%
	Resource	0.0%	0.0%	0.0%	0.0%	0.0%	98.3%	0.0%	1.7%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	1.8%	0.0%	0.0%	1.9%	1.9%
Burbot	Gear type	0.0%	0.0%	6.1%	0.2%	1.8%	0.0%	0.0%	0.0%	1.1%	1.1%
	Resource	0.0%	1.6%	34.4%	1.6%	62.4%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.4%	0.0%	0.7%	0.0%	0.0%	0.0%	1.1%	1.1%
Unknown chars	Gear type	0.0%	0.0%	0.0%	1.1%	0.0%	0.0%	21.6%	0.0%	0.2%	0.2%
	Resource	0.0%	0.0%	0.0%	56.5%	0.0%	0.0%	43.5%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%	0.0%	0.2%	0.2%
Arctic grayling	Gear type	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Resource	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Northern pike	Gear type	0.0%	0.1%	0.0%	2.6%	63.0%	1.4%	0.0%	0.0%	24.6%	24.3%
	Resource	0.0%	0.1%	0.0%	0.9%	98.9%	0.1%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.2%	24.0%	0.0%	0.0%	0.0%	24.3%	24.3%
Sheefish	Gear type	27.6%	3.4%	11.3%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	2.4%
	Resource	16.4%	54.6%	29.1%	0.0%	0.0%	0.0%	0.0%	0.0%	83.6%	100.0%
	Total	0.4%	1.3%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	2.4%
Broad whitefish	Gear type	61.3%	7.7%	24.1%	0.0%	0.0%	0.0%	0.0%	0.0%	4.5%	5.3%
	Resource	16.4%	55.5%	28.0%	0.0%	0.0%	0.0%	0.0%	0.0%	83.6%	100.0%
	Total	0.9%	3.0%	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	4.5%	5.3%
Bering cisco	Gear type	0.0%	12.2%	37.7%	0.0%	0.0%	0.0%	0.0%	0.0%	7.1%	7.0%
	Resource	0.0%	66.7%	33.3%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	4.7%	2.3%	0.0%	0.0%	0.0%	0.0%	0.0%	7.0%	7.0%
Least cisco	Gear type	0.0%	1.0%	1.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	0.4%
	Resource	0.0%	83.4%	16.6%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.4%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.4%
Humpback whitefish	Gear type	11.1%	5.8%	15.1%	0.0%	0.0%	0.0%	0.0%	0.0%	3.2%	3.3%
	Resource	4.7%	67.3%	28.0%	0.0%	0.0%	0.0%	0.0%	0.0%	95.3%	100.0%
	Total	0.2%	2.2%	0.9%	0.0%	0.0%	0.0%	0.0%	0.0%	3.2%	3.3%
Round whitefish	Gear type	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.3%
	Resource	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.3%
Unknown whitefishes	Gear type	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Resource	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Unknown nonsalmon fish	Gear type	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Resource	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

Plate 2-5.–Typical pike bait includes a large treble-hooked spoon tipped with live bait, such as blackfish, and a piece of brightly colored surveyor tape that acts as a visual attractant.

Rod and reel and set gillnets in open water were used for the remaining pike harvest. One respondent explained that high pike abundance in the Scammon Bay area may be attributed to the fish's behavior and diet.

> There's a whole bunch, lot of pikes. I know how carnivorous they are. They're wolves in the water. So, I don't know where they congregate, but their numbers are pretty high…my family, her family [respondent's wife] goes crazy for pikes. There was so many last year that they even gave us three or four sacks. (111016SCM02)

Another fisher shared observations about the growing population and size of pike:

> Okay, from my life's experience, there was not so abundant [pike]. Now today at the present moment they're more, more spread out. And they're much bigger. Now they're just growing, expanding. (033018SCM01)

Another elder explained that "We never used to see pike fish around. Now they start coming. I don't [know] where they come from" (111016SCM03).

One elder explained that the Central Yup'ik name for pike, *cuukvak*, referred to the structure of the fish's head. The elder also reiterated the ferocity of pike. As explained through the translator:

> It's because of their elongated mouth. And they, compared to the other water species we get, fish, so they named it because of the mouth and its features. It's huge and bigger. It has a little more teeth. And these are the dominant species. They go after all kinds of fish, mice, muskrats, anything that moves, it would… These go after anything small that's potential to eat even. And in the spring time, early summer when the little ducks or birds are swimming, they go after them. He saying the bigger species will eat muskrats. Bigger game. (033018SCM01)

Plate 2-6.–Spring smelt fishing on the south bank of the Kun River.

Another fisher shared similar thoughts regarding the indiscriminate feeding behaviors of pike and explained that anything smelly attracts these fish: "Pike will eat anything…Get a piece of beaver skin, beaver pelt, you cut a chunk off, spray a little WD-40, they gonna bite it" (110916SCM05).

Scammon Bay fishers harvested over four tons of smelt in 2017 (Table 2-5). The harvest equated to 61 lb per household. Approximately 67% of the community used smelt during the study year. More than half of households (56%) attempted to harvest smelt, and most (53%) were successful in their efforts. The vast majority of smelt (99%) were harvested through the use of hook and line through the ice, and far fewer harvests were made by fishers who used rod and reel in open water (Figure 2-6; tables 2-6 and 2-7; Plate 2-6).

Over 5,000 lb of halibut were harvested by fishers in 2017 (Table 2-5). The harvest equated to 39 lb per household. Over one-half of the community used halibut, 40% attempted to harvest halibut, and 34% were successful in their efforts. All halibut were harvested using rod and reel in open water (Figure 2-6; tables 2-6 and 2-7). Fishing for halibut can be more difficult than fishing for other nonsalmon species, as one fisher explained. "It takes a little bit more effort…gotta have gas to go get halibut. Get out to the good halibut grounds. And then once you get there it's a gamble, you know. Be there all day and get one nibble" (110916SCM05).

Scammon Bay fishers also harvested large amounts of several different whitefish species during the study year. Harvested whitefish species included Bering cisco (*imarpinraq*), broad whitefish (*qaurtuq* or *akakiik*), humpback whitefish (*cingikeggliq*), and sheefish (*ciiq*). According to an elder, whitefish have always been an important nonsalmon resource for local people. He explained that whitefish abundance and distribution was highly dependent on a number of environmental factors that directly impacted harvest opportunities. As told through a translator:

> All this are abundant but they vary with the seasons. You know, fall, spring, summer. In some certain years when there's not enough water, sometime…what he's stating is that our elders…sustained on this. Sometimes they go, they move around before they get to where they want to fish. Sometime we go set net and get the tail end of the fish. Because they're due to low water level. When the water level's higher, they stay a lot longer. So it varies depending on the snow condition and water, water level. (033018SCM01)

Fishers harvested nearly 5,000 lb of Bering cisco in 2017, which equated to 38 lb per household. Approximately 71% of the community used Bering cisco during the study year, and the same percentage of households that attempted to harvest the species (39%) were also successful in their efforts. All Bering cisco were harvested with set gillnets under the ice and in open water (Figure 2-6; tables 2-6 and 2-7). One elder explained through a translator that he had harvested abnormally large Bering cisco in the past.

> What he's stating, you see, we see this photo [of Bering cisco], all we think of is they're small; in between the smallest and the large. This is the first time I hear, just like you. Same species of *imarpinraq* can grow even to about the size of a sheefish. He said it's very rare to get 'em. But they can grow to [be] huge. (033018SCM01)

Scammon bay fishers also harvested close to two tons of broad whitefish in 2017 (Table 2-5). This equated to nearly 30 lb per household. Two-thirds of the community used broad whitefish during the study year. Forty-one percent of households attempted to harvest broad whitefish, and 40% were successful. The majority of broad whitefish were harvested with set gillnets set under the ice or in open water, although some broad whitefish were retained from commercial catches. One key respondent described the behavior and distribution of large broad whitefish, also known as *akakiik.*

> Akakiik. "The one that rolls." When there's peak water in these vicinities here—especially when the flooding from the Yukon, along the tributaries—there's this, there's rivers here that overflows to these, since, you know, the small shallow streams they can't swim out, they roll out. This bigger broad [white] fish. They can't—since they're the biggest, the whitefish—they can't swim like these normally do, these. It's too shallow, they roll. (033018SCM01)

This elder provided additional details about broad whitefish behavior.

> This species, you know, they go upstream to spawn, and they're, he's telling me, that they're very protective [of their young] compared to salmon, other species that go spawn and die. These go spawn and they live on. And that's why they grow bigger. They're very protective of their own fish…If it hasn't been high water enough, they're still [in this lake] til there's peak water and they're able to—you know, there's a stream—they'll be able to [swim out]. That's the reason why these grow so ginormous. (033018SCM01)

Fishers harvested 2,379 lb of humpback whitefish (*cingikeeeliq*) in 2017 (Table 2-5). The harvest equated to 18 lb per household. An estimated 64% of the community used humpback whitefish, and all households (35%) that attempted to harvest the species were successful. With the exception of a small amount of humpback whitefish that were retained from commercial salmon harvests, all humpback whitefish were harvested with set gillnets used in open water or through the ice (Figure 2-6; tables 2-6 and 2-7). One lifelong fisher talked about humpback whitefish distribution as it related to the fish's diet. He also discussed the importance of being observant.

> And when we go in July, I do notice that when we gut 'em, they're eating, something's up there spawning because I always see these little, little tiny eggs in their stomach. Something's spawning. And those things I pay a lot of close attention to. What are they eating, why do they go here. And I know a lot of people take note of stuff like that. And I find it interesting because it helps me be a better provider for my family. (110916SCM05)

Over 1,700 lb of sheefish were harvested in 2017, which equated to 13 lb per household (Table 2-5). Approximately 40% of the community used sheefish during the study year, and all who attempted to harvest sheefish were successful in their efforts. Except for a small amount of sheefish that were retained from commercial salmon fishing, sheefish were harvested with set gillnets used in open water or through the ice (Figure 2-6; tables 2-6 and 2-7). One elder shared an observation about sheefish anatomy and behavior. As explained through a translator: "He say these fish don't have teeth…when they cut 'em up they observe that the intestine, stomach, has sand to help grind up the food. They eat anything" (033018SCM01).

The same elder described how sheefish abundance and distribution has changed since he was young.

> As he was growing up this specie[s] wasn't dominant. It was hard to get, there were just a few. And over his lifetime this species has become dominant all over. He's caught just about everywhere: on the coastline, inland, and along the Yukon. At an early age, as far as he can remember, this species was rare to get. But now they've just become more. (033018SCM01)

Another fisher shared similar sentiments.

Plate 2-7.–Scammon Bay fisher snagging saffron cod (locally known as “tomcod”) at Smith Point with homemade fishing gear. The carriage bolt or “rod” is visible in the fisher’s right hand.

> And more and more I’m starting to see, and they’re smaller in size, the juvenile sheefish, in our nets in the fall. And then after a while they sort of fizzle out. But we’re definitely getting more and more of them over on the other side there. They were very rare at some point, but we’re getting more. (110916SCM05)

In addition to the nonsalmon fish species mentioned above, Scammon Bay fishers also harvested large amounts of saffron cod. During the study year, fishers harvested close to 1,600 lb of saffron cod, which translated to 12 lb per household (Table 2-5). Over 60% of the community used saffron cod and nearly the same percentage of households that attempted to harvest the species were also successful in doing so. Fishers employed several different gear types to harvest saffron cod. These included open water and under-ice set gillnets, rod and reel in open water, and hook and line through the ice (Figure 2-6; tables 2-6 and 2-7).

During participant observation, the author witnessed one fisher employ an interesting method for catching saffron cod.[13] The technique involved the use of a four-inch galvanized carriage bolt that had several feet of monofilament fishing line attached. On the opposite end of the line, the fisher affixed a heavily weighted trebled snagging hook. Several inches above the hook, the fisher attached a small, zinc-plated hardware nut; he explained that this acted as a visual attractant for the fish. The fisher then laid down on the ice, peered down into the hole, and used his parka hood to block out residual sunlight from entering the hole. This position, he explained, enabled him to clearly see the fish as they swam up to inspect the hardware nut. At the moment the curious fish came close enough to the nut, the fisher quickly pulled up the line and snagged the unsuspecting saffron cod, which he then extracted from the hole, removed from the hook, and set aside on the sea ice (Plate 2-7).

13. C. McDevitt field notes, March 2017.

The 2017 Alaska blackfish[14] harvest amounted to over 1,300 lb, or 10 lb per household (Table 2-5). Forty-three percent of community households used blackfish during the study year, and nearly all who attempted to harvest blackfish (17%) were successful in doing so (16%). With the exception of a minimal harvest through the use of "other methods," the blackfish harvest was done exclusively through the use of fish traps (Figure 2-6; tables 2-6 and 2-7). One elder discussed through a translator the distribution and resiliency of this nonsalmon fish species.

> They're [blackfish are] abundant, as far as he can remember. Regardless of water level. You know, for fishing anywhere in one of the stream, our favorite stream, we get there and it's kind of low, we get a few, they beat us to the spawning areas or they already moved on. But regardless, even though the water's low—they live in the low, marshy wet—you know, when you walk on, you've been out on tundra before where, called marsh, where it creates waves. In our area it's called *aangaaqs*.[15] You know, the land that sensitive to most when we step on it. Even the water's low, inside that soft ground, they're still there. He say that they're always abundant; they will not run out…the species doesn't die off. So it's just like the other whitefish. They're abundant, everywhere. And they [blackfish] have preferred areas that it's rich and abundant and good. The food that is available, you know for this size, they stay there the entire winter; spring, summer, fall. Because of the availability of their edible food, what they eat. If it's, food's not available, they won't be around long. They'll move. (033018SCM01)

The elder also mentioned that "Just like the whitefish. They [blackfish] also have, always have sand in them, to help grind their food up" (033018SCM01).

One respondent discussed the traditional importance of blackfish.

> I was asked to talk to the kids about fishing, fish camp and so on…so I started off and I asked the teacher "So…when you think of fish camps, fishing, what do you think of, you know, what species?" She goes, "Salmon." And I was like, "That's not the most important species we deal with." And I point out all the little settlements that are out there. Each one had a very distinct feature and that's a lake and a slough where people set traps for blackfish. That's what they're doing here. And that meant something to us as a special species of fish. So blackfish…just to my dad, my parents, was probably the most important species. It was there during times of scarce, when things were scarce, they were there. Salmon were never guaranteed. Blackfish…would sustain us through the winter. (110916SCM05)

This respondent shared a story that further emphasized the importance of blackfish, in the context of harvest prioritization between two different generations of fishers.

> Here's how important blackfish are…there's a young man…he showed up at the gas station and he says, "Man, I'm going halibut fishing." He was gonna go 40 miles out. Just being a man about it. He's the man. And my late brother-in-law walks up to him and says "Only if I was starving to death I'd try to go get some halibut." And young man didn't really like it…And I said "Hey, you bring me some blackfish this winter, I'll call you a man." (110916SCM05)

Scammon Bay residents harvested over 1,350 lb of marine invertebrates in 2017 which equated to over ten pounds per household. The harvest included seven different types of marine invertebrates and the largest harvests occurred with mussels, clams, and cockles (Table 2-5; Figure D2-2). Over one-half of the community attempted to harvest marine invertebrates, and nearly the same amount were successful in their

14. Hereinafter, *blackfish*.

15. According to the translator, *aangaaqs* refer to mossy portions of tundra that undulate under one's weight when walked upon. C. McDevitt field notes, March 2017.

efforts. Nearly 60% of the community used marine invertebrates in 2017. All marine invertebrates were harvested by hand.[16]

Approximately 449 lb of nonsalmon fish was used as dog food in 2017 (Table 2-8). The majority of nonsalmon dog food (89%) was composed of pike (248 lb) and sticklebacks (150 lb). Smaller amounts of saffron cod, chars, smelt, and herring were also fed to dogs. Combined, these contributions totaled 52 lb.

Table 2-8.–Estimated harvest of nonsalmon fish for consumption by dogs, Scammon Bay, 2017.

Resource	Amount	Pounds
Nonsalmon fish		
Pacific herring	1.3 gal	7.5 lb
Rainbow smelt	2.3 gal	13.5 lb
Saffron cod	2.6 gal	15.8 lb
Sticklebacks (needlefish)	25.0 gal	150.0 lb
Unknown chars	4.5 ind	14.9 lb
Northern pike	75.0 ind	247.5 lb
Total		**449.1** lb

Source ADF&G Division of Subsistence household surveys, 2018.

Sharing of Nonsalmon Resources

Household Specialization in Resource Harvesting

Previous studies (Wolfe 1987; Wolfe et al. 2010) have shown that in most rural Alaska communities, a relatively small portion of households produces most of the community's fish and wildlife harvests, which they share with other households. A recent study of 3,265 households in 66 rural Alaska communities found that about 33% of the households accounted for 76% of subsistence harvests (Wolfe et al. 2010). Wolfe et al. (2010) observed that factors frequently associated with higher levels of subsistence harvests included larger households with a pool of adult male labor, higher wage income, involvement in commercial fishing, and community location. Recent Division of Subsistence studies in 16 Yukon-Kuskokwim Delta communities also recorded that a minority percentage of households in each community commonly produced a majority percentage of the wild food harvest. This was true for a variety of resource categories, including nonsalmon fish (Brown et al. 2013; 2015; Ikuta et al. 2014; 2016; Runfola et al. 2017; 2018).

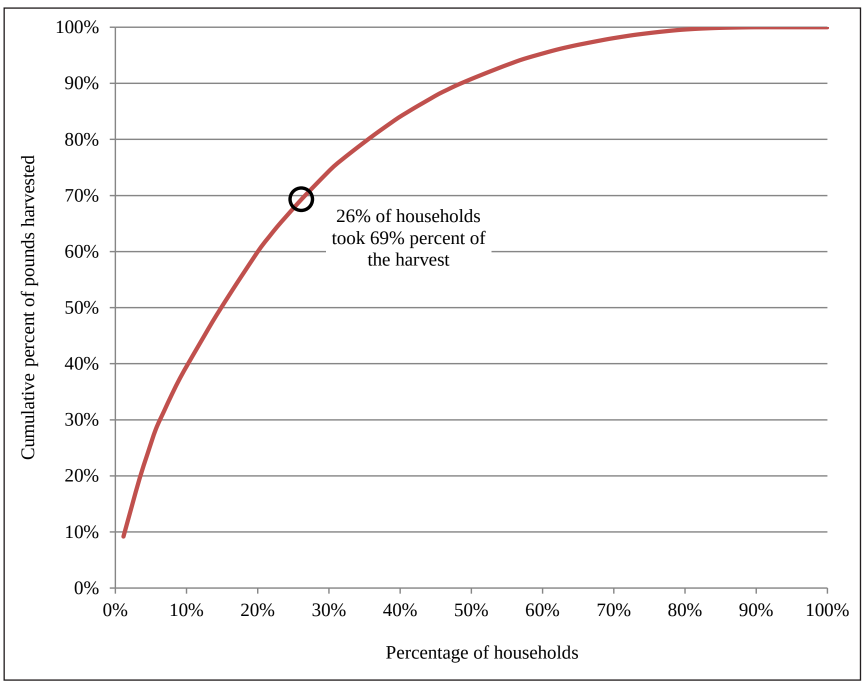


Figure 2-7.–Household specialization, Scammon Bay, 2017.

For Scammon Bay in 2017, 69% of nonsalmon fish harvests, as estimated in pounds usable weight, were harvested by 26% of the community's households (Figure 2-7). Further analysis of the study findings, beyond the scope of this report, might identify characteristics of the highly productive households in Scammon Bay and the other study communities.

16. C. McDevitt field notes, March 2017,

Comparing Harvests and Uses in 2017 with Previous Years

Harvest Assessments

During the surveys, researchers asked respondents to assess their use of whitefishes and sheefish, other nonsalmon fishes, and marine invertebrates in two ways. First, they asked whether the household had used more, less, or about the same amount of the resources during 2017 as compared to the last few years; if there was a change in use, researchers asked why. Second, researchers asked respondents if they got enough of the resource in 2017; if they had not gotten enough, they were asked why, how severe the impact had been, and if they had done anything differently to compensate for not getting enough.

Over one-half of Scammon Bay households used the same amount of whitefishes and sheefish in 2017 as they had in the past (Figure 2-8; Table D2-6). Approximately 60% of households indicated that they used the same amount of other nonsalmon fish in 2017 as they had in the past. Lastly, 42% of households used the same amount of marine invertebrates in 2017 as they had in the past.

Reasons for reduced use of whitefishes and sheefish varied among the 17 households that used less in 2017 compared to previous years (Table D2-7). The most frequent responses for less usage included the resources being less available, lack of effort, and working/no time.

According to one elder, decreased harvests for some nonsalmon fish was part of an ongoing trend that he had observed throughout the years. He explained that "When I was younger there was so much. But this time… so many years later, they get less" (111016SCM04). Other respondents talked about decreased harvests of certain species of nonsalmon fish such as blackfish: "It's hard to find them now. It depends which…slough. You gotta look, you know, because we're not catching as much as we used to anymore" (111016SCM03).

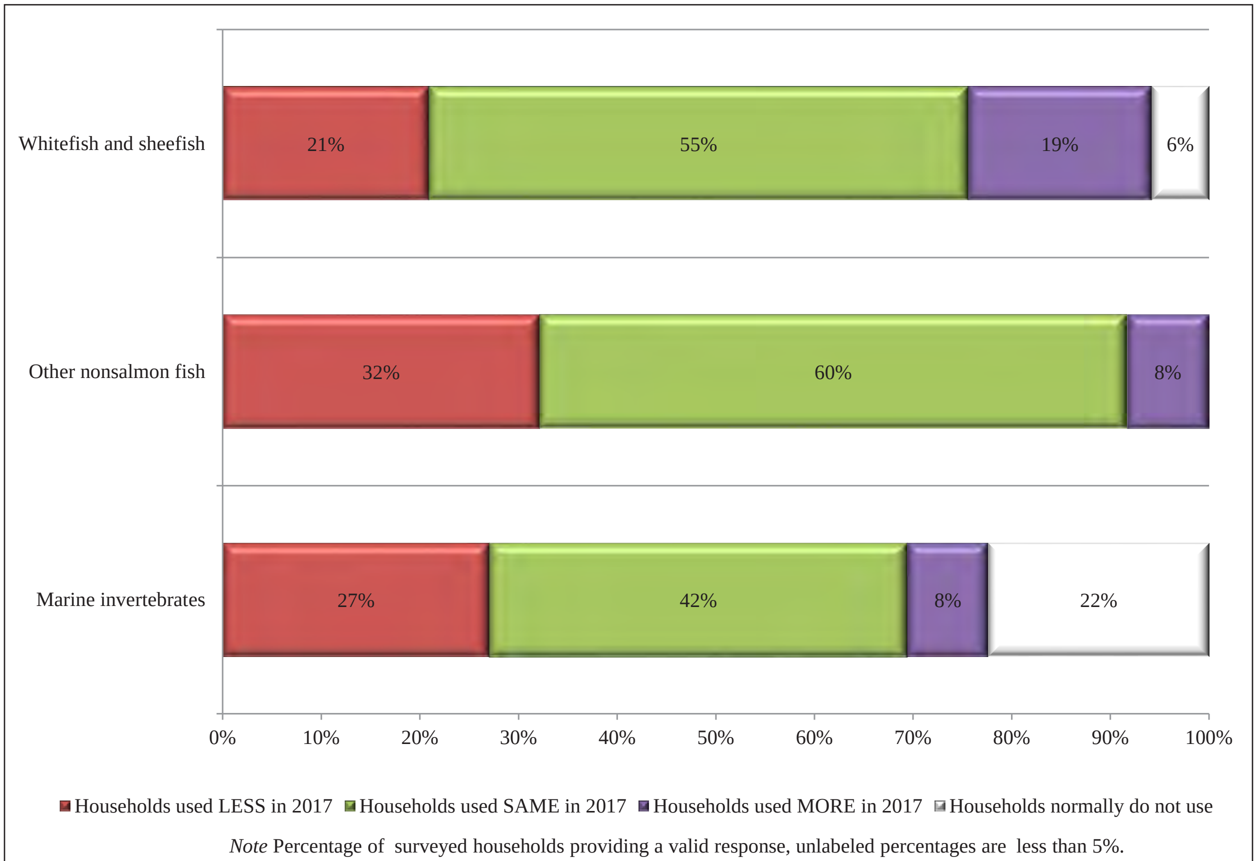
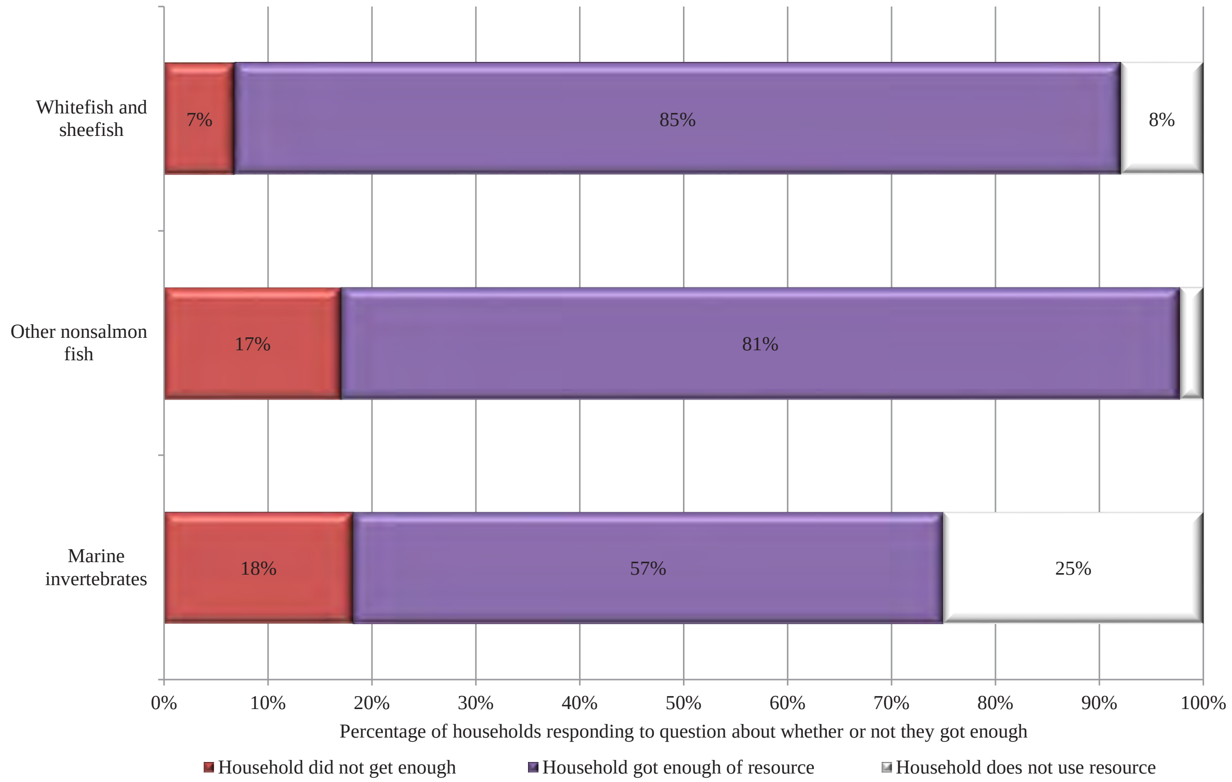


Figure 2-8.–Changes in household uses of nonsalmon fish and marine invertebrates compared to recent years, Scammon Bay, 2017.



Note Unlabeled percentages are less than 5%.

Figure 2-9.–Percentages of households reporting whether or not they got enough nonsalmon fish and marine invertebrates, Scammon Bay, 2017.

Reasons for less use also included family/personal, lack of equipment, and weather, among others (Table D2-7). For the households that claimed they used less marine invertebrates in 2017 compared to previous years, the most frequent reason was lack of effort. Other reasons cited included family/personal, resources less available, and working/no time.

For the households that claimed to have used more whitefishes and sheefish in 2017 compared to previous years, the two most frequent responses for the increased use were increased availability and that households received more of these resources (Table D2-8). Other reasons included increased effort and more harvest success. Reasons provided by households who used more of the other nonsalmon fish included increased effort and that they received more of the other types of nonsalmon fish. For increased usage for marine invertebrates, the most frequent response was increased effort.

The majority of households indicated that they got enough nonsalmon fish in 2017 (Figure 2-9; Table 2-9). This included 85% of households that got enough whitefishes and sheefish as well as 81% of households that got enough other nonsalmon fish during the study year. Lastly, over one-half of households indicated that they got enough marine invertebrates in 2017.

For the 7% of households that did not get enough whitefishes and sheefish, the effects were somewhat evenly distributed (Table 2-9). Two households indicated that the impact was not noticeable and one household each claimed that the impact was minor, major, and severe. Two households said that the effect of not getting enough nonsalmon fish was severe, and five households said that the impact was minor. For the households that indicated that they did not get enough marine invertebrates, three households expressed that the impact was minor and one household said that the impact was severe.

Table 2-9.–Reported impact to households that did not get enough nonsalmon fish or marine invetebrates, Scammon Bay, 2017.

		Households not getting enough _______ .				Impact to those not getting enough ______ .									
	Sample	Valid responses[a]		Did not get enough		No response		Not noticeable		Minor		Major		Severe	
Resource category	households	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	88	81	92.0%	6	7.4%	1	16.7%	2	33.3%	1	16.7%	1	16.7%	1	16.7%
Other nonsalmon fish	88	86	97.7%	15	17.4%	2	13.3%	6	40.0%	5	33.3%	0	0.0%	2	13.3%
Marine invertebrates	88	66	75.0%	16	24.2%	4	25.0%	8	50.0%	3	18.8%	0	0.0%	1	6.3%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Includes households failing to respond to the question and those households that never used the resource.

Households that indicated that they did not get enough whitefishes and sheefish in 2017 compared to previous years provided several different reasons to researchers. These included family/personal reasons, less resource availability, and lack of effort (Table D2-9). For those who did not get enough of other nonsalmon fish, the most frequent responses included family/personal reasons, resource availability, lack of equipment, and lack of effort. Households that indicated that they did not get enough marine invertebrates cited as reasons lack of effort, lack of equipment, and family/personal reasons.

Some households that claimed that they did not get enough of certain nonsalmon resources in 2017 compared to previous years provided explanations as to what they had done differently to compensate for the reduced harvest. Households that did not get enough whitefishes and sheefish either replaced these resources with other subsistence foods, or they asked others for help (Table D2-10). Households that did not get enough of other nonsalmon fish bought or bartered other foods, replaced with other subsistence foods, asked others for help, or obtained food from other sources. Lastly, households that did not get enough marine invertebrates either replaced them with other subsistence foods or made do without.

Respondents were also asked if there were any particular nonsalmon resources that they had used in the past but no longer used in more recent years (Table D2-11). Eight respondents indicated that they no longer used sticklebacks, commonly known as needlefish. According to many respondents, sticklebacks were primarily harvested in the past to feed dog teams. Because residents now primarily rely on snow machines for transportation, sticklebacks harvests have subsided greatly.[17] One elder shared specific details about the abundance and distribution of sticklebacks. As told through a translator:

> And they're a very abundant, especially on the coastline where there's freshwater and saltwater, they're abundant everywhere. You know, you go down there in the summer time, spring time, and you'll see 'em, they're all over. You can go further inland, and they're everywhere. You can go to any little water way, and they're abundant. In the spring time when the water gets high, any trickle of water. (033018SCM01)

When asked by researchers if sticklebacks were more abundant than blackfish, another widespread smaller nonsalmon fish species, the elder explained through a translator:

> More than blackfish. He says they're very abundant everywhere and they're always on the move. Spring breakup time, high water, any trickling runoff, they go with it. You can see 'em everywhere. You go up to Kusilvak, you look down in the water, you'll see 'em. You know, anywhere. They're small and they move, you know, high water come in and they move in. High water come in, and they move with it. They're everywhere. Stream runs out and they're in ponds and lakes. As far as you can remember from one generation to the next, you know, for example in the leanest times of the year, this sustained human life. Anywhere. Because it was so abundant, everywhere. You know other species, black [fish], whitefish, so forth, this [needlefish] sustained life practically everywhere. Yeah. That's what he's stating is that of all fish species, this is the most abundant and it has sustained life since, you know, even in times, the [leanest] time of the year. (033018SCM01)

Six respondents indicated that they no longer used blackfish (Table D2-11). Some respondents said that beaver activity and low abundance have led to less use of blackfish. Others indicated that they had received less blackfish from friends and family members over the years. Lastly, one elderly respondent explained that he could no longer chip the ice out in order to set the trap, due to old age.[18]

Harvest Data

Changes in the harvest of resources by Scammon Bay residents can also be discerned through comparisons with findings from other study years. Research conducted in 1982–1983 documented nonsalmon subsistence

---

17. The sticklebacks harvest in 2017 was 180 lb, or just over one pound per household (Table 2-5).
18. Survey notes, March 2018.

harvest data from several communities near the mouth of the Yukon River (Fienup-Riordan 1986). During that time, an independent researcher collected harvest data from 69% (29 of 42) of Scammon Bay households for the study period June 1981 through May 1982 (Fienup-Riordan 1986:222).[19] The results indicated that the per household harvest for nonsalmon fish and marine invertebrates was close to 1,800 lb per household: 1,260 lb per household more than the 2017 harvest (Fienup-Riordan 1986:219–220).[20] The most heavily harvested nonsalmon resources included blackfish (364 lb per household), broad whitefish (297 lb per household), burbot (281 lb per household), saffron cod (250 lb per household), Bering cisco (219 lb per household), herring (162 lb per household), and pike (157 lb per household). Despite differing methodologies between this earlier study and that of 2018 (Fienup-Riordan 1986:218,226), a brief comparison indicates that per household harvests totals between the two studies differ greatly. In terms of pounds per household, the only individual species harvest data between the two studies which were similar were those of herring and pike: herring harvest differed by 21 lb per household and pike harvest differed by 26 lb per household (Fienup-Riordan 1986:219–220). For the remaining species listed above, the 2017 per household harvest averages were 181 lb to 354 lb lower than the 1981–1982 per household harvest averages.

Prior to 2018, the only subsistence harvest research conducted by ADF&G in Scammon Bay was in 2014 for the study year 2013 (Ikuta et al. 2016). The comprehensive subsistence harvest survey effort gathered harvest and use information for all resource categories, including nonsalmon fish and marine invertebrates. The results indicated that Scammon Bay fishers harvested 64,788 lb of nonsalmon resources in 2013 (Table 2-10). The 2017 harvest of 71,113 lb represented a 10% increase in harvest. Despite the more than three ton difference in harvest between the two study years, the annual per capita harvest increased by only 20 lb.

Further examination of harvest amounts and harvest composition between the two study years shows substantial differences between several nonsalmon resources. Total harvests of herring, smelt, and pike increased between the 2013 and 2017 study years. Scammon Bay fishers harvested slightly over 10,000 lb of herring in 2013 whereas in 2017, the harvest was over 18,600 lb. The per capita harvest of herring doubled over this time, from 16 lb to 33 lb. Herring accounted for 16% of the nonsalmon harvest composition in 2013 and 26% in 2017. The smelt harvest rose by more than 200% (2,580 lb in 2013 to 8,034 lb in 2017) from 2013 to 2017, and pounds per capita more than tripled, from 4 lb to 14 lb. Smelt accounted for 4% of the nonsalmon harvest composition in 2013 and 11% in 2017. Fishers harvested close to 7,000 lb of pike in 2013, which equated to 11 lb per capita. In 2017, fishers harvested over 17,000 lb of pike, or 30 lb per capita. The 2017 harvest represented a 171% increase in pounds per capita. In 2013, pike accounted for 11% of the nonsalmon harvest composition, whereas in 2017 the contribution was 24%.

Community members also harvested significantly more marine invertebrates in 2017 compared to 2013. The difference in the total marine invertebrate harvest amounted to 572 lb. This included an 87% harvest increase for mussels, from 149 lb in 2013 to 280 lb in 2017.

Halibut and saffron cod decreased in harvest between the two study years. The 2013 halibut harvest was close to 20,000 lb (32 lb per capita), but the 2017 harvest was slightly over 5,000 lb (9 lb per capita). Halibut accounted for 31% of the nonsalmon harvest composition in 2013, but only 7% in 2017. One key respondent talked about the challenges residents encountered with halibut fishing in 2017, which may help to explain this reduction in harvest.

> This year it wasn't too much of a good year because of the weather…we weren't able to go out halibut fishing too much this year because of wind. This year we got probably a lot less halibut then we did the year before. Just because it's windier and you're less chance to get out. (111016SCM03)

19. Average household size included seven individuals.

20. Research collected data on ten nonsalmon resources: Bering cisco, broad whitefish, sheefish, blackfish, saffron cod, pike, burbot, "shellfish," herring, and smelt. Harvests ranged from zero to 4,260 lb per household. Results were based on interviews with 29 of 42 households and were not expanded for the community.

Table 2-10.–Estimated total and per capita harvests, Scammon Bay, 2013 and 2017.

	Estimated harvest in pounds usable weight					
	2013			2017		
Resource	Total	Per capita	CIP	Total	Per capita	CIP
Nonsalmon fish	**64,788.4**	**103.2**	**13.7%**	**71,144.0**	**123.51**	**16.0%**
Pacific herring	10,136.3	16.1		18,649.1	32.38	
Pacific herring roe	1,377.0	2.2		3,990.1	6.93	
Capelin (grunion)	2,580.3	4.1		0.0	0.00	
Rainbow smelt	12.9	0.0		8,070.4	14.01	
Pacific (gray) cod	12.9	0.0		504.0	0.88	
Saffron cod	10,679.5	17.0		1,593.1	2.77	
Walleye pollock (whiting)	16.0	0.0		42.0	0.07	
Unknown flounders	67.7	0.1		38.0	0.07	
Pacific halibut	19,784.1	31.5		5,131.9	8.91	
Unknown sculpins	46.5	0.1		36.0	0.06	
Sticklebacks (needlefish)	42.9	0.1		180.0	0.31	
Alaska blackfish	1,139.9	1.8		1,334.6	2.32	
Burbot	303.8	0.5		786.8	1.37	
Unknown chars	45.1	0.1		113.9	0.20	
Northern pike	6,935.9	11.0		17,270.6	29.98	
Sheefish	1,004.0	1.6		1,713.1	2.97	
Rainbow trout	2.0	0.0		0.0	0.00	
Broad whitefish	3,149.4	5.0		3,797.9	6.59	
Bering cisco	3,424.8	5.5		4,998.9	8.68	
Least cisco	596.4	0.9		315.7	0.55	
Humpback whitefish	3,402.5	5.4		2,379.0	4.13	
Round whitefish	41.5	0.1		185.6	0.32	
Unknown whitefishes	0.0	0.0		13.4	0.02	
Marine invertebrates	**780.1**	**1.2**	**22.0%**	**1,352.2**	**2.35**	**21.9%**
Chitons (bidarkis, gumboots)	0.0	0.0		4.5	0.01	
Butter clams	0.0	0.0		168.0	0.29	
Razor clams	0.0	0.0		49.5	0.09	
Unknown clams	0.0	0.0		514.3	0.89	
Unknown cockles	0.0	0.0		312.8	0.54	
Red king crab	0.0	0.0		0.0	0.00	
Unknown mussels	149.2	0.2		279.9	0.49	
Shrimps	0.0	0.0		0.0	0.00	
Unknown marine invertebrates	42.6	0.1		23.2	0.04	

Sources For 2017, ADF&G Division of Subsistence household surveys, 2018; for 2013, ADF&G Division of Subsistence Community Subsistence Information System (CSIS).

Several survey respondents also indicated that poor weather was the primary limiting factor that influenced their halibut harvest efforts in 2017.[21]

Fishers also harvested considerably more saffron cod in 2013 compared to 2017. The 2013 harvest was 10,680 lb whereas the 2017 harvest totaled 1,593 lb. This represented an 85% reduction in total harvest. In addition, the per capita harvest fell from 17 lb in 2013 to less than 3 lb in 2017.

In 2013, 39% of the community indicated that they used less nonsalmon fish in 2013 compared to previous seasons, and 29% of households said that they used less because of weather or other environmental factors, and roughly 26% of respondents said that the resources were less available. For 2017, 21% of the community indicated that they used less whitefish and sheefish compared to previous seasons, whereas 32% expressed less use of other types of nonsalmon fish (Table D2-6). The primary reasons for less usage of whitefish and sheefish included less availability, lack of equipment and lack of effort, and work obligations (Table D2-7). Reasons for less usage of other nonsalmon species were similar to the reasons stated above, and also included weather, family/personal reasons, and less sharing.

Scammon Bay fishers may replace one nonsalmon species with another in order to maintain total harvest levels. For example, although fishers harvested over 8,000 lb less herring in 2013 compared to 2017, their harvest of saffron cod was over 9,000 lb greater in 2013 than in 2017. Also, the reduced halibut harvest from nearly 20,000 lb in 2013 to slightly over 5,000 lb in 2017, may help to explain why the pike harvest increased by over 10,000 lb from 2013 to 2017. As fishers experienced reduced harvests of one or more nonsalmon species, they may have refocused their efforts on other nonsalmon species in order to compensate for the reduced harvest of the originally targeted species.

Current and Historical Harvest Areas

Scammon Bay fishers utilized approximately 1,200 square miles in their search and harvest of nonsalmon resources in 2017. This included numerous locations within close proximity to the community as well as areas further removed from Scammon Bay (Figure 2-10). The northernmost extent of the search area included locations near the community of Nunam Iqua, approximately 53 miles north of Scammon Bay. To the west, the search and harvest areas extended as far as 30 miles off the coast near Cape Romanzof. The eastern extent of search and harvest areas included waterways adjacent to and on the south and east sides of the Kusilvak Mountains. Lastly, fishers also focused their search and harvest efforts as far south as the southern side of the Askinuk Mountains, south of the community.

The search and harvest areas for sheefish and whitefishes included several locations along the Kun River and nearby tributaries (Figure 2-11). Fishers also focused their efforts directly south of the community along the southeast side of the Askinuk Mountains. One fisher talked about fishing etiquette in the context of where he preferred to set his whitefish net in these areas.

> I like to set right where, where the main system is because so when the weather gets very cold the tide doesn't come up the river, just drops, some of the nets get…pulled out. So I set mine where I know the channel is so the weather, the temperature drops, the river doesn't get the tide, my net's safe, safely set. A whole bunch of men set like one, two, three, four, five, six, seven, eight. If I come around it'll be nine, I say, 'what's the point?' I'm not going to go out and set wherever you know, I know where the other men set, but out of respect I let them have those spots. And I set, you know, where I think I can get the most. So I set somewhere else where I think there might be a good number of fish. And I've found those. I like to travel…where no one has traveled. It's who I am. (111016SCM02)

Another fisher added: "We're definitely getting more and more [sheefish] over on the other side there. They were very rare at some point, but we're getting more" (110916SCM05). Fishers also focused their efforts for whitefishes at select locations directly west of the community along the coastline west to Smith Point. Some fishers traveled as far north as Melatolik Creek and Black River, about 27 miles and 45 miles away,

21. C. McDevitt field notes, March 2018.

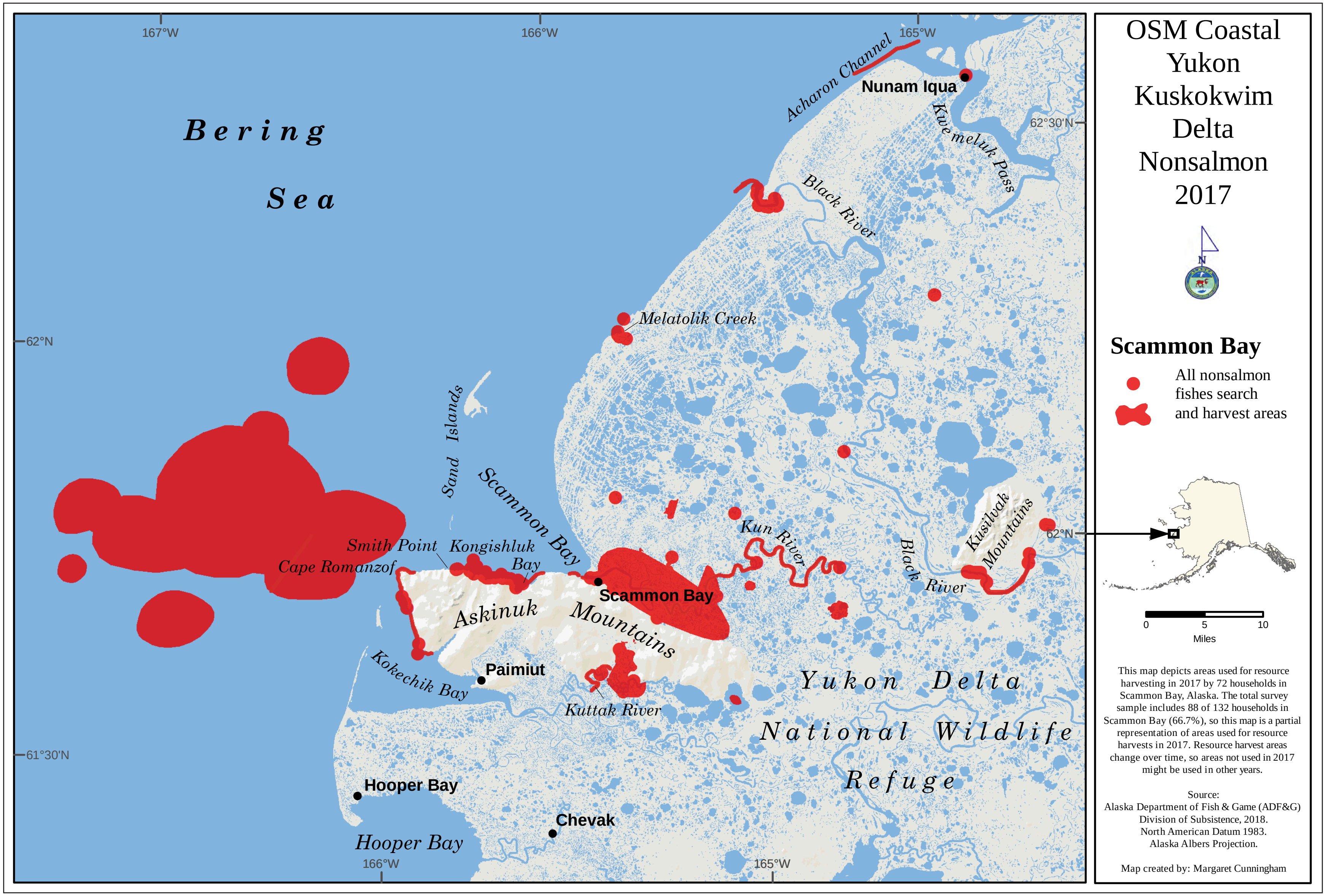


Figure 2-10.–Nonsalmon fishing areas, Scammon Bay, 2017.

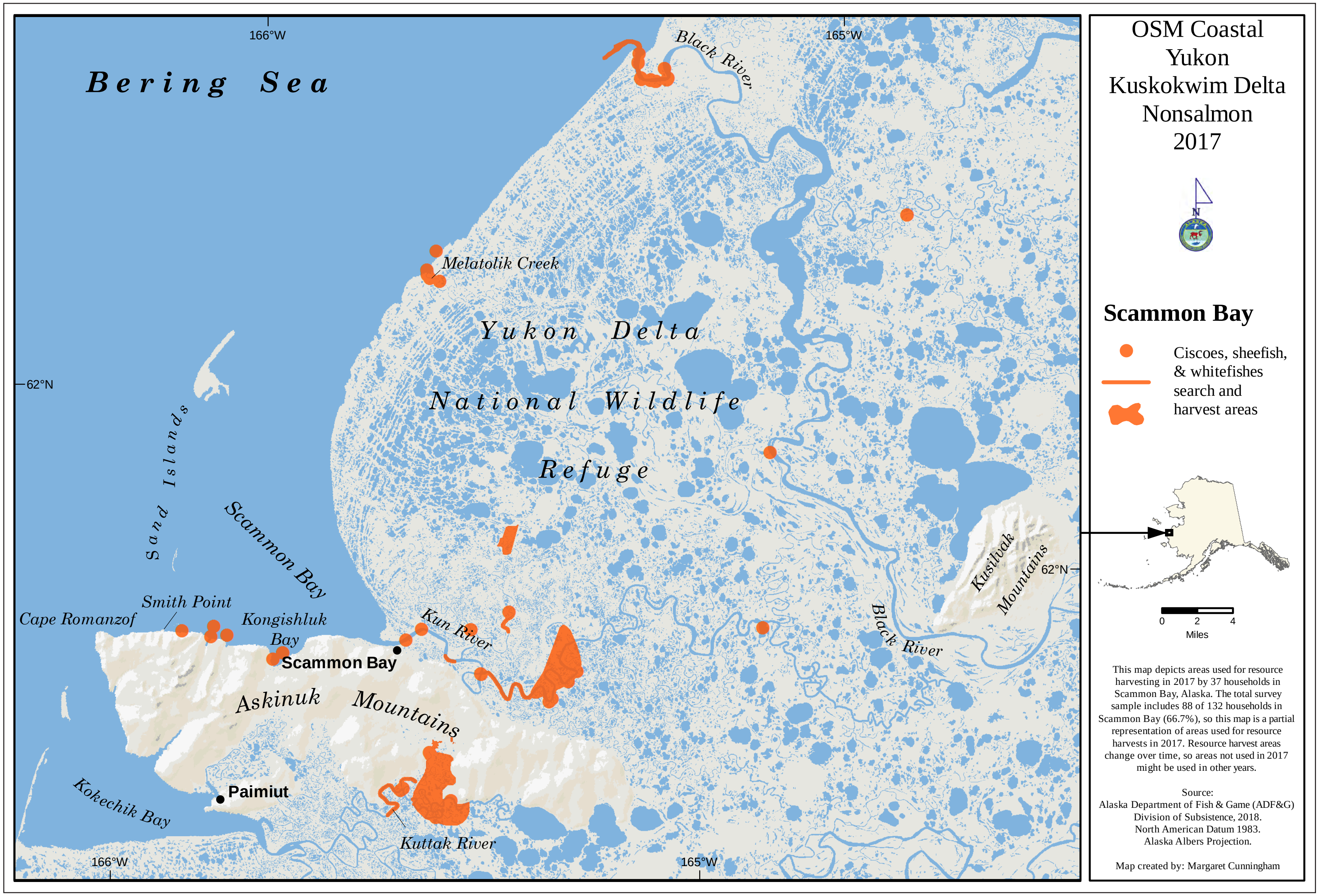


Figure 2-11.–Ciscoes, sheefish, and whitefishes fishing areas, Scammon Bay, 2017.

respectively. The Black River locations included fishing sites that were primarily concentrated near the mouth, but some fishers traveled further upstream. One fisher discussed the importance of net placement and maintenance when fishing for whitefishes at Black River.

> It's the thickness of the ice that counts. We set, you know, once this river [Kun] freezes, we take off, we're gone, heading north and set our nets in Black River, you know. We can check our nets four, five times, and that'll be it. Because the ice is getting thicker and thicker. And we don't want to get our nets caught into the ice. The fish over there is so thick. Sometimes you have to tie your snow machine to your net and pull it out. Yes. I did that once. I thought my net was stuck on the ice. So it tied it up. I was kinda mad, but as I pulled, it came out. There was, packed. It's because I didn't check it for two days. You have to check it pretty much every day. And that's a forty mile ride. The closer you set to the mouth the more slush-up ice accumulates. The further upriver the less slush that accumulates. You know, you wanna catch the fish when they're coming out. The colder it gets the more fish comes out. (111016SCM02)

Search and harvest locations for blackfish included a 40 square mile area directly adjacent to and to the east of the community (Figure 2-12). In addition, fishers searched for and harvested blackfish from select locations scattered throughout the low-lying delta to the north and east of the community. One fisher talked about how natural indicators facilitated the search for blackfish.

> Me and my dad, when blackfish got scarce during the winter we'd go, just go out with dog team, and just look for any places where a fox went, dug into the snow and we check and see if there's a little slough there. We chop through the ice and set a blackfish trap there. Late in the winter blackfish are coming back into lakes and so much, in great abundance that they melt through the ice. That they go through very tight little sloughs, they melt through the ice and they, they call it *pugluteng* which literally means "come up."[22] They come up. And I know I know three times in my life I've seen melt ice middle of the lake and there they are. There's a hole in the middle of the lake, there's fox there eating, partying, there's blood all over. Because the blackfish are just coming up to that hole. And I don't know if it's just friction or the heat from them being in great numbers, but they melt the ice. (110916SCM05)

One fisher described how he determined his trap placement as well as when to move it.

> If there's two lakes in between or it's just a slough or a creek to a lake or a neighboring water, you get 'em early they're mainly good, you know, when they wanna come out. As the water's receding, you move the fish trap further downstream. And they still can get more. And it's, there's always water fluctuation, tide come in, the water comes up, goes back. You can get fish the entire winter. (033018SCM01)

Burbot search and harvest areas included select locations in four specific areas (Figure 2-12). These included locations near Nunam Iqua, the mouth of Black River, within Black River on the east side of the Kusilvak Mountains, and on the south side of the Askinuk Mountains. One fisher described the most productive fishing spots in this last area.

> And it's, right now it's pretty much one stream just right over the hill there…other areas, I think they starting to make a, they're starting to show up a little bit more, more and more. You know, almost all the streams over on the other side, south face of the hills here…and it's three streams, four streams…where traditionally where they set lush fish traps. And I know this one here is steadily getting more and more.

22. *Pugluteng* is derived from the root word *puge* which literally translates to "to surface, to come to the surface" (Jacobson 1995:499).

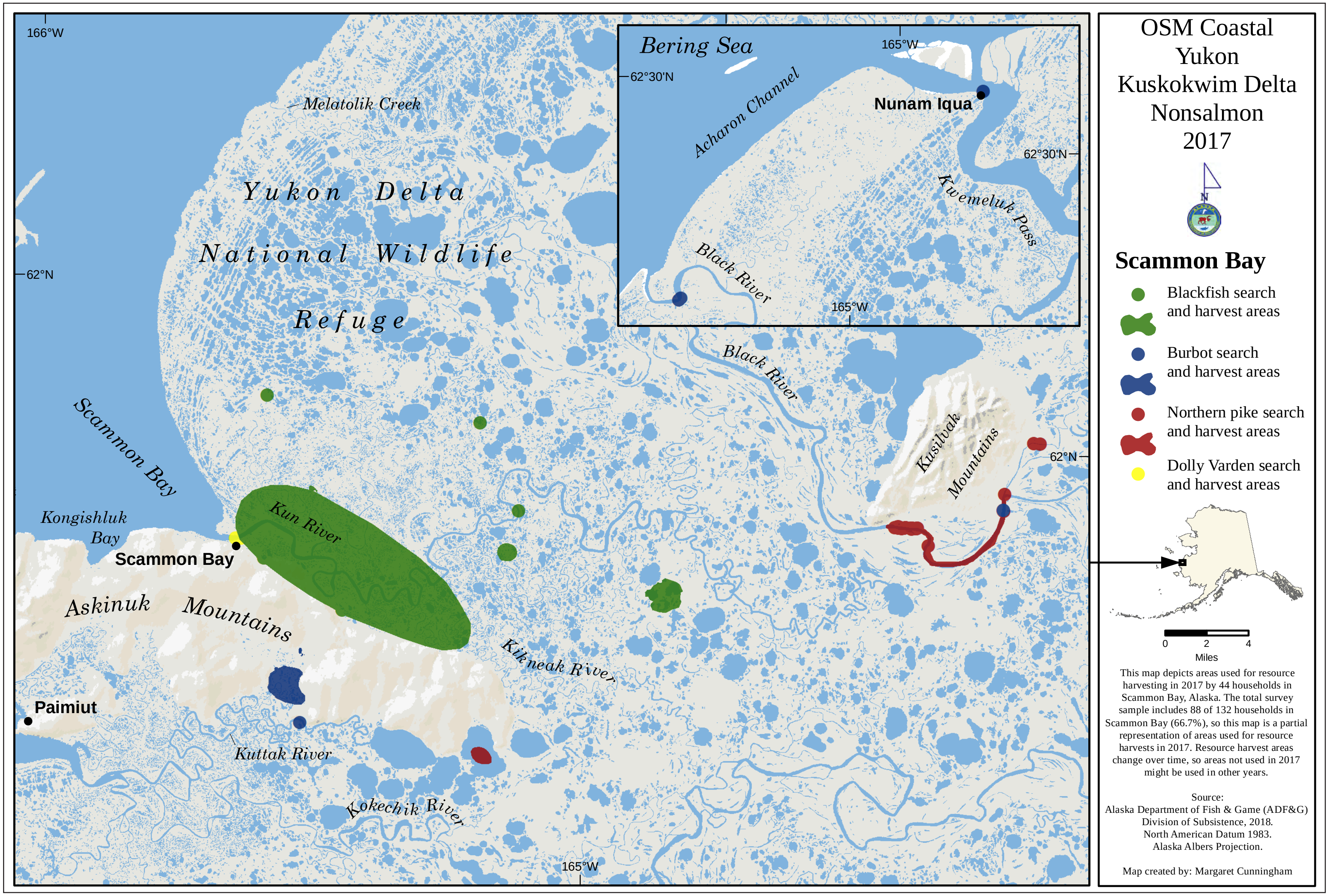


Figure 2-12.–Alaska blackfish, burbot, northern pike, and chars fishing areas, Scammon Bay, 2017.

> And mom had a specific date, right around my younger brother's birthday, was when the big ones, they come up and spawn around the 14th of February, 13th of February. (110916SCM05)

Despite reports from some fishers who indicated that burbot populations have declined in recent years in the areas mentioned above as well as in Black River, one fisher argued that the reason for decreased harvests were not linked to abundance issues. Instead, the fisher attributed harvest declines to the loss of traditional methods for catching burbot.

> You know, some people can say the fish that they're going after are depleting, like for example lush fish. Men are saying it's harder to catch a lush fish. It's probably because due to the fact that the tradition, the tradition of how to catch the lush fish is being lost. Back in the old days growing up as a kid, the old men that you know grew up with the other men that hunted with canoes and dog team, they were children. Those children's traditions are lost and that's why some people are saying this fish is depleting or that fish is depleting because the tradition of how to catch these fish is slowly going away. They're, some of the men are trying to catch lush fish with five-inch nets, five-and-a-half-inch nets, deep nets, and they're not catching much because the traditional way is to build a fence way upstream, and that's digging through five feet of thick ice, and you make a fence with sticks. And at the end you put a tailgate trap, like a blackfish trap. That's the way to catch lush fish. They're trying to do a shortcut of setting a net. That's not tradition. A handful of those old men that hunted with canoes and dog teams, they ice pick four or five feet of ice, a foot wide. They set their wood trap fence, and then at the end they put their trap for the lush fish. They did all the hard work and that's the way we catch those fish…But nowadays nobody does it. All you can see is remnants of the old men's traditions around the tundra of the lush fish traps. And they're twenty, thirty years old. And nobody, they haven't been renewed. You don't see a brand new trap. (111016SCM02)

With the exception of one location on the far eastern edge of the Askinuk Mountains, all pike were harvested from Black River and nearby sloughs on the east side of the Kusilvak Mountains (Figure 2-12; Plate 2-8). According to one fisher: "Some of the ones I've seen caught at Kusilvak are, they look like alligators. They're huge, they're very huge" (110916SCM05). In March of 2017, the author traveled by snow machine to pike fishing locations at the base of the Kusilvak Mountains. Over the course of two days, he participated in pike fishing and spoke with several Scammon Bay residents as well as fishers from Nunam Iqua, St. Mary's, Mountain Village, and Hooper Bay who had also come to harvest pike and enjoy the pleasant spring weather (Plate 2-9).

Char search and harvest areas were limited to one location: a small, spring-fed freshwater stream that begins in the mountains behind the community and discharges into the Kun River (Figure 2-12). Very few char were harvested in 2017 (35 fish; Table 2-5). According to one elder, char have always been scarce in the Scammon Bay area: "Growing up, as far as I can remember, on the rarest occasions, these smaller ones [char] were caught in nets…But those are rare species out here, along the coast or anywhere up here" (033018SCM01).

One fisher provided several details about char fishing and explained that the Yup'ik word "literally means… little things that, they hide under rocks and that's what they do" (110916SCM05). The respondent explained:

> And I think they got that name because little girls, they used to go out there with salmon eggs, and try to get 'em. They come out and bite the egg. Yeah, they just kind of come up and come back. And that's literally what that name is…Yeah, some are bigger. And my daughter gets, got over a foot long. And I don't know if those bigger ones stay year round, I know the smaller, real small ones stay year

Plate 2-8.–The Kun River and the Kusilvak Mountains.

Plate 2-9.–On the Black River, looking northeast towards the lower Yukon River drainage.

> round. I think the bigger ones show up sometime over the course of the summer. (110916SCM05)

When asked by researchers if char were a highly sought after species, he replied “No. It was just like game fish pretty much. Mom send kids out there to go practice patience, you know” (110916SCM05).

Scammon Bay fishers harvested herring and herring roe along a ten-mile stretch of the coastline that began near the community and extended west to Smith Point (Figure 2-13). Fishers also searched for and harvested herring and herring roe along the coastline near Cape Romanzof (Plate 2-10). This search and harvest area included locations which extended from the cape to roughly ten miles inside of Kokechick Bay. In addition, some fishers traveled as far north as the coastal waters near the southernmost pass of the Yukon River in their search for herring and herring roe.

Search and harvest areas for saffron cod and rainbow smelt included several locations along the Kun River, beginning directly in front of the community and extending upstream roughly eight miles (Figure 2-14). One lifelong fisher described fall time saffron cod fishing in this area.

> We usually go way upriver when all the females are heading up I think, to spawn all their, or their sac roes are plumb full, and we use a dip net and we just go upstream and herd ‘em down into the net and scoop ‘em up…scare ‘em into the net and then bring a toteful back…My dad used to have a trap, fish trap in the river, just a fence and had little doorways where they could go in, and they go into a trap. That’s how we used to get fish…the trap was where that low tide ended. And tomcods [saffron cod] are, they’re, they pretty much stay along the banks. They hit that fence they follow it. (110916SCM05)

Scammon Bay residents also fished at small concentration of locations near Smith Point (Plate 2-11). The author visited these locations in March of 2017 and participated in both smelt and saffron cod fishing with local residents. The majority of springtime and fall time smelt fishing occurs near the mouth of the Kun River, within view of the community, and springtime saffron cod fishing is more concentrated near Smith Point.[23] At Smith Point, a small freshwater stream that originates from the Askinuk Mountains discharges into the Bering Sea. Some fishers deploy under-ice nets near the mouth of this stream where its load of freshwater mixes with the surrounding saltwater, while others fish through the ice with hook and line (Plate 2-12). This particular spot is preferred by some fishers because it is believed to be a highly productive environment for larger saffron cod (Plate 2-13).[24]

According to one elder, Scammon Bay fishers have only relatively recently started to harvest saffron cod.

> There’s an area here, [people] didn’t for a long time, didn’t realize we had these species until this stranger from another place came and visit and decided one day to go out and fish, and start getting these tomcods here. Even the people that are, reside, who lived here before us, they didn’t realize they were available. So, this is fairly new that they realized we had, could catch ‘em by hook. (033018SCM01)

The respondent indicated that Scammon Bay residents started fishing for saffron cod less than 100 years ago.

Search and harvest locations for halibut included a roughly 300 square mile area of coastal waters directly west of the community (Figure 2-15). The extent of this search began a few miles from the coastline near Cape Romanzof and extended northwest to roughly 15 miles due west from the main northernmost body of the Sand Islands. From there, the search and harvest area extended to the west and south approximately 30 miles (Plate 2-14). According to many respondents, Pacific cod and, to a lesser extent, walleye pollock were often caught incidentally while halibut fishing. Although the area mentioned above also included the harvest locations for these fish (in addition to halibut), fishing in these areas was not targeting these two nonsalmon fish species.

---

23. C. McDevitt field notes, March 2017.
24. C. McDevitt field notes, March 2017.

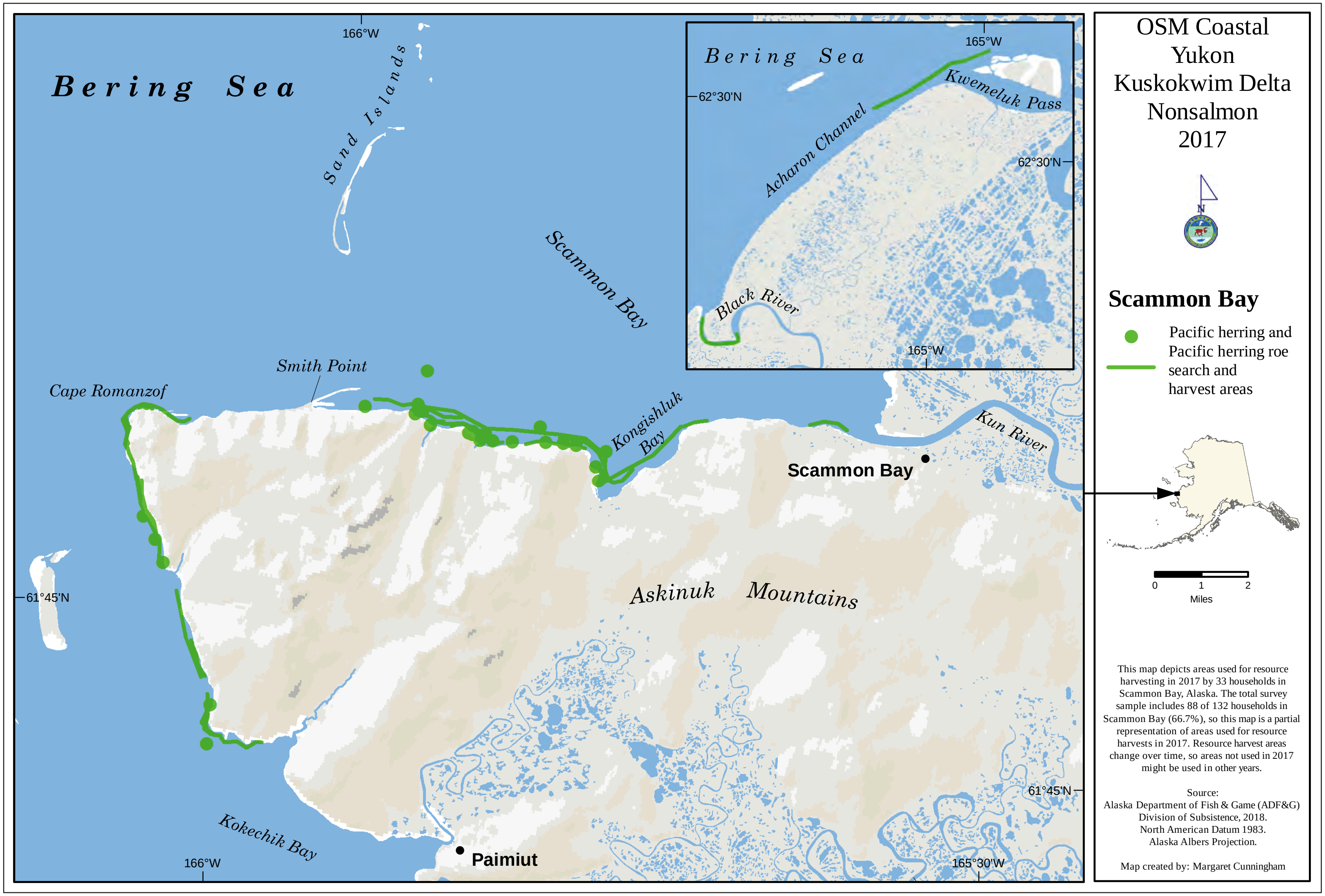


Figure 2-13.–Pacific herring and Pacific herring roe search and harvest areas, Scammon Bay, 2017.

Plate 2-10.–Cape Romanzof in spring. The cape is a popular search and harvest area for Pacific herring and herring roe, among other nonsalmon resources.

As mentioned in the Seasonal Round section, halibut fishing is a relatively new activity for Scammon Bay fishers. One fisher offered more detail about this emerging fishery.

> My brother-in-law set a long line out not too far from here, maybe about nine miles from here. He caught a five-footer halibut. And everybody said "Where'd you catch that?" He went out here. That's when they started going out. And that's the start of rod and reel. (111016SCM03)

According to three respondents, rod and reel was not a primary fishing gear utilized by fishers prior to the emergence of the halibut fishery (111016SCM03). Another fisher talked about his first experiences fishing for halibut.

> So we anchored out one time and, right near the [Sand] island, ten miles out, and we're pulling them up, "whoa!" getting caught on. They get big as eight feet. We got one, we try to put it in the boat, but we didn't have no gun. We didn't know we had to bring a gun. Threw it away, took off. Yeah. And when they take off, they take off. But we bring home five footers, four footers. You come around in July and you be out there pulling them up. (111016SCM02)

Another fisher wondered about fishing location preference in relation to halibut distribution.

> We just, we just found out about halibut fishing, you know like first island [Sand Islands], it's like ten miles out. But now we're going halibut fishing thirty miles out. I don't know why? Bigger fish, more numbers maybe. I can halibut fish like ten miles right here. (111016SCM02)

Although Pacific cod were not the primary targeted species within these areas, one lifelong fisher explained that people in the past fished specifically for Pacific cod.

> I did hear about cod at the cape [Romanzof]. And I was, that was way before… contact with white people. Mom and dad had told stories about men tying their kayaks together, and fishing for cod at the cape. Just tie up their kayaks together, just jig. (110916SCM05)

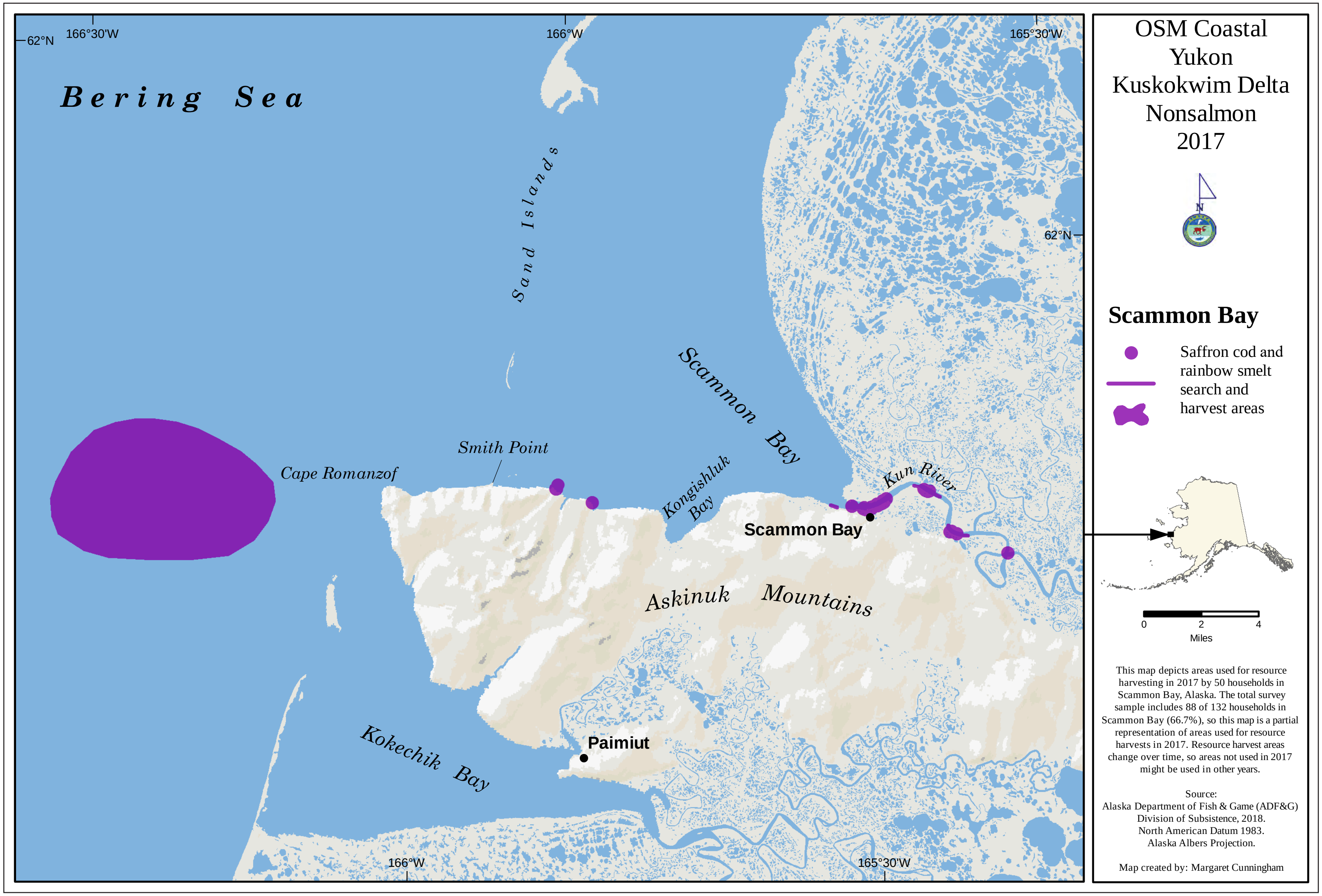


Figure 2-14.–Saffron cod and rainbow smelt fishing areas, Scammon Bay, 2017.

Plate 2-11.–Smith Point is a productive area for several different nonsalmon resources.

Plate 2-12.–Saffron cod harvested with a hook and line through the ice at Smith Point.

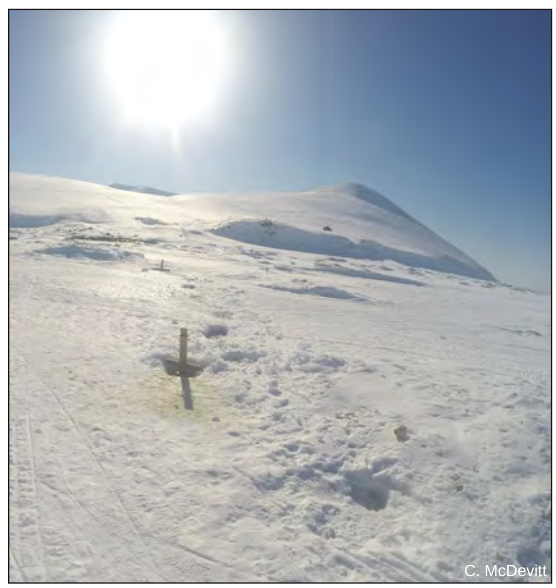


Plate 2-13.–An under-ice setnet for saffron cod at Smith Point. Exposed rock at the base of the freshwater stream is visible near the upper left of the photograph.

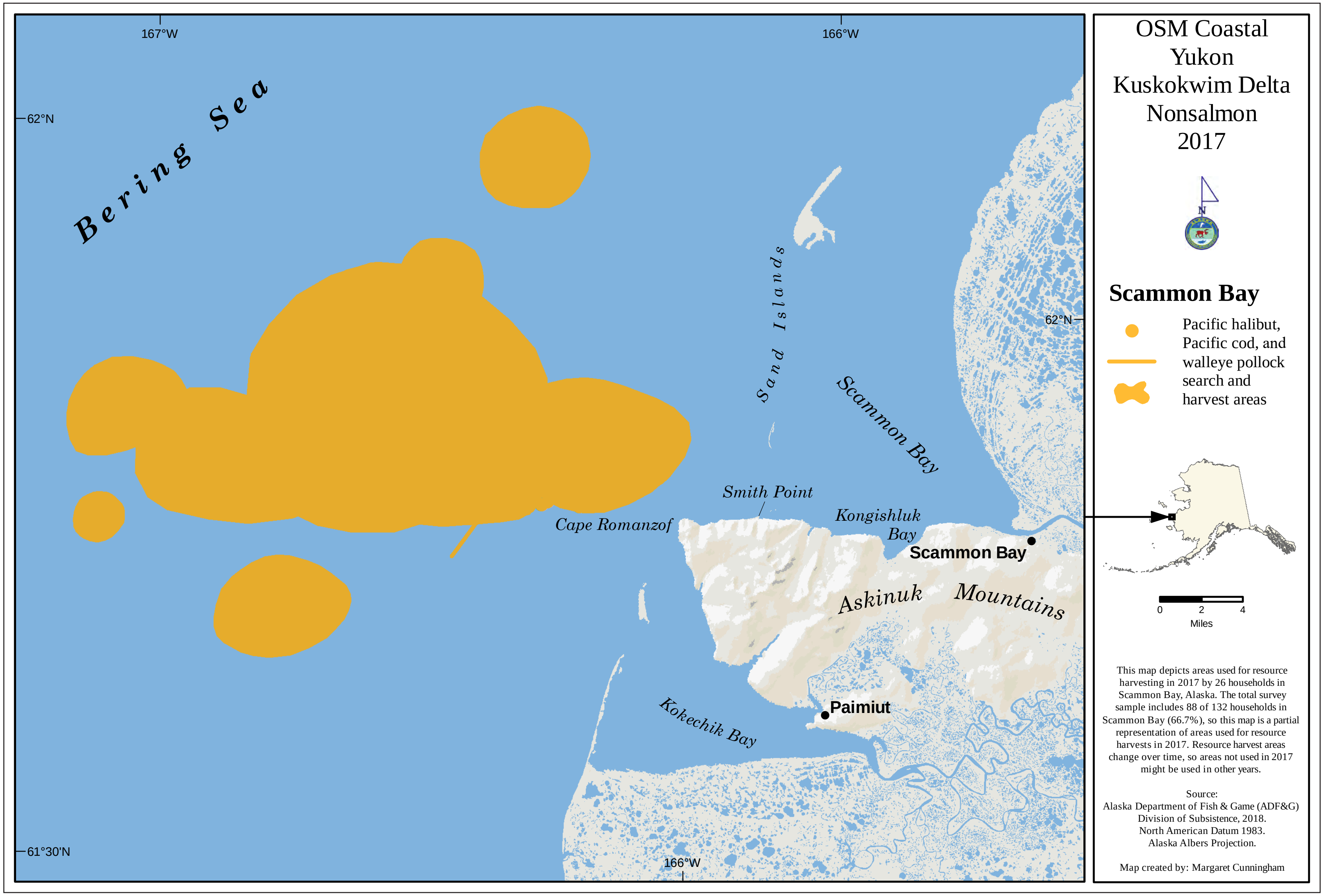


Figure 2-15.–Pacific halibut, Pacific cod, and walleye pollock fishing and harvest areas, Scammon Bay, 2017.

Plate 2-14.–Pacific halibut fishing grounds approximately 20 miles from the coast. Cape Romanzof can be seen in the distance.

Scammon Bay residents fished for flounders and sculpins (locally referred to as "devilfish") along the coastline west of the community, within the Kun River upstream of the community, and in Black River (Figure 2-16). The search area for flounders included the west side of Kongishluk Bay, approximately eight miles west of the community, as well as at the mouth of Black River. According to many fishers, flounders and sculpins were oftentimes caught incidentally in setnets that were deployed for other nonsalmon fish species such as whitefishes (111016SCM03).[25] Some fishers stated that they preferred the smaller sculpins that are sometimes found in nearby streams close to the community, as opposed to the larger fish caught in the ocean (111016SCM03). They explained that the preference was based on taste, and that the larger sculpins were too salty compared to the smaller sculpins. One fisher talked about sculpin abundance and distribution.

> This [devilfish] is very abundant species along the coastline. It's available spring, and mainly in the summer. So our ancestors have caught these…these are just like migratory fish, you know, they're further out in the ocean and if the weather changes, summer's growing, and towards fall time they become more abundant on the shoreline. All along the coastline. (033018SCM01)

The elder talked about how people harvested sculpin in the past, as explained through a translator:

> Our ancestors back then used kayaks, and dragged their net really slow along the beach to get these [devilfish]. They're very abundant mainly in the fall time. (033018SCM01)

This lifelong fisher was born and raised at seasonal camps 30 miles north of Scammon Bay and roughly 20 miles inland from the coast. Through a translator, he shared a story about his first sculpin harvest:

> Growing up inland, this species [devilfish] he did not know about. Because mainly they're mostly saltwater fish. First time I guess further towards the coast, when he

25. C. McDevitt field notes, November 2016, March 2017, and March 2018.

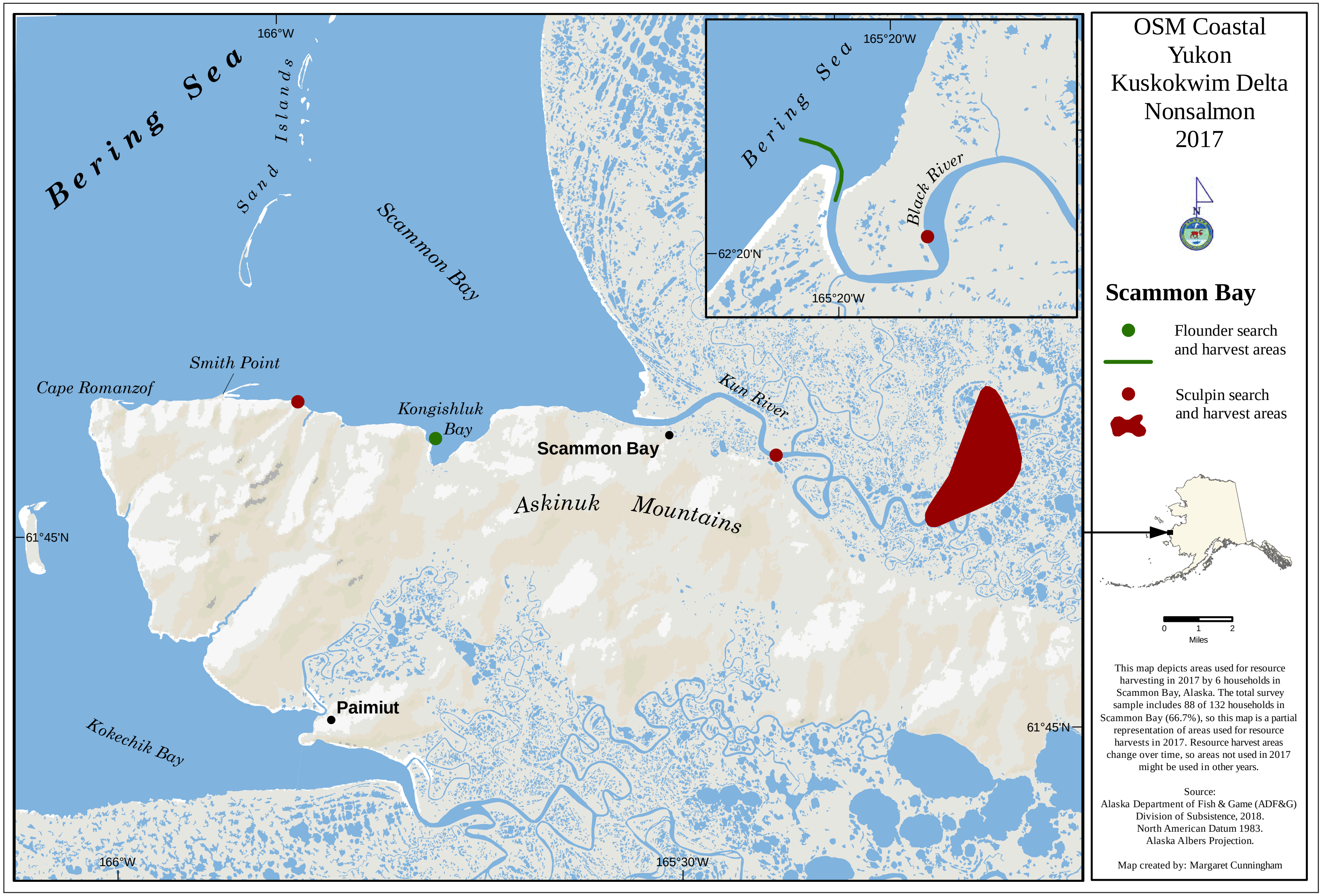


Figure 2-16.–Flounders and sculpins fishing areas, Scammon Bay, 2017.

first caught one of these he thought it was monstrous fish…If you have never seen it before, scare the living daylights out of you for a while. He's stating when he first caught this fish [devilfish] in his net and this was the first time he ever see one, he literally didn't realize they had these sharp barbs and he cut his finger from it. So he stomped it with his foot. Pull it out of his net, threw it back out. Little did he know, it was one of the few tastiest fish to eat. (033018SCM01)

The search and harvest areas for marine invertebrates included several locations along a 12-mile stretch of coastline beginning near the mouth of the Kun River and extending to Smith Point (Figure 2-17). Residents also collected marine invertebrates on the south side of the Aksinuk Mountains, from approximately five miles southeast of Cape Romanzof to roughly three miles further south Community members also harvested marine invertebrates from the Sand Islands, roughly ten miles west of Scammon Bay. Residents also searched for and harvested marine invertebrates along the coastline north of the community to Black River. One respondent explained that mussels were typically harvested along rocky stretches of coastline nearer the Askinuk Mountains, whereas clams were harvested from sandy shoaled areas such as the Sand Islands (110916SCM05). These observations were corroborated by several other residents.[26]

Observations of Changes Affecting Nonsalmon Fisheries

Researchers asked survey respondents whether they have observed any changes in local environmental conditions or any changes to nonsalmon fish and marine invertebrate resources. Surveyors documented the kinds of changes that respondents reported observing and how these changes may have affected their households' use of these resources. Following is a summary of observed changes and their effects on household harvest and use of subsistence nonsalmon fish and marine invertebrates. Some households provided one or more observations, and others did not offer any additional information during the survey, so not all households are represented in the summary.

Over one-half of survey respondents (45 of 88) provided a total of 88 responses when asked by researchers if they had observed any specific environmental changes in recent times (Table 2-11). Of these 88 responses, roughly 36% (32 of 88) were concerned with climate change and seasonal timing. Comments such earlier breakups and later freeze-ups were commonly discussed and were often augmented with examples of how these conditions affected nonsalmon fishing activities for individuals. One lifelong subsistence fisher explained how later freeze-ups forced him to adapt.

> I guess it just sort of changes my schedule. It freezes up later. We set nets under the ice later. We set blackfish traps later. It's just one of those deals where you just, what do you do? (110916SCM05)

Another fisher talked about how later freeze-ups and earlier breakups affected his access to fishing areas during times when certain nonsalmon fish species were most abundant. "Sometimes we're a little bit late. And we're not catching. What do you expect? Because they're going out. Fish are going out. They're already out [and we've missed our opportunity]" (111016SCM03).

Poor ice conditions in recent years directly affected the nonsalmon fishing activities of many Scammon Bay fishers. Approximately 14% (12 of 88) of the responses were directly related to ice conditions. Comments such as increasingly thin ice conditions and an overall lack of ice were the common themes among these responses. Access to specific search and harvest areas are highly dependent on a sufficient amount of ice on which to travel and fish. One fisher talked about the types of ice conditions that needed to exist in order to travel safely.

> It's the thickness of the ice that counts. Yeah. Four and a half, five inch. I wait myself until the ice is four inches. If we can run our snow machines over the ice. Some of the men they head to Black River by snow machine once it's safe, safe enough to cross and safe enough to set the nets in Black River for lush, mainly. (111016SCM02)

26. C. McDevitt field notes November 2016, March 2017, and March 2018.

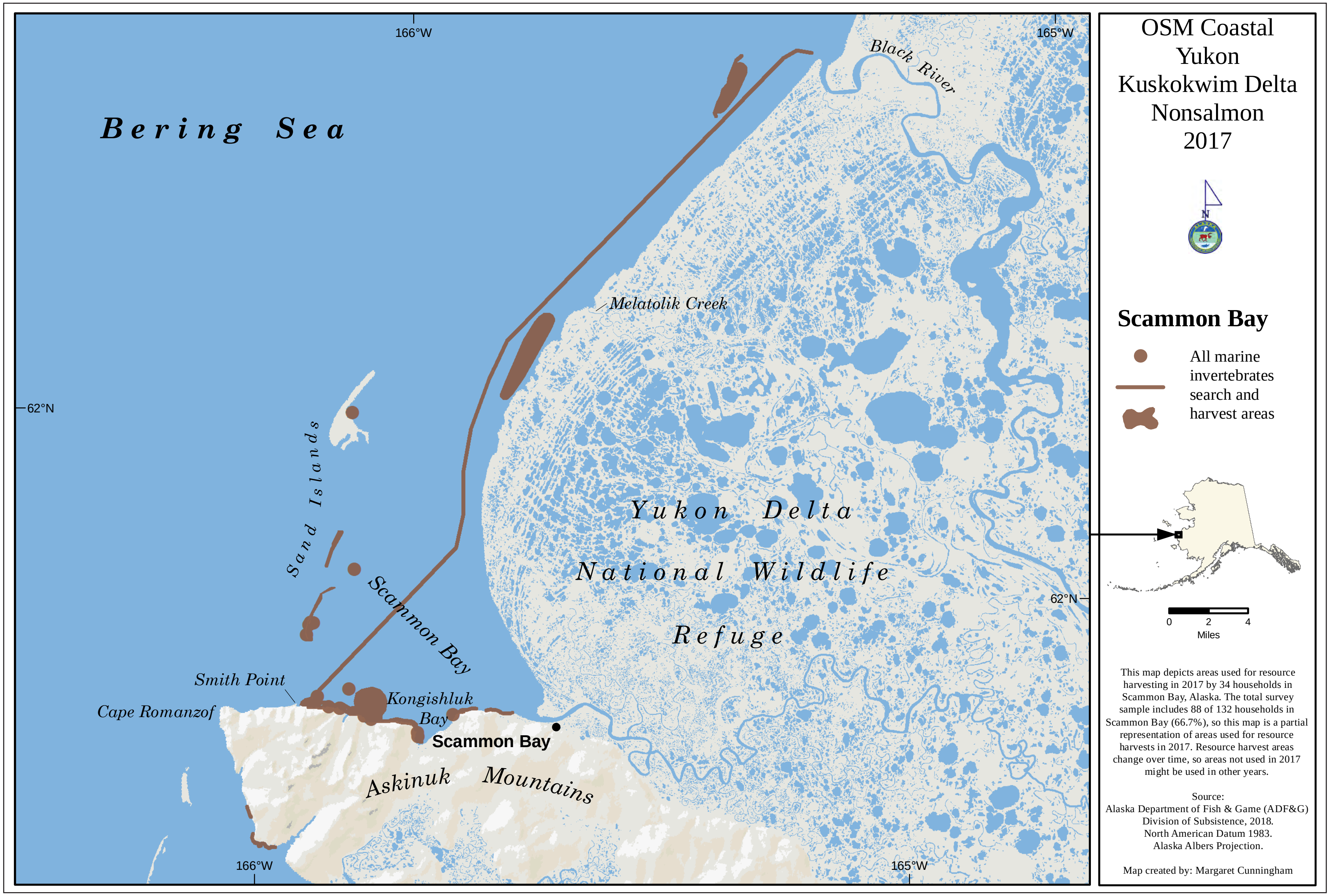


Figure 2-17.–Marine invertebrate collection areas, Scammon Bay, 2017.

Table 2-11.–Observations and observed effects of changes in environmental conditions, Scammon Bay, 2017.

Observations	Effects
Warmer winters, lots less ice, less snow. Landmarks for trails going down. High ground sinking, all flat now. Weather has changed a lot. Used to snow in August, melt in April of May. 3–4 months of summer. Ocean is closer now and open more and more. Timing of snow is later, just getting here.	Adapt—pay attention as best you can. See where you are going by, where you have been. Now it [open water] is right there all year
Spring is faster, fall is slower.	Just adapt; boating to November
Big flooding non stop, ocean level went up. Flooding every year even in spring too. Permafrost melting. More storms in fall, blew away weak ice, boating in November	Hard to say. Sept or Oct—high floods; fish get pushed inland and stuck in lakes
Fall floods, late freezeup, early breakup	Affect blackfish. Can't set nets, affects timing
Fall floods, late freezeup, early breakup	Fish pushed back by flooding, get stuck in lakes and can't get out (change location)
Global warming, pollution from trawlers dumping water, water affecting land = decline in fish numbers	[Fish] declining in some areas
Really changing—warmer, less snow, back and forth a lot hot cold, hot cold	Less fish, must be the reason. Salmonberries need the snow.
Lack of snow and warmer climate	Smelts didn't hang out long; herring
Warmer water. Erosion filling in channels, creating shallow areas = warmer water	Chums swimming deeper. Used to swim up Black River in shallow areas. Bigger fish being affected, not so much with smaller fish
1. Beaver dams disrupt stream flow. 2. Storms are more frequent. 3. High water. 4. Freezeup later thaw earlier. 5. Bad ice so we don't go to Cape Romanzof	1. Pike, lush are less abundant; blackfish stay in lakes where we don't catch them. 2. Stay close to others—and go out less. 3. Blackfish stay in lakes. 4. Miss timing of smelts and tomcods
Less cold, later freeze by a month. Flooding with salt all over the land.	(White)fish move before we set the net; less blackfish
1. More sand bars in the ocean. 2. Warm weather in fall seasons.	1. Block fish from coming in close. 2. Fish don't show up—they stay way out there where it's deep
High water in fall	[Note from back page] Dead tomcods near Black River. Maybe got stuck in lakes during high tide floods.
Global warming	Winds affect fish migration
Beavers. So warm.	Fish can't pass [burbot]
Everything came early. Break up is early	People missed opportunity
Warmer temps	Smelt fish coming in later
Freeze ups late; less ice, less snow, lots more erosion. Bank caving in 2–4 feet per year. Early spring.	Timing for halibut
Water temp warmer. Warmer. No southwinds—affects snow, stays soft melts out fast in spring.	Affects timing. Have to adjust approach to access, where to set nets, search additional locations
Less snow	Access
Warming—winters are short and mild—dangerous when doesn't freeze	Be careful—later in fall, earlier in spring

-continued-

Table 2-11.–Continued

Observations	Effects
Flooding more often	Hard to get out
Windier than normal (last year) Used to be a lot more snow	Too rough for ocean. Low water—access.
Late winters.	For smelts is seems like now you can't get on the ice and fish them because they run strong in October/November and the ice hasn't frozen by then
More wind and late spring	Can't use boats as much anymore; wind no good for clamming
Drier all seasons. Lot warmer now, longer to freeze, always dangerous.	Move slower or don't go at all
Mild winters, not cold until December/ Then in January snow, snow storm after snowstorm—lots of waiting for flights	Didn't go for tomcod out at Smith Point. Ocean too close and dangerous
Climate change affects all. Pollution	Fish stay out farther in cold water. Fish migrating elsewhere
Thin ice	Access
Stream in town not freezing over. Warmer winter, warmer ground water. More rain instead of snow	More freshwater in saltwater/brackish areas might affect fish migration
Smith Point doesn't freeze anymore, since 2000s	Not catching tomcods like we used to—can't get out.
Thin ice	Access to tomcods
Bad weather, very little ice (thin, absent)	Access
Warmer temps. Short window to go halibut fishing. We don't get any long warm days to target halibut. Days are more stormy now.	Less opportunity to go halibut fishing
Winter ice isn't thick	Late freeze up—slows us down, takes longer to get what we need. Keep trying.
When ice stays in, fish pass under it; seasons now, early break up—unsafe most of the time.	Harder to get them without ice; dangerous
Thin ice and melting fast	Limits spring fishing.
Melting earlier—open water closer than earlier in my life. Used to freeze end of September, now boating in November	Still catching
Warmer, less snow	Talk to the men
At low tide mud discoloration—strange	Unsure how this affects fishing. May have impacted water quality.
More water, rising water. More vegetation. Global warming	
Never seen it like this winter: warm, cold, warm, cold. Less snow.	
Everything's changed—weather, tundra. Where he was born it sank down	
Global warming.	
El niño, warmer water	

Source ADF&G Division of Subsistence household surveys, 2018.

Another fisher talked about how the absence of adequate ice conditions affected fishers who traveled to the south side of the Askinuk Mountains to search for and harvest whitefishes.

> They don't have ice to go other side like they usually do, to go out and get the *imarpinraq* [Bering cisco]. So it's not safe for them to travel. That's one thing that affects a lot of fishing. (111016SCM03)

Of the 88 responses, 8% (7 of 88) spoke directly to winter precipitation. Several respondents talked about an overall lack of precipitation during more recent winters, and how it affected their ability to travel by snow machine to certain nonsalmon fish search and harvest areas. In addition, one elder talked about the relationship between winter precipitation and blackfish survival and distribution. As explained through a translator:

> For example, they [blackfish] live in one area all winter and [if] there's a lack of snow and…there's not enough high water and freshwater to replace it…not enough high water, the water becomes stagnant. Stagnant, and they can't live in it long enough and they die off. What he's saying, it fluctuate. Depending on snow conditions and water conditions of our neighboring waterways, freshwater. And if there's not enough snow. And where they live becomes stagnant, you can smell it. Dig a hole, dead ground. It's very strong odor. It's like ammonia. The water gets stagnant, they die off. It's not replaced in the spring. Because…it depends on our snow condition and freshwater condition of our neighboring Yukon [River], that cleanses freshwater. Once there's not enough snow, the lakes, stream, becomes stagnant; they die off. And what he's stating before, where they grew up and if it's a healthy, you know, ecosystem around there, they stay there from one [season] to the next. Once there's some changes like lack of water, they move on to better, you know, waterways. Fresh water. (033018SCM01)

Several respondents also discussed fall flooding in the Scammon Bay area. According to many respondents, fall storms were typical occurrences each year, but have intensified considerably in recent times. When asked about the frequency and intensity of these storms, one elder stated, "Fall storms…here's the deal we get 20-year storm every year now…It was just sort of a maybe a sudden deal here. It seems like we have a flood every year" (110916SCM05). According to many elderly and middle-aged respondents, in the past, thick ice conditions would be established by late September or early October. They explained that the ice would act as a natural barrier to suppress the effects of these annual storms. In more recent times however, the lack of ice or poor ice conditions exacerbated the wind damage and other effects of storms, which in turn resulted in severe flood conditions in and around the community. Two key respondents talked about a particularly bad storm that occurred during the fall of 2013.

> One of the floods three years ago…we had big tidal surge here and it broke up all the ice and we were able to go out seal hunting in December. But that ice was damaging lots of boats. Damaged maybe like three or four boats down in the river. You see tree trunks all over. Damaged our airport very bad. It lasted, it lasted about maybe four or five hours. (111016SCM03)

One elder described how powerful the winds became during one of these storms.

> Well, for like, for instance you talk about winds coming in, out in the ocean. And we didn't have this kind of winds. Not that much winds. Not this big winds. We had a cabin out there…Ten minute boat ride out from here. His brother's house. A cabin out there. I think it was 16 by 20. The wind picked it up and blew it around and busted it all up. That's what kind of winds we're getting now. (111016SCM03)

Another elder discussed the effects of flooding on certain nonsalmon fish species, such as blackfish. "A lot has to do with the fall floods. The areas where, especially, there's a lot [of blackfish], and I think the blackfish are freshwater fish, 'cause my dad said once they reach saltwater they die" (110916SCM05). Freshwater habitats become inundated with saltwater during storm events, and the saltwater is believed to kill as well as displace certain nonsalmon fish species. This key respondent explained that he was forced to search elsewhere for blackfish. "I don't go to the same place anymore. I have to go further up in order to try to get blackfish" (110916SCM05).

The same key respondent indicated that the floodwaters also affected his family's ability to harvest saffron cod. He explained that he and his family members could not access the areas they typically searched for and harvested saffron cod from due to extremely high floodwaters (110916SCM05). The respondent added that other natural phenomena, such as a super moon[27] event that had just occurred a couple of weeks prior to the interview, also factored into the flooding.

> I know that super moon had a heck a lot to do with our high tides last month…it was that very super, very bright moon and boy did we have high water. Very high water…people are wondering why are we having such high tides. You see it come out every night, moon is very bright. Higher than normal tides for almost a week. You know these floods a couple of weeks ago, there was never ever really a storm. Yeah, just a lot of high water. And it wasn't, we didn't have hurricane or typhoon really affecting us. Just flooded. And that's the one change this year. We didn't get a twenty-year storm, but boy did we flood. (110916SCM05)

Some respondents talked about increasingly warmer water temperatures in recent years, in marine as well as freshwater environments.[28] One respondent indicated that warmer waters impacted fish distribution. He explained, "It impacted us very much. Yeah, water warming up. We're not catching as much as, from last year. There's a lot difference now. We're not catching as much as we did" (111016SCM03).

A total of 34 responses were gathered from respondents who expressed concerns about fish health (Table 2-12). Some fishers explained that they harvested sickly looking fish both in 2017 as well as during previous seasons. The majority of the observations provided about sick fish pertained to smelt and saffron cod, specifically. Respondents described harvesting smelt or saffron cod with approximately one-inch, raised, circular black spots on the lateral portions of the body. One respondent indicated that seeing these lesions on smelt or saffron cod was a relatively new occurrence in the Scammon Bay area.

> We didn't see them [sick smelt or saffron cod] many years ago. Now they're, we're seeing a lot more. These few, starting maybe five, six years ago, start seeing this stuff. More and more coming up with tumors, black tumors. We don't even know where it's, how it's, they get those. Discoloring of, or a little bump on them. It's like some indication of some kind of disease. (111016SCM03)

Respondents who caught these fish either fed the infected fish to dogs, used it for bait, or threw it away.

During participant observation in March of 2017, the author harvested one of these affected smelt. The fish was cut up and used for bait after photographs were taken. After returning from Scammon Bay, the author shared his photographs of the infected smelt with an ADF&G fish pathologist. The fish pathologist indicated that the smelt was infected with phaeohyphomycoses, a fungal infection typically observed on saffron cod and smelts that is most prevalent in the late fall and early winter.[29] The author shared this information with the Scammon Bay Tribal Council and provided them with literature and a public notice (Plate 2-15).

Some respondents believed that the increasing presence of beavers affected the distribution of certain nonsalmon fish species: beaver dams reduced the abundance of fish upstream from beaver dams in certain search and harvest areas.[30] One elder explained that beavers are a relatively new animal to the Scammon

---

27. A supermoon refers to a new or full moon that occurs at the same time when the moon is closest to earth and has the strongest gravitational pull. The resulting tides that coincide with a supermoon are referred to as perigean tides. NOAA Ocean Service, n.d. "What is a perigean spring tide?" Accessed January 15, 2020. https://oceanservice.noaa.gov/facts/perigean-spring-tide.html
28. Survey notes and C. McDevitt field notes November 2016, March 2017, and March 2018.
29. Ted Meyers, ADF&G fish pathologist, Juneau, AK, email correspondence with C. McDevitt, March 28, 2017.
30. C. McDevitt field notes March 2018.

Table 2-12.–Observations and observed effects of changes in nonsalmon fish and marine invertebrates, Scammon Bay, 2017.

Observations	Effects
Used to have lots of blackfish at camp.	I don’t know
Spots on tomcods, smelts.	Doesn't eat.
Black spots on the tomcod and smelt. Fukushima?	Throw them back and wonder.
Spots on chum.	Doesn't keep.
Blacks spots on salmon and tomcod and smelt started 4 or 5 years ago. Not much, now there are a lot—300/400.	I'm afraid, throw those back or to foxes.
Black spots on tomcods, smelts.	Don't eat.
Seems like less halibut.	
Black spots on smelt, tomcod.	Throw back.
Pus in chums, tomcods, herrings—black spots.	Don't eat.
Fish and birds getting smaller every year.	
Herring run seems off but not a fisher.	
Black spots on smelts.	Don't eat.
Black spots on smelts and tomcods.	Don't eat—dog food.
More tumors on cod—maybe last 15 years. More pus in salmon, especially chum (not tumors).	Throw those away.
Lots of herring that were earlier.	Caught less.
Way less salmon, lots more time and work.	
Black spots on tomcods, smelts.	Doesn't eat.
Halibut were early; fish in July usually catch. Herring were early maybe—or 2nd or 3rd pulse not abundant. Pacific cod had rock-hard sores, infections from catch and release.	Missed them. Lots more salmon.
Warmer. Sometimes tomcod have black spots. Smelts lots more last year.	Throw those back.
Sick chums, maybe sores?	Don't eat.
Our fish have black spots (smelts and tomcod). I think it's the landfill.	We don't take them, we just leave them by the river.
Tumors on humpback, smelts, and tomcods.	Dog food.
Bubble on skin of tomcod	Don't eat.
Last time I caught tomcod with sores	
Black spots on tomcods.	Don't eat.
Blackfish—quiet VHF, usually every other day. Run times less predictable	
Less blackfish out there because of salt water.	
Black spots on tomcod and smelt.	Set aside or use for bait.
Mold on smelts, tomcods. Started seeing 5–10 years ago, blue green color	Doesn't eat.
Smelts have black spots.	Don't use them.
2–5 years ago discoloration on chums, and "glow in the dark" tomcods several years ago	Don't eat.
Black spots—chums and cohos	Doesn't eat/keep—dog food.

-continued-

Table 2-12.–Continued.

Observations	Effects
Discoloration on chums and kings, sores. Looked healthier when he was young	Doesn't eat.
Black spots on tomcods	Don't eat.
Black spots on tomcods and smelts	Doesn't eat.
Sores on whitefish	Doesn't eat.
Salmon in ponds—nasty big floods push fish inland	
Black spots on tomcods, injured eyes—also with cisco	Don't eat.
Tomcods/Pacific cod—black spots	Doesn't eat.
Tomcods/smelt had black	Don't eat these.
Smelts are sick	Don't keep them.
Smelts had lots of worms. Pustules in salmon—dark lesions along fins and back. Tomcods as well have pus and black along gills	Don't eat—leave them out.
Less tomcod—fishing or fish? Both. 1960s diesel spill at Romanzof—used to tomcod right there Smith Point too	
Tumors on smelts and tomcods	Throw on ice for birds.
Black spots on tomcods	Don't eat.
Whitefish are less abundant; tomcod and smelts have black stuff on them	Don't take them.
Where's the halibut	Hardly any.

Source ADF&G Division of Subsistence household surveys, 2018.

Plate 2-15.–Harvested smelt infected with phaeohyphomycoses, a fungal infection found on smelt and saffron cod.

Bay area: "We didn't know what beaver was…we just found out that there was this animal…That was about twenty years ago…And the problem with that is probably beaver dams all over. In the creeks where they [nonsalmon fish] go up. And that's one of the causes [of disrupted distribution and lower abundance]" (111016SCM03).

This elder described how beaver dams altered the habitat and affected distribution of a variety of nonsalmon fish, including blackfish.

> It's hard to find them now. It depends which slough. You gotta look, you know, because we're not catching as much [nonsalmon fish] as we used to anymore, and blackfish too. And there's beaver dams around. All over this area. Messing up rivers. Beavers are messing up sloughs, there's no more sloughs in summer anywhere. You can't [find any sloughs], they're dried up now. Mostly grass in that area now. (111016SCM03)

The elder emphasized that many kinds of nonsalmon fish are affected by beaver dams. However, the elder briefly spoke about the conflict that controlling the beavers presented to his own traditional values.

> Another thing that our people, our mom and dad, my mom and dad used to tell me, "Don't catch anything what you wouldn't eat" or "Don't waste anything," you know. Don't kill unless you're going to do something about it. You know, that's one of the things that we follow too, so. But right now I don't think I want to see beavers anymore. (111016SCM03)

This elder also discussed how erosion was changing fish habitats. Eroding riverbanks have filled in the channels of some waterways in the area, so people have had to adapt their fishing techniques.

> Wherever that erosion was, it's shallow area. In our time, many years ago, we fished right where the channel is and there was no problem. But right now if we try to fish in that same area, it'll be too much in the middle of the river. We need to set our net right where the channel is, right on the edge of where the deep water is. And the land, the land would be full up. It didn't used to happen like that. Nowadays there's a lot of change. Yeah, we have to look for better spots. (111016SCM03)

The elder believed that melting permafrost was the cause of the erosion.

> I have a fish camp up last year across the river. And I used to dig maybe four, five inch and I would hit the permafrost. But now I could dig further down. Before I even reach the permafrost. Like I told you, erosion. There's no more permafrost. (111016SCM03)

Local Comments and Concerns

Following is a summary of local observations of nonsalmon fish populations and trends as well as related comments and concerns that were described during the surveys and ethnographic interviews. Some households did not offer any additional information during the survey, so not all households are represented in the summary.

Many of the comments and concerns shared by respondents were similar in nature to the responses provided in the previous section (Table 2-13). Respondents talked about the general warming trend in the area as it pertained to air and water temperature. They also talked about abnormal timing for weather and for fish movements, deteriorating ice conditions, and fall storms. Some residents mentioned a decrease in blackfish abundance, and one respondent indicated that whitefish populations had increased due to the increased availability of prey such as sticklebacks and krill. Some respondents talked about pollution in the area of Cape Romanzof. Lastly, others wondered about the fallout from the Fukishima nuclear disaster of 2011: specifically, if any fish harvested from Alaska waters had been tested for radiation.

Table 2-13.–Respondent comments, Scammon Bay, 2017.

Wonders if salmon quota will be lowered (commercial fishing)
People running over net with boat/ motor damages net, can't set = less fish
Fish stage in Black River—slower current.
Not really. Seems like more cods swimming north. Water temp is rising—now it's thin ice out there. Not like it used to be.
ADFG comes to Scammon Bay too late—people forget what they catch.
Greens too dry.
The weather had changed so much. More storms—lake freeze up—early thaw.
People say the ice isn't far enough for tomcoding
Keep studying—smelts and tomcod
Contaminents with salmon? Water? Fukushima disaster?
More fish (whitefish)—because of more needlefish and krill. More tomcods and smelts. Saw a lot more whitefish in 2017. Thinks its due to increase in food sources (krill, tomcods, and smelts).
Snow geese changing migration, fly right by. Used to be all day and night come in to rest in flats a couple weeks now they take the Yukon, stay north longer and fly by. Glad to have unrestricted subsistance fishing (kings)! All that hardship paying off. Still have chums from 2 years ago.
Too many rules open wrong time (chums, kings) since he's been aware—elders were the Fish & Game: don’t take too much, don’t waste, take what you need.
Sometimes they are early and sometimes they are late.
Every year is always the same—global warming is fake. I was injured last year, I don’t do subsistence just catch fish when I want to eat it
Timing is different used to freeze up earlier (late Oct) now freezing later (Dec). Water temps affect migrations.
Dead tomcods near Black River maybe got stuck in lakes during high tide, floods. 15–20 years ago saw people from radar station burying toxic waste near Cape Romanzof. Saw hairless seal pups with sores on island near Cape Romanzof—2 years ago not healthy summer (June).
Less blackfish—past 5–6 years.
Caught huge pike in Kun River. No more blackfish—do not go near metal (steel, aluminum)—garbage. Have to travel further for blackfish.
Caught "salmon size" broad whitefish.
When working at Emmonak, lots of fish thrown because too soft—water too warm. Lots of waste. Fish is a big part of the diet here (salmon and nonsalmon).
Pike eat everythings—targeted to keep population down but it grows.
Used to commercial in Cape Romanzof.
Last year was a record year for worms in the salmon.
They need to do more testing at Cape Romanzof. Carcinogenics and pollutants and spills. It cycles through species.
Open king season.
Predictions that north wind bring plenty of fish especially salmon. South wind in May they get pushed to Kotlik. Go fishing.

Source ADF&G Division of Subsistence household surveys, 2018.

Acknowledgments

The author would like to thank all Scammon Bay residents who participated in the survey. He would also like to thank all staff members at the Scammon Bay Traditional Council office as well as all council members. In addition, thanks to the Scammon Bay school for lodging, thanks to all local research assistants who helped with the study, and a special thanks to Seth Aguchak for use of his snowmachine and for guiding the author to popular nonsalmon fishing locations. Thanks to Darren Smith for also guiding the author to nonsalmon fishing locations. Lastly, the author would like to thank Peter George for his real-time translation of key respondent interviews as well as all key respondents who took the time to sit down with staff and share their invaluable knowledge about the Scammon Bay area and nonsalmon fishing. A sincere thanks and remembrance to Felix Walker and Sebastian Kasayuli, two lifelong fishers and knowledgeable key respondents who passed on before this report was published. Quyana cakneq.

Plate 3-1.–Nightmute from the air.

3. NIGHTMUTE

Christopher R. McDevitt

In the spring of 2018, two Division of Subsistence staff worked with two local research assistants to conduct nonsalmon subsistence harvest surveys with households in the community of Nightmute (Plate 3-1). Researchers surveyed 34 of 54 (63%) randomly selected households that spring (Table 1-7), and the average survey length was 29 minutes (Table 1-8). The 2017 total nonsalmon fish and marine invertebrate harvest for the community of Nightmute translated to 252 lb per capita (Table D3-1).

In addition to the household surveys, ADF&G researchers conducted three key respondent interviews with three lifelong Nightmute subsistence fishers. Key respondents shared their knowledge, experiences, comments, and concerns, and they provided researchers with invaluable information regarding subsistence activities associated with nonsalmon fish, including seasonal harvest patterns and changes in fishing over time. This information helped to contextualize the quantitative harvest and use data collected in the surveys.

Community Background

The community of Nightmute lies at an elevation of 30 feet and is located along the north bank of the Toksook River on the southwest side of Nelson Island, approximately 15 miles inland and to the east of the Bering Sea coast (Figure 1-1). Nightmute is situated 17 miles upstream from the mouth of the Toksook River and sits at the base of the westernmost tundra ridge that extends south-southeast from the main body of Nelson Island. Nearby communities include the remaining two Nelson Island villages of Toksook Bay and Tununak, both of which lie to the northeast of Nightmute, approximately 14 and 20 miles, respectively.[1]

1. Google Earth V 7.3.2.5487. “Nightmute.” 60º28’46.00 N and 164º43’26.00 W. Landsat / Copernicus. 2019. Digital Globe. Accessed November 14, 2018.

According to several Nightmute Traditional Council members, the Central Yup'ik word for the community is *Negtemiut*.[2] This translates to "people of the pressed-down place" and refers to the consistently strong windy conditions that characterize this portion of the island.

The landscape to the east, west, and south of Nightmute is typical of the Yukon-Kuskokwim Delta and features expansive treeless tundra flats and extensive wetlands networks. North of Nightmute, a series of mountainous ridges alternates with low-lying valleys that contain numerous ponds, lakes, and creeks, most of which discharge into the nearby Kolavinarak River. The far northeastern end of Nelson Island eventually terminates at the shores of Baird Inlet, a 35-mile-long body of water that is the source of the Kolavinarak River.[3]

Inhabitants of Nelson Island, historically known as the *Qaluyaarmiut* or "dipnet people" in Central Yup'ik (Fienup-Riordan 2011:4), have occupied Nelson Island for over 2,000 years.[4] The island's remote geographical setting coupled with the "lack of commercially exploitable resources" deterred non-Native commercial interests, and local inhabitants remained relatively isolated from Western influences well into the 20th century (Fienup-Riordan 2011:4). As a result, the *Qaluyaarmiut* have maintained their traditional customs and continue to adhere to seasonally dictated subsistence activities to the present day.

In 1957, the Bureau of Indian Affairs established a school at what would become the present-day community of Nightmute at a location that was traditionally used as a winter camp for inhabitants who lived on the south side of the island. Families who lived in nearby camps such as Monrak, a seasonal camp situated on the middle Kolavinarak River, began to migrate westward to Nightmute to take advantage of newly established services (110518NME02). Families would stay in Nightmute through winter and move in the spring to various other camps, such as Umkumiut,[5] a traditionally used herring camp approximately four miles west of Toksook Bay (Fienup-Riordan 2011:11).

In 1964, several Nightmute families moved to the traditional spring camp known as Nunakauyaq, now the community of Toksook Bay. The impetus for the move was based on the availability of and proximity to various subsistence resources, fear of losing usable land to erosion, and a desire to be situated in a location that provided easier barge access to the community (Pete 1984). Because the Toksook Bay area is close to marine mammal hunting opportunities as well as freshwater and marine fish resources, families were no longer obligated to travel extensively between seasonal camps, as they had in the past. According to lifelong Nightmute resident John George, the move to Toksook Bay was influenced by the concerns of families who feared that the Toksook River would eventually "dry up."[6] George explained that during the time shortly preceding the move, the dynamics of the Toksook River underwent significant changes, which continue through the present. Oxbow lakes (referred to as "cutoffs" by George) began to form a few miles upstream from the river mouth as well as upstream from the community itself. According to George, prior to the formation of the oxbows, the Toksook River had no noticeable current and was not significantly affected by incoming and outgoing tides. After the oxbows formed, however, the flow of the river increased, as did tidal influences, which affected water levels. Nonetheless, about 70 families remained in the area. George noted that these families stayed because of the abundant freshwater fish resources in and around Nightmute (111518NME01).

The community of Nightmute was incorporated in 1974 and has since undergone substantial growth in terms of infrastructure development. A series of boardwalks and all-terrain vehicle trails link different

2. Nightmute Traditional Council, project approval meeting, May 2017.

3. Google Earth V 7.3.2.5487. "Nightmute." 60º28'46.00 N and 164º43'26.00 W. Landsat / Copernicus. 2019. Digital Globe. Accessed November 14, 2018.

4. Alaska Department of Commerce, Community, and Economic Development (ADCCED) Division of Community and Regional Affairs, Juneau. n.d. "Alaska Community Database Online: Community Information." Accessed March 7, 2019. https://dcra-cdo-dcced.opendata.arcgis.com/

5. Roughly translated to "the people of the rock that stands off by itself."

6. John George, Nightmute resident, telephone conversation with C. McDevitt, November 15, 2018. The story of the move to Toksook Bay was told to George by his grandmother.

Plate 3-2.–Boardwalks provide access to many homes and services in the community.

portions of the community together (Plate 3-2). The community hosts a health clinic, tribal and city offices, a community hall, a gas station, a post office, a landfill, a sewage lagoon, two grocery stores, and a newly constructed kindergarten–grade 12 school.[7] Nightmute's electrical power is supplied by generators located in Toksook Bay and is delivered via a series of power lines between the two communities.[8]

Seasonal Round

Many Nightmute residents search for and harvest nonsalmon fish throughout the year. Accessibility to and the harvest of several different species of nonsalmon fish depends on a variety of environmental factors including snow cover, water and air temperature, ice thickness, and others. These factors directly affect subsistence users' access to specific fishing locations, which in turn may affect users' likelihood of successful harvests. In addition, these factors dictate fish movement, availability, abundance, and health. Although many nonsalmon fish species can be harvested throughout the year, Nightmute fishers tend to harvest certain nonsalmon fish during specific seasons. These seasonal harvests take place when species are in greater abundance or are in a physical condition that is preferable to fishers. One key respondent provided a concise ordering of seasonal activities.

> We start off with tomcod…Then we go down to herring. Then we go to salmon. Then we go to halibuts. Then whitefish. So, there's seasons for them, in the right time when their meat is thicker and [the fish contain] more eggs. (111518NME01)

The seasonal round for nonsalmon subsistence fishing activities for Nightmute residents starts in early spring as residents begin jigging through the ice for saffron cod. Subsequently, as the ice recedes in May, many families make the 22-mile trip from Nightmute down the Toksook River and across Kangirlvar Bay to Umkumiut. This traditional herring camp has been used by Nelson Islanders for millenia. Many Nightmute residents maintain permanent fish camps at Umkumiut.[9] During this time, Nightmute families prepare for the herring run, which typically begins in late May to early June depending on ice conditions; nets are mended, boats and motors tended to, and beach grass harvested. Nightmute fishers harvest thousands of

7. The construction is scheduled to be completed in the spring of 2019.

8. Nick Tom, Nightmute Tribal Administrator, personal communication with C. McDevitt, March 2018.

9. C. McDevitt field notes, March 2018.

pounds of Pacific herring[10] and herring roe during this time. As herring are processed, hung to dry, and subsequently stowed away, fishers begin to focus their harvest efforts on other marine fish such as Pacific halibut[11] as well as freshwater nonsalmon species found in lakes and streams further inland. Fishers also harvest anadromous fish species such as salmon during the summer months. Several species of whitefish as well as smelt are harvested throughout the fall. In addition, Nightmute fishers harvest northern pike[12] and burbot (locally known as "lush") during this time, although fishing efforts for these species also continue into the winter months. Many fishers set Alaska blackfish[13] traps in various locations throughout the fall and winter as well.

Population Estimates and Demographic Information

Surveys conducted in March 2018 for the 2017 study year recorded demographic and nonsalmon fish harvest and use information from a sample of all Nightmute households that resided in the community for at least six months of the study year. Surveyors attempted a census of all households and achieved a sample of 63% (Table 1-7), and demographic data were expanded to estimate a total population for the community. Survey results estimated a total population of 234 individuals residing in 54 households in 2017 (Table 3-1; Figure 3-1).

The U.S. Census Bureau identified 59 households in Nightmute in the 2010 decennial census (2010 Census) with a total population of 280 (Table 3-1). The U.S. Census Bureau American Community Survey (ACS) estimated a five-year (2013–2017) average number of occupied households of 42 and a five-year average population of 212. Differences between population estimates and counts by the Division of Subsistence, 2010 Census, ACS, and the Alaska Department of Labor and Workforce Development (ADLWD) are likely due to differences in sample sizes and variations in methods of expansion from sampled to unsampled households. For example, the 2010 Census count is based upon the total number of individuals who considered Nightmute to be their principal place of residence on April 15, 2010, whereas the Division of Subsistence population estimate is based upon a quantitative expansion of the number of individuals who resided in responding households in Nightmute for at least six months during the study year. Different population estimates are considered to be significantly similar if one estimate falls within the range of error calculated for another estimate.

Table 3-1.–Population estimates, Nightmute, 2010, 2013–2017, and 2017.

		5-year American Community Survey (2013–2017)		This study (2017)	
		Estimate	Range[a]	Estimate	Range[b]
Total population					
Households	59	42.0	32 – 52	54.0	
Population	280	212.0	173 – 251	233.5	205 – 262
Alaska Native					
Population	266	212.0	173 – 251	231.9	204 – 260
Percentage	95.0%	100.0%	76.% – 100.0.%	99.3%	87.4% – 100.0%

Sources U.S. Census Bureau (2011) for 2010 estimate; U.S. Census Bureau for American Community Survey (ACS) 2017 estimate (5-year average); and ADF&G Division of Subsistence household surveys, 2018 for 2017 estimate.
Note Division of Subsistence household survey elegiblity requirements differ from those used by ACS.
a. ACS data range is the reported margin of error.
b. No range of households is estimated for division surveys.

10. Herinafter, *herring*.
11. Hereinafter, *halibut*.
12. Hereinafter, *pike*.
13. Hereinafter, *blackfish*.

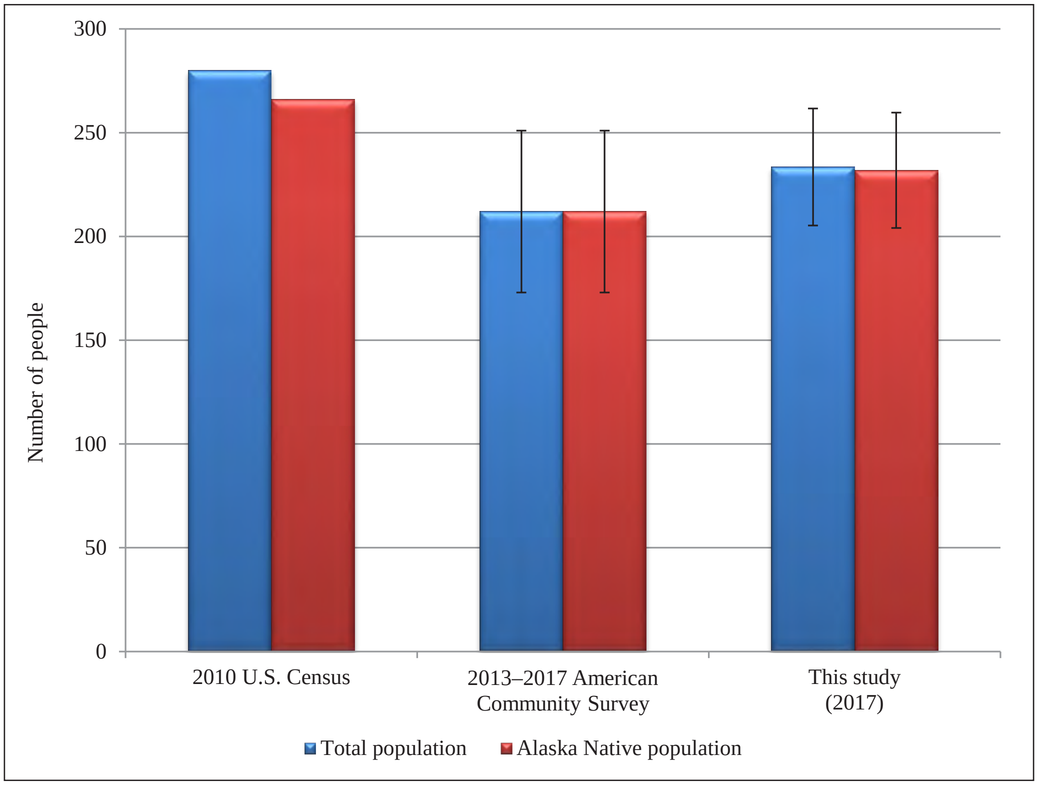


Figure 3-1.–Alaska Native and overall population estimates, Nightmute, 2010, 2013–2017, and 2017.

Historical census data for Nightmute indicated that the community has experienced substantial population growth since the middle part of the 20th century (Figure 3-2). The most notable increase occurred between 1950 and 1960, during which Nightmute's population grew by 778%, from 27 to 237 residents. This increase was presumably a result of the construction of a Bureau of Indian Affairs school in the latter part of the 1950s. As mentioned in the Community Background section, many families permanently relocated to the area from their traditional seasonal camps in 1957. There was also a 46% decrease in population from 1960 to 1970. As indicated in the Community Background section, in 1964 several Nightmute families relocated to the north side of Kangirlvar Bay area and subsequently established the community of Toksook Bay. Since 1980, the community's population has steadily increased to the present day.

Nightmute is a predominantly Alaska Native community, primarily Central Yup'ik. According to 2017 estimates, Alaska Native people made up 99% of the population (Table 3-1; Figure 3-1). This figure was greater than 2010 U.S. Census data and the five-year ACS estimate by four to five percentage points.

In 2017, the population of Nightmute showed some marked characteristics. Overall, male residents outnumbered female residents by 13%, or 124 males to 110 females (Figure 3-3; Table D3-2). Additionally, 56% of residents were less than 35 years old, which indicates that Nightmute was a relatively young community in 2017.

Average household demographic characteristics were also calculated from the data, as shown in Table 3-2. The average household size was four individuals. The average age was 29 years old, and the average length of residency for all individuals was 25 years; the average length of residency for household heads was 40 years.

Fifty-five percent of community residents were born to parents living in Nightmute (Table D3-3). Approximately 21% of residents were born to families in other Yukon-Kuskokwim Delta (YKD) communities, and close to 20% of the community was born elsewhere in Alaska, including urban communities such as Anchorage and North Pole. A lower portion of household heads specifically (43%)

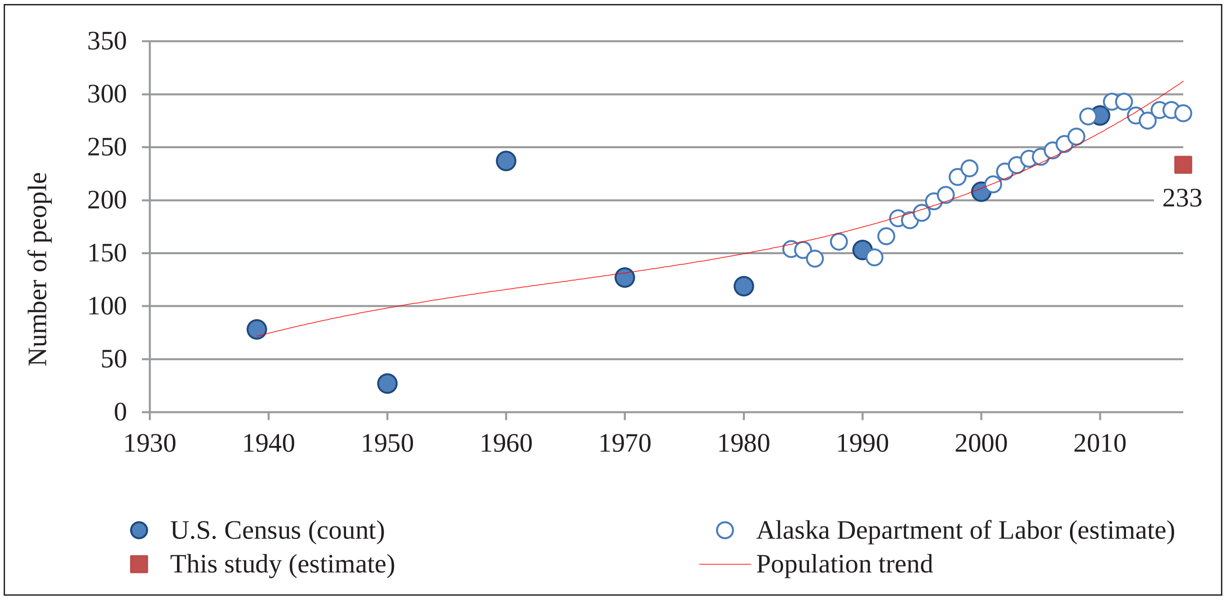


Figure 3-2.–Population estimates, Nightmute, 1939–2017.

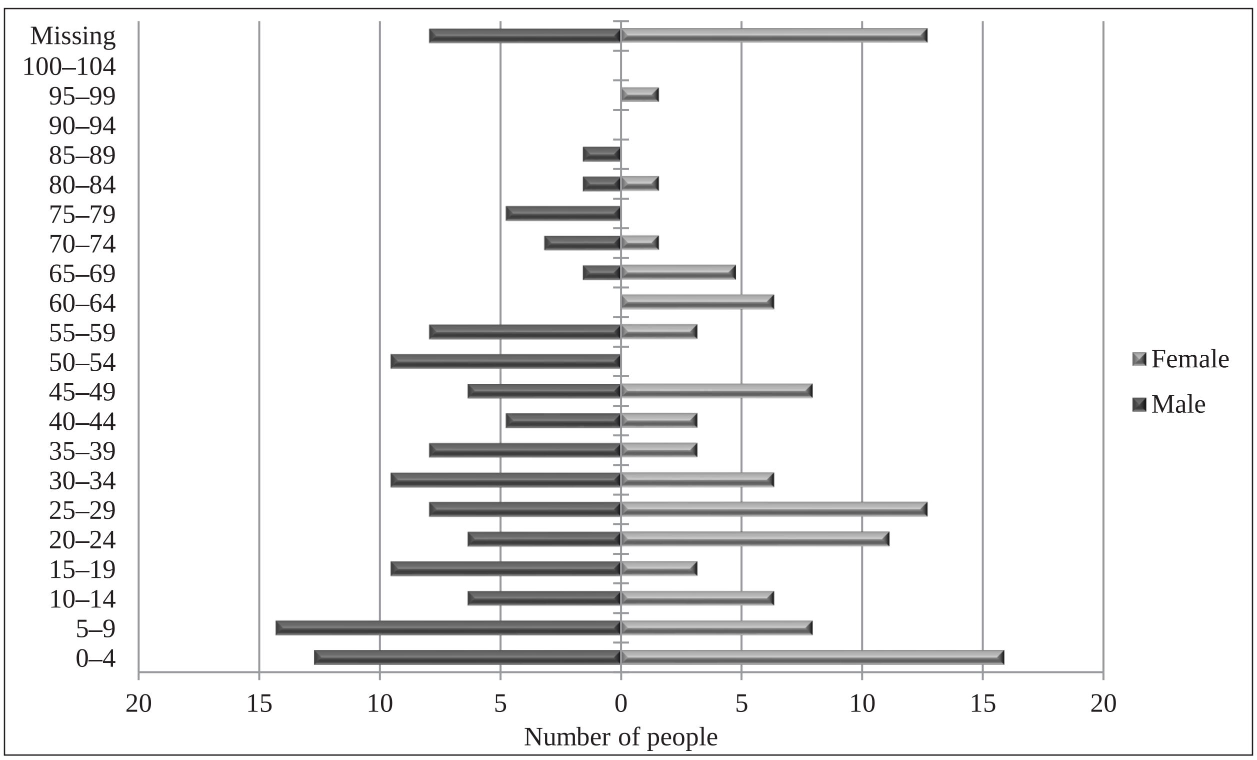


Figure 3-3.–Population profile, Nightmute, 2017.

Table 3-2.–Sample and demographic characteristics, Nightmute, 2017.

Characteristics	Community Nightmute
Sampled households	34
Eligible households	54
Percentage sampled	63.0%
Sampled population	147
Estimated community population	233.5
Household size	
Mean	4.3
Minimum	1.0
Maximum	11.0
Age	
Mean	28.6
Minimum[a]	0
Maximum	99
Median	28.0
Length of residency	
Total population	
Mean	24.7
Minimum[a]	0
Maximum	99
Heads of household	
Mean	39.8
Minimum[a]	2
Maximum	99
Alaska Native	
Estimated households[b]	
Number	52.4
Percentage	97.1%
Estimated population	
Number	231.9
Percentage	99.3%

Source ADF&G Division of Subsistence household surveys, 2018.

a. A minimum age of 0 (zero) is used for infants who are less than 1 year of age.

b. The estimated number of households in which at least 1 head of household is Alaska Native.

were born to parents living in Nightmute (Table D3-4). Approximately 25% of household heads were born in other YKD communities, and over 13% of household heads were born elsewhere in Alaska.

Summary of Harvest and Use Patterns

Harvest and Use of Nonsalmon Resources at the Household Level

Figure 3-4 shows the percentages of households that attempted to harvest, actually harvested, and used nonsalmon fish and marine invertebrates in 2017. Nonsalmon fish are a widely used subsistence resource among households in Nightmute. In 2017, 94% of the community used one or more nonsalmon fish species. All households that actively participated in nonsalmon fishing for any one species in 2017 (71%) reported successful harvests; this indicates both Nightmute fishers' abilities as well as their breadth of nonsalmon fishing knowledge.

Table 3-3 summarizes nonsalmon fish and marine invertebrate harvest and use characteristics for Nightmute in 2017 at the household level. The average harvest was 1,089 pounds usable weight (lb) per household. Community households harvested an average of eight different kinds of resources and used an average of 12 kinds of resources. The maximum number of resources used by any household was 21. In addition, households gave away an average of seven kinds of resources. Overall, Nightmute households used at least 26 types of fish and marine invertebrates (Table D3-5).

Harvest Quantities and Composition of Nonsalmon Fish

In 2018, surveyors recorded the nonsalmon fish and marine invertebrate resources harvested and used by members of responding households in 2017, and the data were expanded to estimate harvests and uses for the whole community. Table 3-4 lists the nonsalmon fish used by the highest percentages of households, and Figure 3-5 shows the species with the highest harvests during the study year.

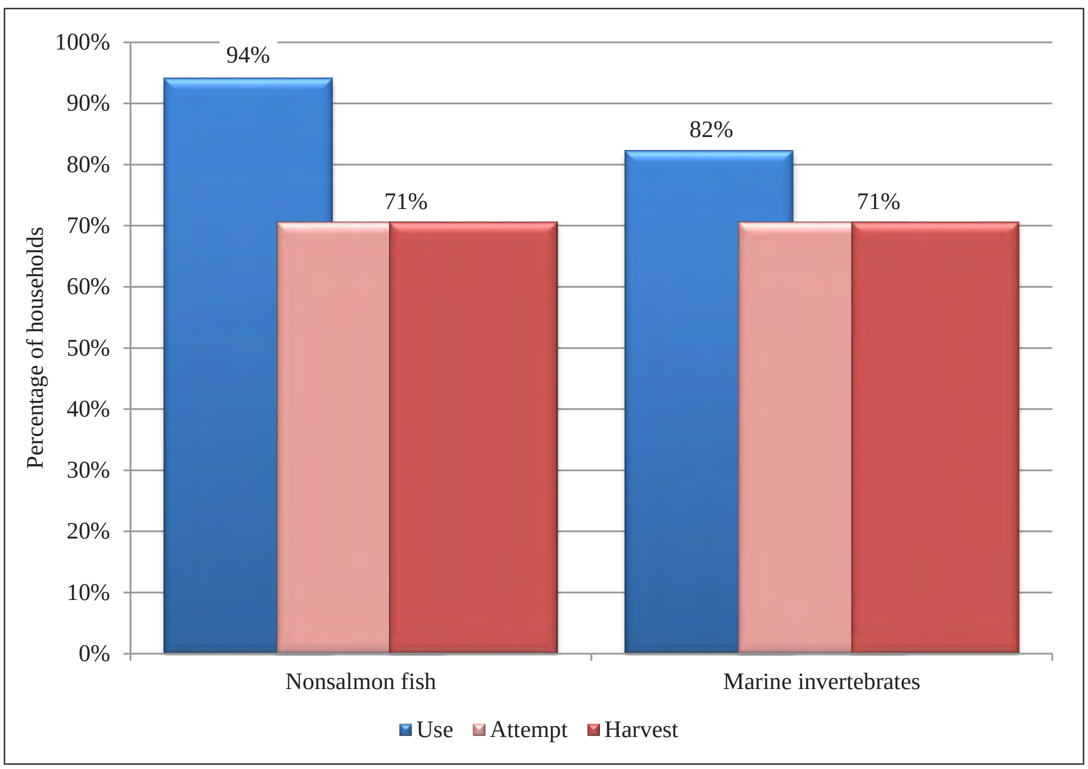


Figure 3-4.–Percentages of households using, attempting to harvest, and harvesting nonsalmon fish and marine invertebrates, Nightmute, 2017.

Table 3-3.–Nonsalmon fish and marine invertebrate harvest and use characteristics, Nightmute, 2017.

Characteristic	
Mean number of resources used per household	**11.7**
Minimum	0
Maximum	21
95% confidence limit (±)	9.7%
Median	12.0
Mean number of resources attempted to harvest per household	**7.5**
Minimum	0
Maximum	18
95% confidence limit (±)	15.1%
Median	8.0
Mean number of resources harvested per household	**7.5**
Minimum	0
Maximum	18
95% confidence limit (±)	15.1%
Median	8.0
Mean number of resources received per household	**7.9**
Minimum	0
Maximum	21
95% confidence limit (±)	17.2%
Median	7.5
Mean number of resources given away per household	**7.1**
Minimum	0
Maximum	20
95% confidence limit (±)	16.2%
Median	6.5
Household harvest (pounds)	
Minimum	0
Maximum	7,414
Mean	1,088.8
Median	621.6
Total harvest weight (lb)	58,794.0
Community per capita harvest (lb)	251.8
Percentage using any resource	94%
Percentage attempting to harvest any resource	82%
Percentage harvesting any resource	82%
Percentage receiving any resource	82%
Percentage giving away any resource	85%
Number of households in sample	34
Number of resources asked about and identified voluntarily by respondents	33

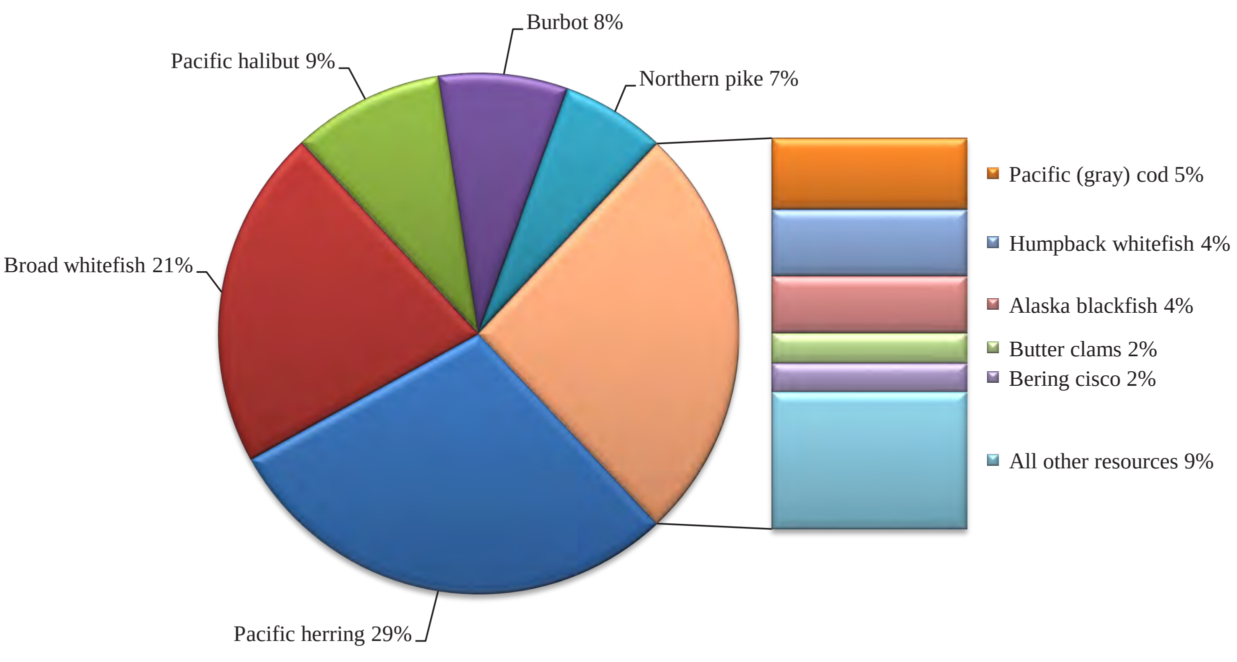
Source ADF&G Division of Subsistence household surveys, 2018.

Table 3-4.–Top ranked nonsalmon fish and marine invertebrates used by households, Nightmute, 2017.

Rank[a]	Resource	Percentage of households using
1.	Pacific herring	85.3%
1.	Burbot	85.3%
3.	Northern pike	82.4%
4.	Pacific halibut	76.5%
4.	Broad whitefish	76.5%
6.	Alaska blackfish	67.6%
6.	Bering cisco	67.6%
6.	Humpback whitefish	67.6%
9.	Least cisco	64.7%
10.	Butter clams	55.9%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Resources used by the same percentage of households share the lowest rank value instead of having sequential rank values.



Note The "all other resources" category represents all species that contributed less than 1% to the total harvest.

Figure 3-5.–Top nonsalmon fish and marine invertebrates harvested by percentage of total harvest weight, Nightmute, 2017.

Nightmute residents used a wide variety of nonsalmon resources in 2017 (Table 3-4). The top ten most used resources included both freshwater and marine fish species as well as one type of marine invertebrate. Approximately 56% to 85% of the community used one or more of these resources during the study year. herring, burbot, and pike were the three most used species in this list.

In terms of contributions to the harvest, herring and broad whitefish (*qaurtuq*) accounted for one half of the total harvest in 2017 (Figure 3-5). Other notable contributors included halibut, burbot, and pike. Combined, these species contributed nearly one quarter of the total harvest. The remaining harvest included smaller contributions from other whitefish species as well as smelts and blackfish (Figure D3-1).

Table 3-5 reports estimated subsistence nonsalmon fish and marine invertebrate harvests and uses by Nightmute residents in 2017. All edible resources are presented in pounds usable weight (lb; see Appendix C for conversion factors), and results are organized first by general category and then by species. The harvest column shows percentages of households in which any member of the surveyed household harvested a resource during the study year. The use column shows percentages of households that took or used a resource, including resources acquired from other harvesters or given away. Purchased foods are not included, but fish retained from commercial fishing are included, whether they were the target species or caught incidentally. Differences between harvest and use percentages reflect sharing among households, which results in a wider distribution of wild foods.

According to many residents, herring is one of the most important annually harvested nonsalmon fish species for the community of Nightmute.[14] Anthropologist and experienced Nelson Island researcher Anne Fienup-Riordan wrote that

> Of all the fish sought, herring are the most important in terms of quantity, ease of storage, and nutritional value…The size of the herring run means the difference between feast and famine in the late winter and early spring…it is the food that maintains the family when other stores are depleted. (Fienup-Riordan 1983)

In 2017, 85% of the community used herring. This high degree of community-wide usage indicates the significance of this species to Nightmute households. Fishers harvested over eight and one-half tons of herring for subsistence use in 2017, which equated to 315 lb of herring per household. Approximately 56% of the community both attempted to harvest and harvested herring. All herring harvested in 2017 was taken with set gillnets (Figure 3-6; tables 3-6 and 3-7). To process the herring, long strands of beach grass are braided into ropes which are then used to hang herring to dry. Following the drying process, herring are collected and stowed for later use (Plate 3-3).

Broad whitefish was the next highest contributor to the total nonsalmon fish harvest for the community of Nightmute in 2017 (Table 3-5). Over 12,000 lb of broad whitefish were harvested during the study year, and the total harvest translated to 230 lb per household. Broad whitefish was used by 77% of Nightmute households, and over 40% of households fished for and harvested this important whitefish species. Nightmute fishers harvested the majority of broad whitefish (89%) with set gillnets in open water (Figure 3-6; tables 3-6 and 3-7). In addition, smaller amounts were taken with under-ice set gillnets. Some fishers reported harvests of broad whitefish with beach seines These harvests were most likely incidental catches, because this type of gear is not typically used to harvest this species.[15] However, as one respondent explained, fishers in the past were limited to the use of seine gear to harvest broad whitefish.

> They'd head inland upriver before freeze-up and use a net seine (similar to dip-net or fish trap), then since they had no long nets to use under the ice they couldn't fish that way at freeze-up. They used to go fishing for those in the fall time that way, dry them, keeping the roe for *akutaq*, Eskimo ice cream. Then when wintertime arrived they'd stop fishing that way altogether since they had no nets. They were like that. When they had no long set-nets. (110518NME02)

14. C. McDevitt field notes, March 2018.
15. C. McDevitt field notes, March 2018.

Table 3-5.–Estimated harvest and use of nonsalmon fish and marine invertebrates, Nightmute, 2017.

	Percentage of households					Harvest weight (lb)			Harvest amount			
Resource	Using	Attempting harvest	Harvesting	Receiving	Giving away	Total	Mean per household	Per capita	Total	Unit	Mean per household	95% confidence limit (±) harvest
All surveyed resources	**94.1**	**82.4**	**82.4**	**82.4**	**85.3**	**58,794.0**	**1,088.8**	**251.8**	**58,794.0**	**lb**	**1,088.8**	**30.1**
Nonsalmon fish	**94.1**	**70.6**	**70.6**	**82.4**	**82.4**	**57,233.6**	**1,059.9**	**245.1**	**57,233.6**	**lb**	**1,059.9**	**30.7**
Pacific herring	85.3	55.9	55.9	67.6	47.1	17,032.6	315.4	73.0	2,838.8	gal	52.6	36.9
Pacific herring roe	52.9	17.6	17.6	41.2	26.5	295.4	5.5	1.3	49.2	gal	0.9	53.0
Capelin (grunion)	8.8	2.9	2.9	5.9	2.9	79.4	1.5	0.3	13.2	gal	0.2	123.8
Rainbow smelt	47.1	20.6	20.6	41.2	26.5	904.5	16.8	3.9	150.8	gal	2.8	51.9
Pacific (gray) cod	47.1	35.3	35.3	26.5	29.4	2,788.9	51.6	11.9	871.5	ind	16.1	48.0
Saffron cod	50.0	29.4	29.4	35.3	29.4	841.9	15.6	3.6	140.3	gal	2.6	72.7
Walleye pollock (whiting)	11.8	8.8	8.8	11.8	5.9	286.8	5.3	1.2	204.9	ind	3.8	96.5
Unknown flounders	26.5	8.8	8.8	23.5	11.8	294.6	5.5	1.3	267.8	ind	5.0	82.0
Pacific halibut	76.5	47.1	47.1	58.8	44.1	5,545.5	102.7	23.8	5,545.5	lb	102.7	29.2
Unknown sculpins	32.4	26.5	26.5	23.5	20.6	228.3	4.2	1.0	228.3	ind	4.2	52.5
Sticklebacks (needlefish)	23.5	5.9	5.9	17.6	5.9	277.9	5.1	1.2	46.3	gal	0.9	107.1
Wolffish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Alaska blackfish	67.6	41.2	41.2	44.1	41.2	2,221.5	41.1	9.5	370.3	gal	6.9	36.0
Burbot	85.3	58.8	58.8	50.0	55.9	4,707.5	87.2	20.2	1,120.8	ind	20.8	32.4
Unknown chars	11.8	8.8	8.8	8.8	8.8	513.6	9.5	2.2	155.6	ind	2.9	89.2
Arctic grayling	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Northern pike	82.4	64.7	64.7	47.1	50.0	3,792.1	70.2	16.2	1,149.1	ind	21.3	38.4
Sheefish	26.5	14.7	14.7	14.7	17.6	559.1	10.4	2.4	101.6	ind	1.9	97.3
Broad whitefish	76.5	41.2	41.2	50.0	55.9	12,423.2	230.1	53.2	3,105.8	ind	57.5	65.8
Bering cisco	67.6	41.2	41.2	50.0	50.0	1,120.3	20.7	4.8	800.2	ind	14.8	47.0
Least cisco	64.7	38.2	38.2	50.0	47.1	624.0	11.6	2.7	891.5	ind	16.5	50.7
Humpback whitefish	67.6	47.1	47.1	41.2	47.1	2,609.1	48.3	11.2	1,490.9	ind	27.6	39.1
Round whitefish	11.8	8.8	8.8	5.9	2.9	87.4	1.6	0.4	87.4	ind	1.6	89.2
Unknown whitefishes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Unknown nonsalmon fish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Marine invertebrates	**82.4**	**70.6**	**70.6**	**38.2**	**47.1**	**1,560.4**	**28.9**	**6.7**	**1,560.4**	**lb**	**28.9**	**47.5**
Unknown chitons	8.8	8.8	8.8	5.9	5.9	12.7	0.2	0.1	4.2	gal	0.1	73.0
Butter clams	55.9	47.1	47.1	29.4	38.2	1,188.8	22.0	5.1	396.3	gal	7.3	62.6
Razor clams	26.5	23.5	23.5	8.8	14.7	127.1	2.4	0.5	42.4	gal	0.8	45.4

-continued-

Table 3-5.–Continued.

Resource	Percentage of households: Using	Attempting harvest	Harvesting	Receiving	Giving away	Harvest weight (lb): Total	Mean per household	Per capita	Harvest amount: Total	Unit	Mean per household	95% confidence limit (±) harvest
Marine invertebrates, continued												
Unknown clams	26.5	20.6	20.6	11.8	5.9	200.1	3.7	0.9	66.7	gal	1.2	47.1
Red king crab	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Unknown mussels	29.4	23.5	23.5	17.6	17.6	31.8	0.6	0.1	21.2	gal	0.4	96.1
Shrimps	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	gal	0.0	0.0
Unknown marine invertebrates	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	gal	0.0	0.0

Source ADF&G Division of Subsistence household surveys, 2018.

Note Resources where the percentage using is greater than the combined received and harvest indicate use from resources obtained during a previous year.

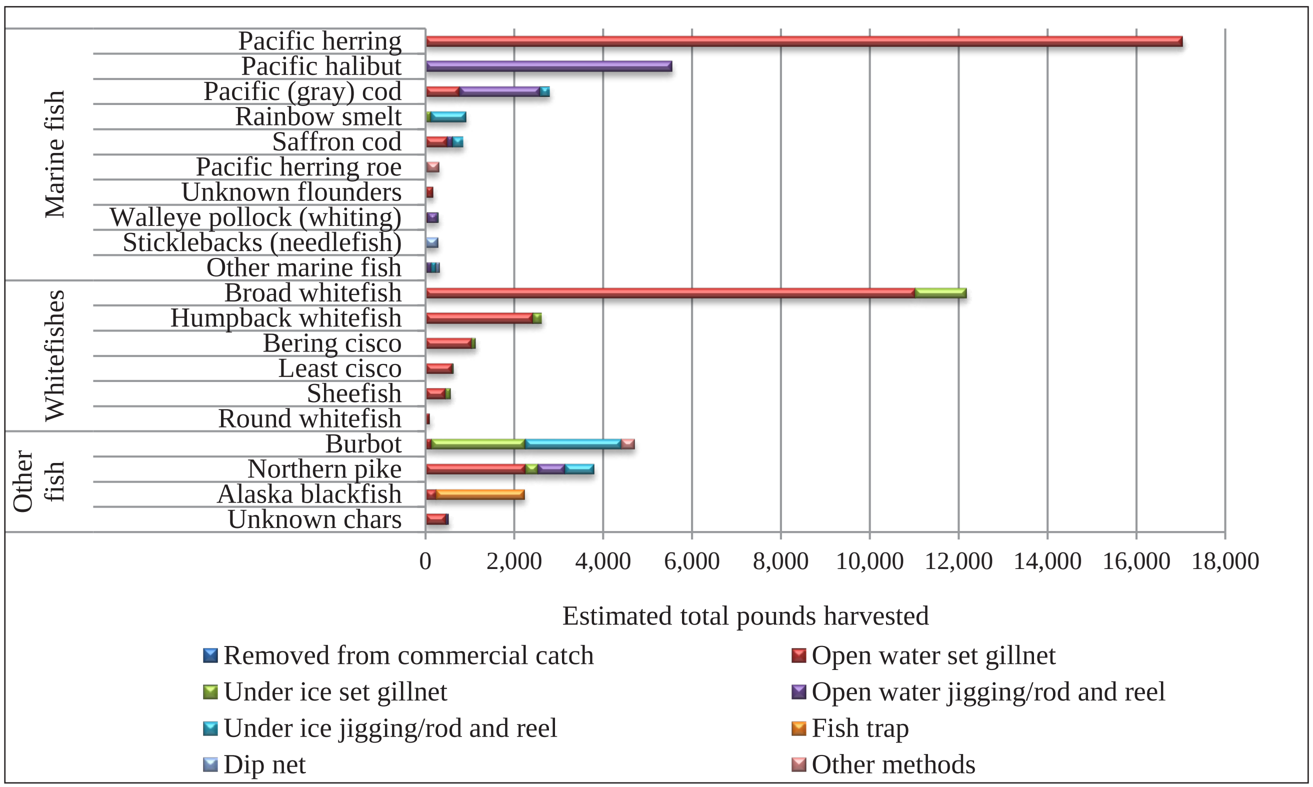


Figure 3-6.–Estimated harvest of nonsalmon fish by gear type, Nightmute, 2017.

Table 3-6.–Estimated harvest of nonsalmon fish by gear type, Nightmute, 2017.

		Removed from commercial catch		Subsistence methods: Open water set gillnet		Subsistence methods: Under ice set gillnet		Subsistence methods: Open water jigging/rod and reel		Subsistence methods: Under ice jigging/rod and reel		Subsistence methods: Fish trap		Subsistence methods: Dip net		Subsistence methods: Seine net		Subsistence methods: Other method		Subsistence methods: Subsistence gear, any method		Any method	
Resource	Units	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds
Nonsalmon fish			**0.0**		**37,236.8**		**4,071.1**		**8,463.4**		**4,167.9**		**1,983.3**		**357.4**		**386.7**		**567.0**		**57,233.6**		**57,233.6**
Pacific herring	gal	0.0	0.0	2,838.8	17,032.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2,838.8	17,032.6	2,838.8	17,032.6
Pacific herring roe	gal	0.0	0.0	4.8	28.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44.5	266.8	49.2	295.4	49.2	295.4
Capelin (grunion)	gal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.2	79.4	0.0	0.0	0.0	0.0	13.2	79.4	13.2	79.4
Rainbow smelt	gal	0.0	0.0	0.0	0.0	19.9	119.1	0.0	0.0	130.9	785.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	150.8	904.5	150.8	904.5
Pacific (gray) cod	ind	0.0	0.0	238.2	762.4	0.0	0.0	566.6	1,813.1	66.7	213.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	871.5	2,788.9	871.5	2,788.9
Saffron cod	gal	0.0	0.0	80.7	484.5	0.0	0.0	20.1	120.7	39.5	236.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	140.3	841.9	140.3	841.9
Walleye pollock (whiting)	ind	0.0	0.0	31.8	44.5	0.0	0.0	157.2	220.1	15.9	22.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	204.9	286.8	204.9	286.8
Unknown flounders	ind	0.0	0.0	147.3	162.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	120.6	132.6	0.0	0.0	267.8	294.6	267.8	294.6
Pacific halibut	lb	0.0	0.0	0.0	0.0	0.0	0.0	5,545.5	5,545.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5,545.5	5,545.5	5,545.5	5,545.5
Unknown sculpins	ind	0.0	0.0	31.8	31.8	0.0	0.0	93.3	93.3	103.2	103.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	228.3	228.3	228.3	228.3
Sticklebacks (needlefish)	gal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.3	277.9	0.0	0.0	0.0	0.0	46.3	277.9	46.3	277.9
Wolffish	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alaska blackfish	gal	0.0	0.0	39.7	238.2	0.0	0.0	0.0	0.0	0.0	0.0	330.5	1,983.3	0.0	0.0	0.0	0.0	0.0	0.0	370.3	2,221.5	370.3	2,221.5
Burbot	ind	0.0	0.0	31.8	133.4	502.1	2,108.9	3.2	13.3	512.3	2,151.7	0.0	0.0	0.0	0.0	0.0	0.0	71.5	300.2	1,120.8	4,707.5	1,120.8	4,707.5
Unknown chars	ind	0.0	0.0	139.8	461.2	0.0	0.0	15.9	52.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	155.6	513.6	155.6	513.6
Arctic grayling	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Northern pike	ind	0.0	0.0	680.6	2,246.1	86.6	285.9	183.3	605.0	198.5	655.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,149.1	3,792.1	1,149.1	3,792.1
Sheefish	ind	0.0	0.0	81.0	445.5	20.6	113.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	101.6	559.1	101.6	559.1
Broad whitefish	ind	0.0	0.0	2,756.4	11,025.5	285.9	1,143.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	63.5	254.1	0.0	0.0	3,105.8	12,423.2	3,105.8	12,423.2
Bering cisco	ind	0.0	0.0	744.7	1,042.5	55.6	77.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	800.2	1,120.3	800.2	1,120.3
Least cisco	ind	0.0	0.0	851.7	596.2	39.7	27.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	891.5	624.0	891.5	624.0
Humpback whitefish	ind	0.0	0.0	1,379.7	2,414.5	111.2	194.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,490.9	2,609.1	1,490.9	2,609.1
Round whitefish	ind	0.0	0.0	87.4	87.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	87.4	87.4	87.4	87.4
Unknown whitefishes	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unknown nonsalmon fish	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source ADF&G Division of Subsistence household surveys, 2018.

a. The harvested number of each resource is measured by the unit in which the resource harvest information was collected; the unit of measurement is provided for each resource.

Table 3-7.–Estimated percentages of nonsalmon fish harvest weight by gear type, Nightmute, 2017.

			Subsistence methods									
Resource	Percentage base	Removed from commercial catch	Open water set gillnet	Under ice set gillnet	Open water jigging/rod and reel	Under ice jigging/rod and reel	Fish trap	Dip net	Seine net	Other method	Subsistence gear, any method	Any method
Nonsalmon fish	**Gear type**	**0.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
	Resource	**0.0%**	**65.1%**	**7.1%**	**14.8%**	**7.3%**	**3.5%**	**0.6%**	**1.0%**	**0.7%**	**100.0%**	**100.0%**
	Total	**0.0%**	**65.1%**	**7.1%**	**14.8%**	**7.3%**	**3.5%**	**0.6%**	**1.0%**	**0.7%**	**100.0%**	**100.0%**
Pacific herring	Gear type	0.0%	45.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	29.8%	29.8%
	Resource	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	29.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	29.8%	29.8%
Pacific herring roe	Gear type	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	47.1%	0.0%	0.5%	0.5%
	Resource	0.0%	9.7%	0.0%	0.0%	0.0%	0.0%	0.0%	90.3%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	0.0%	0.5%	0.5%
Capelin (grunion)	Gear type	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	22.2%	0.0%	0.0%	0.1%	0.1%
	Resource	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%	0.1%
Rainbow smelt	Gear type	0.0%	0.0%	2.9%	0.0%	18.8%	0.0%	0.0%	0.0%	0.0%	1.6%	1.6%
	Resource	0.0%	0.0%	13.2%	0.0%	86.8%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.2%	0.0%	1.4%	0.0%	0.0%	0.0%	0.0%	1.6%	1.6%
Pacific (gray) cod	Gear type	0.0%	2.0%	0.0%	21.4%	5.1%	0.0%	0.0%	0.0%	0.0%	4.9%	4.9%
	Resource	0.0%	27.3%	0.0%	65.0%	7.7%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	1.3%	0.0%	3.2%	0.4%	0.0%	0.0%	0.0%	0.0%	4.9%	4.9%
Saffron cod	Gear type	0.0%	1.3%	0.0%	1.4%	5.7%	0.0%	0.0%	0.0%	0.0%	1.5%	1.5%
	Resource	0.0%	57.5%	0.0%	14.3%	28.1%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.8%	0.0%	0.2%	0.4%	0.0%	0.0%	0.0%	0.0%	1.5%	1.5%
Walleye pollock	Gear type	0.0%	0.1%	0.0%	2.6%	0.5%	0.0%	0.0%	0.0%	0.0%	0.5%	0.5%
(whiting)	Resource	0.0%	15.5%	0.0%	76.7%	7.8%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.1%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	0.5%
Unknown flounders	Gear type	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	34.3%	0.5%	0.5%
	Resource	0.0%	55.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	45.0%	100.0%	100.0%
	Total	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.5%	0.5%
Pacific halibut	Gear type	0.0%	0.0%	0.0%	65.5%	0.0%	0.0%	0.0%	0.0%	0.0%	9.7%	9.7%
	Resource	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	9.7%	0.0%	0.0%	0.0%	0.0%	0.0%	9.7%	9.7%
Unknown sculpins	Gear type	0.0%	0.1%	0.0%	1.1%	2.5%	0.0%	0.0%	0.0%	0.0%	0.4%	0.4%
	Resource	0.0%	13.9%	0.0%	40.9%	45.2%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.1%	0.0%	0.2%	0.2%	0.0%	0.0%	0.0%	0.0%	0.4%	0.4%
Stickleback	Gear type	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	77.8%	0.0%	0.0%	0.5%	0.5%
(needlefish)	Resource	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	0.0%	0.0%	0.5%	0.5%
Wolffish	Gear type	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Resource	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

-continued-

Table 3-7.–Continued.

Resource	Percentage base	Removed from commercial catch	Subsistence methods: Open water set gill net	Under ice set gill net	Open water jigging/rod and reel	Under ice jigging/rod and reel	Fish trap	Dip net	Seine net	Other method	Subsistence gear, any method	Any method
Alaska blackfish	Gear type	0.0%	0.6%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	3.9%	3.9%
	Resource	0.0%	10.7%	0.0%	0.0%	0.0%	89.3%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.4%	0.0%	0.0%	0.0%	3.5%	0.0%	0.0%	0.0%	3.9%	3.9%
Burbot	Gear type	0.0%	0.4%	51.8%	0.2%	51.6%	0.0%	0.0%	52.9%	0.0%	8.2%	8.2%
	Resource	0.0%	2.8%	44.8%	0.3%	45.7%	0.0%	0.0%	6.4%	0.0%	100.0%	100.0%
	Total	0.0%	0.2%	3.7%	0.0%	3.8%	0.0%	0.0%	0.5%	0.0%	8.2%	8.2%
Unknown chars	Gear type	0.0%	1.2%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%	0.9%
	Resource	0.0%	89.8%	0.0%	10.2%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.8%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.9%	0.9%
Arctic grayling	Gear type	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Resource	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Northern pike	Gear type	0.0%	6.0%	7.0%	7.1%	15.7%	0.0%	0.0%	0.0%	0.0%	6.6%	6.6%
	Resource	0.0%	59.2%	7.5%	16.0%	17.3%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	3.9%	0.5%	1.1%	1.1%	0.0%	0.0%	0.0%	0.0%	6.6%	6.6%
Sheefish	Gear type	0.0%	1.2%	2.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	1.0%
	Resource	0.0%	79.7%	20.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.8%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	1.0%
Broad whitefish	Gear type	0.0%	29.6%	28.1%	0.0%	0.0%	0.0%	0.0%	0.0%	65.7%	21.7%	21.7%
	Resource	0.0%	88.7%	9.2%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	100.0%	100.0%
	Total	0.0%	19.3%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	21.7%	21.7%
Bering cisco	Gear type	0.0%	2.8%	1.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	2.0%
	Resource	0.0%	93.1%	6.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	1.8%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	2.0%
Least cisco	Gear type	0.0%	1.6%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	1.1%
	Resource	0.0%	95.5%	4.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.1%	1.1%
Humpback whitefish	Gear type	0.0%	6.5%	4.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.6%	4.6%
	Resource	0.0%	92.5%	7.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	4.2%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.6%	4.6%
Round whitefish	Gear type	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.2%
	Resource	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.2%
Unknown whitefishes	Gear type	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Resource	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Unknown nonsalmon fish	Gear type	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Resource	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

Plate 3-3.–Herring hung to dry on frames on a Nelson Island beach. Lengths of braided grasses are used to link herring together for hanging and drying.

The total 2017 halibut harvest for the community of Nightmute was 5,546 lb, which translated to 103 lb per household (Table 3-5). Almost half of Nightmute fishers attempted to harvest halibut, and the same amount successfully harvested this important nonsalmon marine fish species. Halibut were harvested exclusively with rod and reel in open water (Figure 3-6; tables 3-6 and 3-7).

Nightmute fishers harvested over two tons of burbot in 2017 (Table 3-5). This harvest translated to over 87 lb per household. Over 85% of the community used burbot during the study year, and over one-half of the community both attempted to harvest and successfully harvested burbot. Nightmute fishers utilized several different gear types to harvest burbot (Figure 3-6; tables 3-6 and 3-7). These gear types included hook and line through the ice (*manaq*), open water and under-ice set gillnets, as well as “other” methods, such as longlines. One key respondent described his method for catching burbot with a longline:

> I set the longline…all those hooks, and we put it in a small river or by the mouth of the river. That’s how I catch my lush fish, in open water…we set it like that, but we put a pole on each end and tie them out and let it float, let it float about maybe a foot from the, the bottom of the river. (031618NME01)

An elder explained that fishers typically utilized burbot traps in the past because they did not have nets to set underneath the ice. “And when it freeze up…they set up a lush [burbot] fish trap—the one that looks like blackfish trap, but it’s bigger” (110518NME02). Most burbot was harvested with either under-ice gillnets (45%) or hook and line through the ice (46%; Plate 3-4).

Nearly 3,800 lb of pike was harvested by Nightmute fishers in 2017. The total pike harvest translated to 70 lb per household. Over 82% of the community used pike during the study year, and 65% of the community attempted to harvest and successfully harvested this prolific nonsalmon species. One key respondent shared his reasoning for selectively harvesting smaller pike:

> Yeah, sometimes in the rivers there’s those pikes in the rivers, they are a little bit long…they are about maybe two or three or less than two, two and a half feet long…those are really hard to dry…They are good eating but we like to catch the ones that are a little bit smaller that haven’t gone out already into the river…the ones in the ponds we like to try to catch them because they dry faster and easy to manage. (031618NME01)

Plate 3-4.–Lifelong Nightmute subsistence fisher John George displays his assortment of nonsalmon fishing gear. He constructed the gear himself using a variety of materials and explained that most of the gear is several decades old.

Despite the preference of smaller pike by some fishers, one elder discussed how the overall size of pike has increased over the years.

> Much larger pikes. And upriver. They're growing bigger upriver too. Even here [near Nightmute] they're getting bigger, used to be small or just right, nowadays they're getting bigger. That's how they're becoming. Each pikes are not the same, up there at the big lake they're big, behind Newtok they're big, way there beyond the horizon they're big. That's the way they are. (110518NME02)

Fishers used four different gear types to harvest pike. These included gillnets set in the open water as well as underneath the ice, hook and line through the ice, and rod and reel in open water. Open water set gillnets accounted for over one-half of the total harvest, and hook and line both in open water and through the ice were used to harvest 33% of pike. Fishers employed under-ice set gillnets for the remaining harvest.

Nightmute fishers harvested 2,789 lb of Pacific cod in 2017, which amounted to 52 lb per household. Approximately 47% of the community used Pacific cod, and over one-third of the community both fished for and harvested Pacific cod during the study year. Pacific cod was more often than not caught incidentally while halibut fishing and were not necessarily a targeted species for Nightmute fishers. One key respondent remarked that the prevalence of Pacific cod has increased in recent times: "Pacific cods, we used to hardly see them, but now there is lots. I never heard a lot of cod before" (031618NME01). The majority of Pacific cod were harvested by use of rod and reel, and lesser amounts were caught in set gillnets.

Nightmute residents harvested over 1,500 pounds of marine invertebrates in 2017, and the harvest equated to nearly 30 pounds per household (Table 3-5). Over 82% of the community used marine invertebrates and the 71% of residents who attempted to harvest the resource were successful in their efforts. By far, the most heavily harvested marine invertebrates were butter clams (Figure D2-2. In addition, lesser amounts

Table 3-8.–Estimated harvest of nonsalmon fish for consumption by dogs, Nightmute, 2017.

Resource	Amount		Pounds	
Nonsalmon fish				
Broad whitefish	29.8	ind	119.1	lb
Total	**29.8**	ind	**119.1**	lb

Source ADF&G Division of Subsistence household surveys, 2018.

of unknown clams, razor clams, mussels, and chitons were also harvested. All marine invertebrates were harvested by hand.[16]

From all of these harvests, approximately 30 broad whitefish were used for dog food in 2017 (Table 3-8). This equated to roughly 119 lb.

Sharing of Nonsalmon Resources

Household Specialization in Resource Harvesting

Previous studies (Wolfe 1987; Wolfe et al. 2010) have shown that in most rural Alaska communities, a relatively small portion of households produces most of the community's fish and wildlife harvests, which they share with other households. A recent study of 3,265 households in 66 rural Alaska communities found that about 33% of the households accounted for 76% of subsistence harvests (Wolfe et al. 2010). Wolfe et al. (2010) observed that factors frequently associated with higher levels of subsistence harvests included larger households with a pool of adult male labor, higher wage income, involvement in commercial fishing, and community location. Recent Division of Subsistence studies in 16 Yukon-Kuskokwim Delta communities also recorded that a minority percentage of households in each community commonly produced a majority percentage of the wild food harvest. This was true for a variety of resource categories, including nonsalmon fish (Brown et al. 2013; 2015; Ikuta et al. 2014; 2016; Runfola et al. 2017; 2018).

For Nightmute in 2017, 69% of nonsalmon fish harvests, as estimated in pounds usable weight, were harvested by 24% of the community's households (Figure 3-7). Further analysis of the study findings, beyond the scope of this report, might identify characteristics of the highly productive households in Nightmute and the other study communities.

Comparing Harvests and Uses in 2017 with Previous Years

Harvest Assessments

During the surveys, researchers asked respondents to assess their use of whitefishes and sheefish, other nonsalmon fish, and marine invertebrates in two ways. First, they asked whether the household had used more, less, or about the same amount of the resources during 2017 as compared to the last few years; if there was a change in use, researchers asked why. Second, researchers asked respondents if they got enough of the resource in 2017; if they had not gotten enough, they were asked why, how severe the impact had been, and if they had done anything differently to compensate for not getting enough.

The majority of households surveyed in 2018 provided valid responses when asked whether or not they used less, the same amount, or more nonsalmon resources in 2017 compared to previous years (Table D3-6). Household respondents were asked specifically about species from the following nonsalmon resource categories: whitefishes and sheefish, other nonsalmon fish, and marine invertebrates.

Approximately 42% of households indicated that they used the same amount of whitefishes and sheefish in 2017 as they had used in previous years, and the same percentage of households indicated that they used less whitefishes and sheefish in 2017 compared to previous years (Figure 3-8; Table D3-6). In addition, 12% of households indicated that they used more whitefishes and sheefish in 2017 compared to previous years. Lastly, 3% of households expressed that they did not normally use whitefishes and sheefish. One lifelong

16. C. McDevitt field notes, March 2018

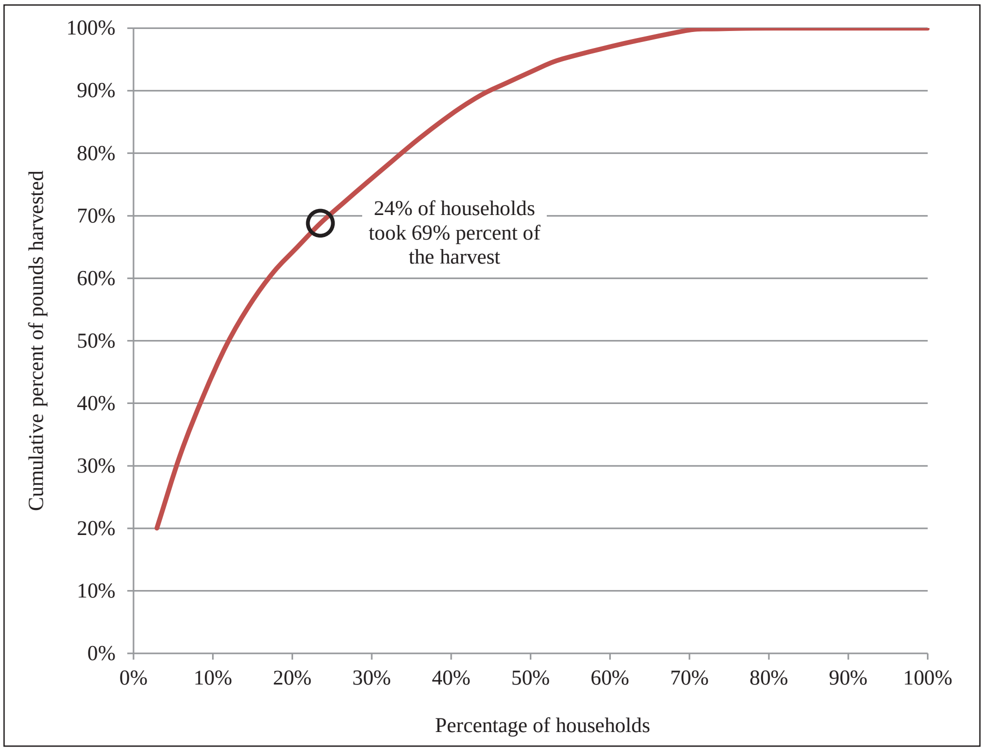


Figure 3-7.–Household specialization, Nightmute, 2017.

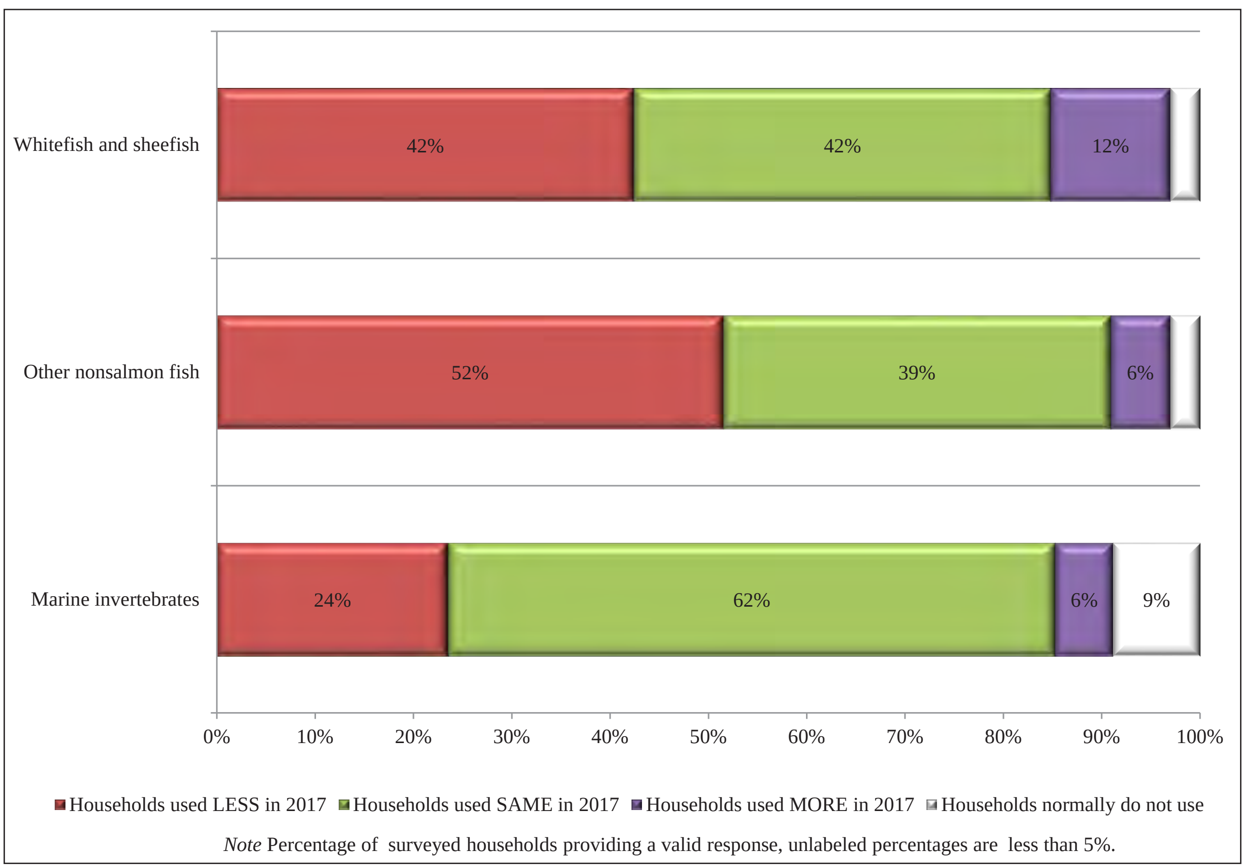
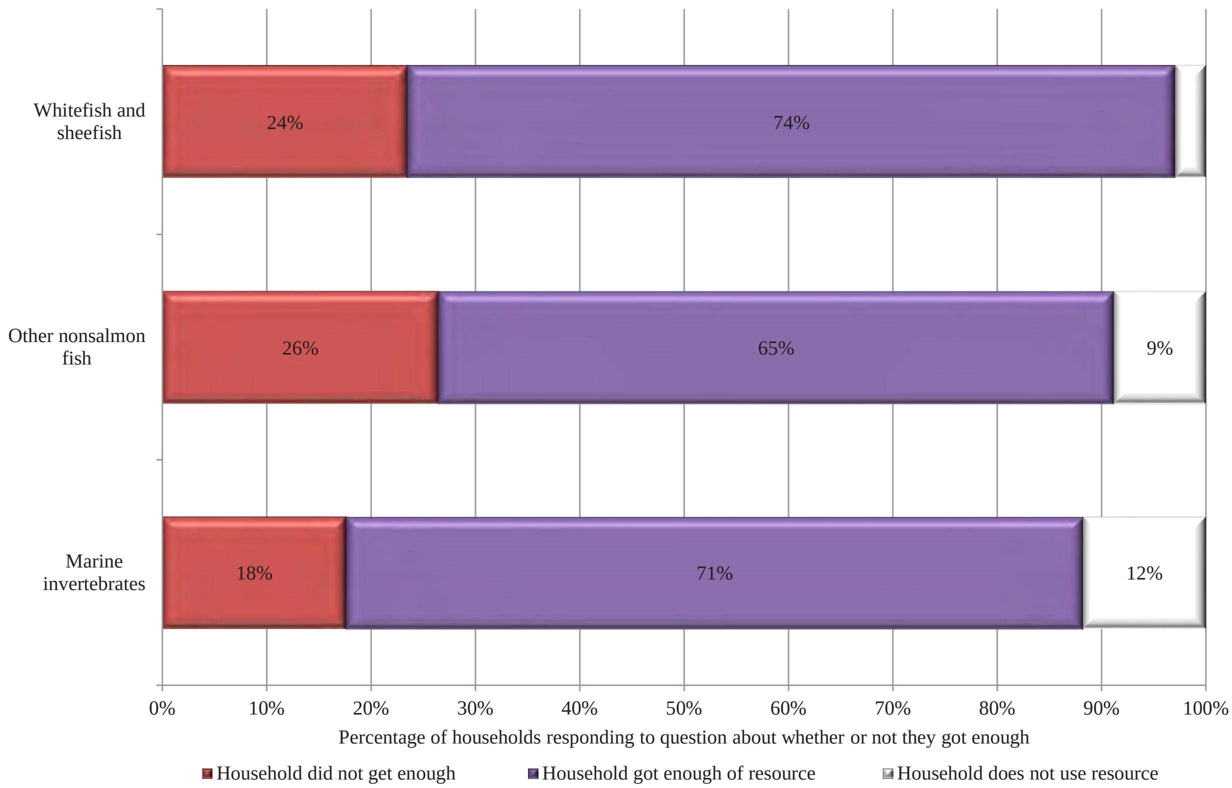


Figure 3-8.–Changes in household use of nonsalmon fish and marine invertebrates compared to recent years, Nightmute, 2017.



Note Unlabeled percentages are less than 5%.

Figure 3-9.–Percentages of households reporting whether or not they got enough nonsalmon fish and marine invertebrates, Nightmute, 2017.

subsistence fisher explained that the presence of sheefish has fluctuated over the past several decades, which may help to explain the change of usage among households.

> I never, when I was growing up, I never seen sheefish before. But I used to hear my grandparents talk about sheefish, that there were some here, but around probably early 50s, or late 50s they quit catching sheefish. And nowadays, I think somewhere around probably late 80s or mid 80s we start hearing people catch again, some sheefish. So, and lately they're starting to catch more. It seems like they're returning I guess. (031618NME01)

Nearly one-third of households provided one or more reasons as to why they used less whitefishes and sheefish in 2017 compared to previous years (Table D3-7). The most frequent response for less use pointed to weather or environmental reasons. The second most common response was lack of effort, and the third most common response was lack of availability of whitefishes and sheefish in 2017 compared to years prior. Additional responses included family or personal reasons, lack of equipment, and other reasons. For the households that used more whitefishes and sheefish, two households indicated that they received more, and one household said that they increased their efforts (Table D3-8).

Nearly three-quarters of households indicated that they got enough whitefishes and sheefish in 2017, and nearly one-quarter indicated that they did not get enough (Figure 3-9). Less than 5% of households indicated that they did not use whitefishes or sheefish in 2017. Only six valid responses were provided to researchers that explained why some households did not get enough whitefishes and sheefish (Table D3-9). Of these responses, a lack of effort was cited two times, and weather/environment, resources less available, lack of equipment, other reasons, and an unspecified reason were each cited once. Of the households that indicated that they did not get enough whitefishes and sheefish, three households expressed that the impact was major, two households said that the impact was minor, and one household indicated that there was no noticeable impact on their household (Table 3-9).

Households that indicated that they did not get enough whitefishes or sheefish were also asked if they had done anything differently to replace or supplement these nonsalmon resources. Most responding households replaced these resources with other subsistence foods (four households). Other households used more commercial foods (two) or obtained food from other sources (one; Table D3-10).

Thirty-three households provided valid responses when asked by researchers whether they used less, the same amount, or more other nonsalmon fish in 2017 compared to previous years (Table D3-6). Close to 40% of households indicated that they used the same amount of other types of nonsalmon fish in 2017 compared to previous years, but only 6% of households expressed that they used more (Figure 3-8; Table D3-6). Lastly, 52% of households indicated that they used less.

Among the 17 valid responses from household respondents who stated that they used less nonsalmon fish in 2017 compared to previous years, most responses indicated that either the resources were less available (six responses) or that weather or environmental factors (six) affected their ability to harvest these resources (Table D3-7). Other responses included lack of effort (three), family or personal reasons (two), and working or no time (two). According to one highly active subsistence fisher, people have been catching less and less smelt over the past several years, due to relatively recent environmental changes:

> Most of it [smelt fishing], it's only in fall time. It's when they [smelt] are easier to catch. And that's when swarms of them are coming into the Kolavinarak, that big river out there. But, recently since what, four or five years, majority of our people quit going there because, because of the late season. It freezes up later after all those are long gone…Freeze-up is too late and we miss the peak. (031618NME01)

Of the two households that used more nonsalmon fish in 2017 compared to previous years, one household cited increased availability and one household said that they received more (Table D3-8).

Approximately 65% of households indicated that they got enough of nonsalmon fish species (other than whitefishes and sheefish) in 2017, and 26% of households expressed that they did not get enough (Figure 3-9). The remaining 9% of households specified that they did not typically use these resources.

Household respondents who did not get enough of other types of nonsalmon fish provided a total of nine valid responses as to why that was the case for their households (Table D3-9). The top three most common responses were weather or environmental factors (four households), lack of effort (three), and that resources were less available (two). In addition, one household mentioned too much competition.

Surveyors asked respondents about the degree of impact on their households of not getting enough of these other nonsalmon fish resources. Two households indicated that it was a major impact on their households, three households expressed a minor impact, and four households indicated that there was no noticeable impact (Table D3-9).

Households that did not get enough other nonsalmon fish were then asked if they had done anything differently to replace or supplement these resources. Of the two valid responses provided to researchers, one household indicated that they replaced the resources with other subsistence foods and one household indicated that they increased their harvest efforts (Table D3-10).

All households provided valid responses when asked if they used less, the same amount, or more marine invertebrates in 2017 compared to previous years (Table D3-6). Over 60% of households claimed that they used the same amount, 6% used more, and 24% of households used less. In addition, 9% of households indicated that they did not use marine invertebrates in 2017 (Table D3-6; Figure 3-8).

Among the seven households that reported less use of marine invertebrates, household responses varied (Table D3-7). For example, respondents indicated twice that resources being less available and weather or environmental factors were responsible for decreased usage. Lack of equipment, lack of effort, lack of need, and small or diseased animals were each cited once. For the households that used more marine invertebrates

Table 3-9.–Reported impact to households that did not get enough nonsalmon fish or marine invertebrates, Nightmute, 2017.

		Households not getting enough _______ .				Impact to those not getting enough ______ .									
	Sample	Valid responses[a]		Did not get enough		No response		Not noticeable		Minor		Major		Severe	
Resource category	households	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	34	33	97.1%	8	24.2%	2	25.0%	1	12.5%	2	25.0%	3	37.5%	0	0.0%
Other nonsalmon fish	34	31	91.2%	9	29.0%	0	0.0%	4	44.4%	3	33.3%	2	22.2%	0	0.0%
Marine invertebrates	34	30	88.2%	6	20.0%	0	0.0%	2	33.3%	1	16.7%	3	50.0%	0	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Includes households failing to respond to the question and those households that never used the resource.

in 2017 compared to previous years, both increased availability and increased effort were cited as their households' reasons for increased use (Table D3-8).

Thirty households (88%) provided valid responses regarding whether or not their household got enough marine invertebrates in 2017 (Table 3-9). Of these 30 households, six indicated that they did not get enough marine invertebrates (Table 3-9; Figure 3-9). Five households told researchers why they did not get enough marine invertebrates (Table D3-9). The most frequently cited reason was a lack of effort. Weather or environmental factors, lack of equipment, and that the resources were less available were each mentioned by one household.

Respondents were then asked about the degree of impact on their households of not getting enough of marine invertebrates. Of the six households that claimed that they did not get enough marine invertebrates, three households considered it to have a major impact and one household indicated that the impact was minor (Table 3-9). The remaining two households said that the impact was not noticeable.

No survey responses were provided to researchers in regard to whether households that did not get enough marine invertebrates compensated by doing something differently (Table D3-10). However, a key respondent explained that there were short windows of opportunity to harvest marine invertebrates. The respondent talked about natural indicators that prompted harvest activity and emphasized how timing played a critical role in the success of harvests.

> Yeah, right at the moment or else you're going to miss out by maybe five, or two, three minutes. Because when the water start coming in, those butter clams, they gonna start lining up and they go start defecating and you will see those, like when you take out a rifle [cartridge], you break it and you dump it, and there's things, powders that are like that, there is a lot of those like that. And once you start doing that before the water start coming in, they start doing that. That's when we start first picking. Then when the light start coming out, it's a lot easier to pick and pick 'em real fast before the water start really coming in. And we do that in May all the way to the ending part of July. Then we start, some of them go back out to try, they tried this year and they said they caught some in the latter part of August. There were some clams out there. But they said the water is not going out as much as in May and June. So, there is a certain time. May and June, that's when the water really goes out. And the bay gets empty and you can see rocks that you never seen before. And it would be really low. That's the time you want to go out and get some butter clams. And after that, there will be some but they are going to be way the hell down there, be hard to catch. But those razor clams, they are easier. Because once [the tide] start going out we start seeing gulls here, several of 'em, get those [razor clams]. They don't go for those as much because they break a lot. And they are not cleaner to eat than butter clams. But that's what I catch. (031618NME01)

Inability to take advantage of these opportunities may help to explain the reduction in harvest levels for some households in 2017.

Harvest Data

Changes in the harvest of resources by Nightmute residents can also be discerned through comparisons with findings from other study years. Documentation of subsistence herring harvests exists for several years, however, no other subsistence harvest information is available for any other nonsalmon fish resource.

Beginning in the summer of 1975, the ADF&G Division of Commercial Fisheries conducted aerial surveys to determine herring abundance in the Nelson Island area. One primary purpose of the research was to "provide information for protecting and mitigating impacts of potential oil and gas exploration and development on the coastal herring resource" to appropriate management agencies. The research also sought to "determine the dependence upon and utilization of herring and herring spawn by coastal residents;" this critical information had not been documented previously (Regnart 1975:2). In order to fulfill the latter objective, ADF&G disseminated “specially prepared catch forms” to Nelson Island residents. Nightmute residents were instructed to record their herring harvests on the forms, which were then collected and sent back to the ADF&G Bethel office.

A 1980 ADF&G report to the Board of Fisheries indicated that between 1975 to 1980, Umkumiut residents harvested over 62 metric tons of herring (137,348 lb; Regnart and Kingsbury 1980:39).[17] The highest subsistence herring harvest for Nightmute for all study years occurred in 1975 when over 66,000 lb were harvested. The lowest harvest occurred in 1977 (6,172 lb). However, sample achievement was not consistent throughout the study years. For example, a total of 109 “fishing families” from all three Nelson Island communities reported harvests in 1975 compared to 42 in 1976, 90 in 1977, 83 in 1978, 54 in 1979, and 70 in 1980. Although harvest totals are listed for each Nelson Island community for each study year, the report does not list the number of fishing families from each individual community for each of the study years. As a result, no definitive comparative analysis can be performed between these past herring harvests and the 2017 harvest.

Subsistence Division staff conducted herring harvest surveys among Nightmute residents throughout the mid-1980s and early 1990s.[18] The impetus for these studies was partly derived from concerns about the health and abundance of the herring stock. According to a 1984 ADF&G Subsistence Division report, “Japanese and Soviet commercial trawl fleets” operating in the 1960s and 1970s had a major effect on the subsistence herring fishery in the Nelson Island area (Pete 1984). The report indicated that as a result, Nelson Island fishers’ harvest efforts were met with challenges during early 1980s. According to fishers, subsistence herring fishing during this time was “more difficult and less productive than prior to high seas commercial fishing” that had occurred in the two previous decades.

Nightmute fishers harvested 19,842 lb of herring in 1981, close to 43,000 lb of herring in 1986, 30,000 lb in 1987, about 32,000 lb in 1988, and 35,000 lb in 1990 (Pete 1984; 1991a; 1992; Pete et al. 1987; Pete and Kreher 1986). Community representatives declined to participate in the 1990 herring survey based on “herring declines” (Pete 1991a:19). As a result, the 1990 harvest data were derived through alternative methods that included counting numbers of stringed herring on drying racks as well as using past harvest estimates from previous surveys. According to Pete (1991a:19), it is a

> traditional Yup’ik belief that inordinate attention directed at shrinking natural resources by presumptuous humans often results in further deterioration of wild resources…Deliberate hastened declines are sometimes affected by natural resources to remind humans of their place with natural resources.

The harvest decreased significantly in 1991 and 1992. In 1991 fishers harvested 16,600 lb, and in 1992, they harvested 19,800 lb (Pete 1992:14).

As indicated above, subsistence herring harvest levels for the community of Nightmute fluctuated from 1975 to 1992. Although there were inconsistencies in the sampling methods used during these studies, the available data show a 74% decrease in the Nightmute subsistence herring harvest between 1975 (66,000 lb) and 2017 (17,033 lb).

Current and Historical Harvest Areas

In 2017, Nightmute fishers utilized an extensive area during their search for and harvest of nonsalmon resources. Search and harvest areas extended as far west as coastal waters along the northeast side of Nunivak Island, eastward to Chakchak Creek on the eastern end of Nelson island, southward to the Ingariak Hills a few miles south of the Kolavinarak River, and northward to Hazen Bay near the community of Tununak (Figure 3-10). The extent of search and harvest areas shows the range of freshwater and marine

17. The report listed harvests for the fish camp Umkumiut along with the communities of Tununak and Toksook Bay as Nelson Island communities. “Umkumiut” is understood to represent Nightmute (Regnart and Kingsbury 1980:15). Harvest data presented in Regnart and Kingsbury (1980) are reported values.

18. ADF&G reports are available for the following years: 1984, 1986, 1987, and 1990–1992 (Pete 1984; 1991; 1992; Pete et al. 1987; Pete and Kreher 1986).

resource distribution and indicates local fishers' breadth of knowledge about that distribution. According to one highly active subsistence fisher, "Fish varies. They might look alike, but the locations change the type of the fish" (110518NME01). The same fisher added that the Toksook River alone provides opportunities for several different species of fish. "I mean we are actually getting everything…We still catch blackfish up there, needlefish, trout, chars, salmon, pink, silvers, kings, I mean everything goes through the river" (031618NME01).

The search and harvest areas for broad, humpback, and round whitefish were primarily concentrated along the middle and upper portions of the Toksook River, upstream of the community of Nightmute (Figure 3-11). These locations included adjoining creeks and sloughs of the Toksook River as well as its mainstem. One key respondent described upper Toksook River fishing locations in detail:

> And fall time those *cingikeggliqs* [humpback whitefish], we go up the river and catch them…way up there where it's really shallow behind the mountain, when we go up the river, up, up river, the river gets really narrow and the water gets really swift and it gets really clear. You can see the bottom of the river even it's five, six feet deep, you can see fish swimming all over down there. But the water is pretty cold because it is coming out of the spring. So that's where we catch even round [white]fish. (031618NME01)

Fishers traveled as far east as the Chakchak Creek drainage as well as west to locations near the mouth of the Toksook River.

Search and harvest locations for other species of whitefish such as Bering cisco (known locally as *naptaq;* 110519NME02, 110519NME01) were concentrated in the lower portions of the Toksook River, including the mouth, select locations along the south side of Kangirlvar Bay, and as far south as Chinigyak Cape. One key respondent noted that physical changes in the Toksook River directly affected nonsalmon species distribution. The respondent had harvested small amounts of Bering cisco far from where they are typically located.

> You know where that mouth of the river and where we nowadays set our, all our nets? That's the only area we used to catch them [*naptaqs*, Bering cisco], and they never ventured this far. But nowadays, for, seems like beginning from late 1980's, I start catching *naptaq*…even those ones that I showed you…We never used to see them up there too and when I caught some, I brought some home and I showed them to my parents and they said "Where you catch those from?" "Upriver." "Upriver? No, you're kidding." "Yeah, really, I did." And I took a picture of where I set my net, when I went back and showed them. "Really?" And they said because of those river cut-offs [oxbows], those, the fish, *naptaqs*…are starting to swim upriver. (031618NME01)

One elder talked about the physical differences between ciscoes that were harvested in different environments.

> Yes, the lake kinds, least cisco, those you see are delicious, fat, and firmer flesh compared to the ones here [Bering cisco], that are from the ocean. And the ones from here at the ocean [Bering cisco] are more like, their flesh is softer. Yes, they're [Bering cisco from ocean] softer. And they're [least cisco from lakes] also more tasty. (110518NME02)

The same respondent explained that there are two different types of *naptaq*: freshwater and saltwater. The least cisco are considered to be the *qagatellaat* [freshwater] *naptaq*, and the Bering cisco are commonly thought of as *imarpinraat* ["from the ocean" or saltwater] *naptaq* (110518NME02).

Most sheefish search and harvest locations were in close proximity to Nightmute. In addition to a location one mile downstream of the community and a location approximately ten miles upstream of Nightmute, some fishers harvested sheefish as far as the upper portions of Chakchak Creek, approximately 45 miles northeast of the community.

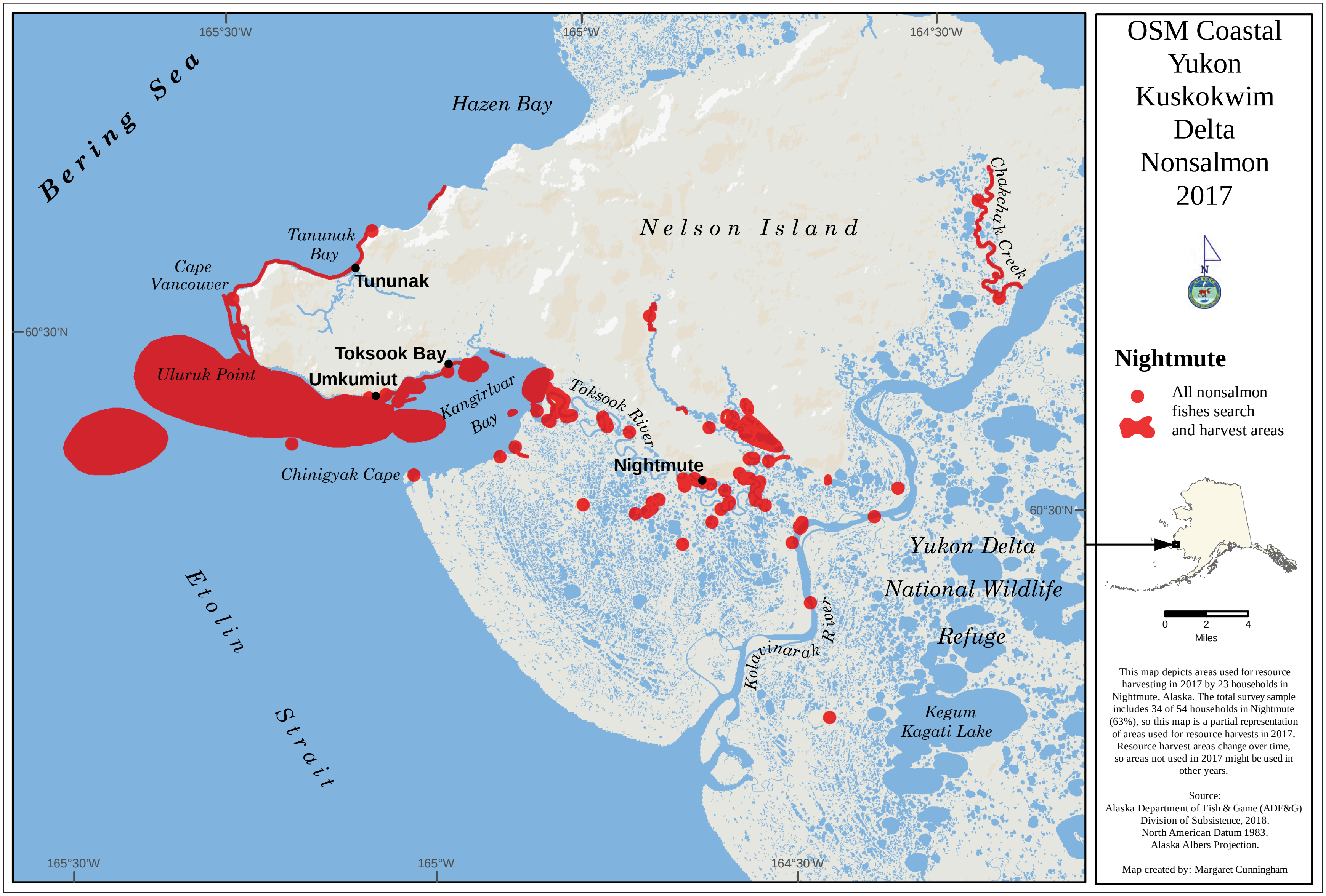


Figure 3-10.–Nonsalmon fishing areas, Nightmute, 2017.

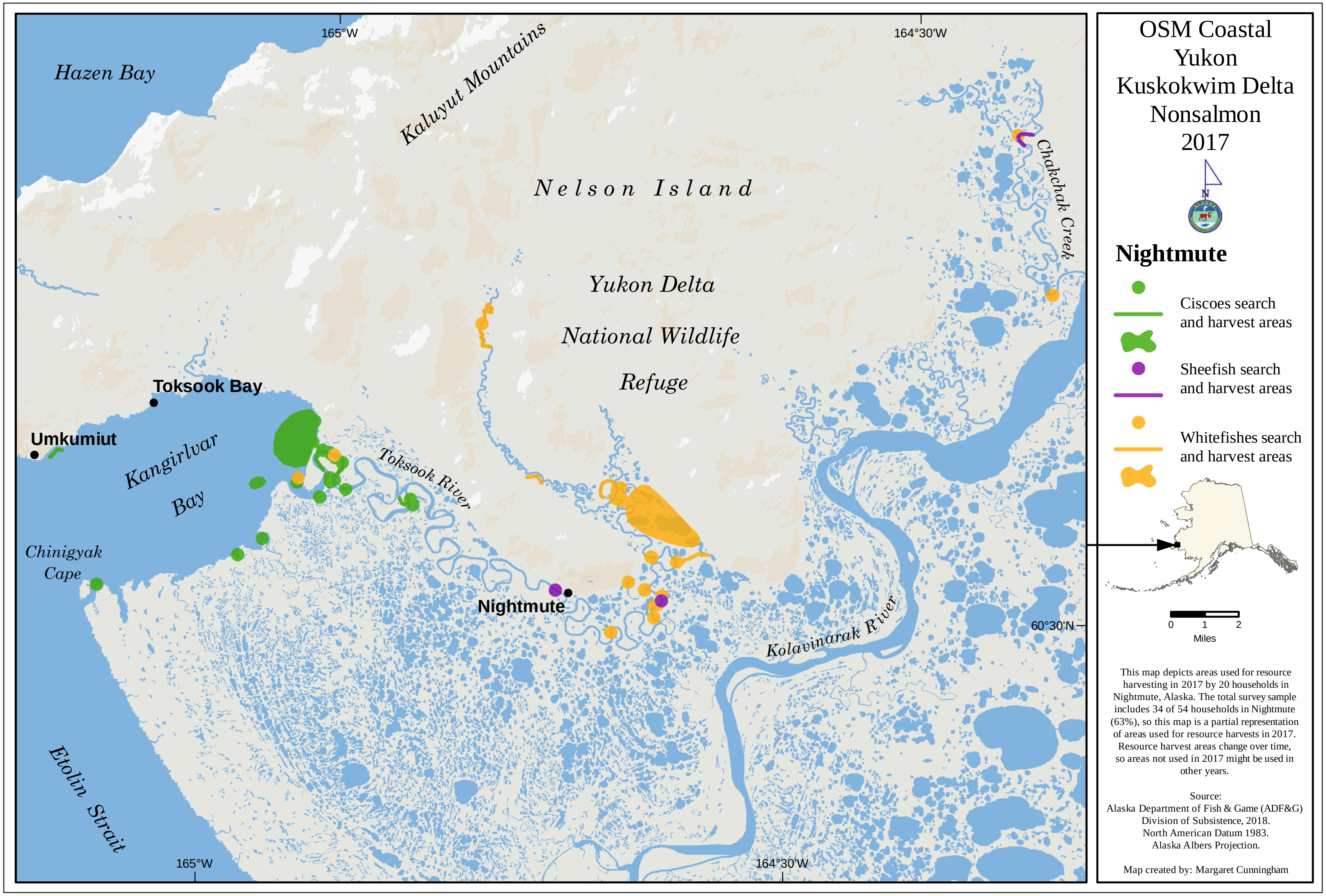


Figure 3-11.–Ciscoes, sheefish, and whitefishes fishing areas, Nightmute, 2017.

Search and harvest areas for other nonsalmon fish species such as burbot, pike, and chars, were spread throughout the Toksook River drainage, including the lower, middle, and upper portions of the river, as well as adjoining sloughs, ponds, and lakes (Figure 3-12). Pike and burbot were harvested from locations along Chakchak Creek. Burbot were also harvested from a location southeast of the community, in the Kolavinarak River.

One key respondent explained that he determined where to set their net based upon certain nonsalmon fish species' diets and their migratory behavior.

> Because when we gut the whitefish, pike, and lush fish, there's, in their guts, there's always needlefish and blackfish and that's where we like to set them, around where we know that there will be a pond way up there and I think most of the whitefish, I think they go into the pond and spawn. Because there is a lot of them in the pond and there's less in the river and they go up to spawn. That's…what I've learned. I used to think they were spawning in the river, but I think some of them do spawn in the river. But majority of them I think they spawn in those ponds where there is fresh spring water. (031618NME01)

Regarding determining setnet locations for pike, the same key respondent added that in

> May, when before the ice breaks up when these ponds start thawing out. We know where there is a big pond and we know, there is a little creek going out into the river and that's where we are going to set our net. In the pond, we use the canoe, set our net. No anchor, just put it there, no current, nothing, and watch it and the fish will start. (031618NME01)

Another respondent shared stories about elders who explained that burbot harvested in one area differ in taste from burbot harvested in other areas.

> It's because different rivers' fish are unique. See there's this one elder Nurataaq, he told a story that in this area [nearer the coast] the lush fish [burbot] are better eating, they have better livers. And farther inland their livers are darker, and their flesh a lot different, saying ones here have better meat. That river's fish are darker. They're different from one another, like a different race of fish. Also that one guy from Kasigluk, [her] father-in-law, said that here the meat from lush fish turns out to be better, has tastier meat, that they're more delicious from the ones up there in the Kuskokwim's lush fish. That their taste has a smell more like from ground, and really saying they're better eating here. You know, that up there their scent is never the same. Like that. (110518NME02)

The search and harvest areas for saffron cod (locally known as tomcod) and rainbow smelt[19] included select locations along the Toksook and Kolavinarak Rivers as well as a few locations near Toksook Bay and Umkumiut (Figure 3-13). Saffron cod fishing locations along the Toksook River were concentrated near its mouth, approximately 12–15 miles downstream from Nightmute. Fishing locations along the Kolavinarak River were situated directly southeast of the community, where smaller creeks discharge into the mainstem. One key respondent talked about saffron cod distribution in relation to fish size and fisher preference, in areas downstream from Nightmute,

> Yeah, there is *iqalluaqs* [saffron cod] down there. Right below, right below in front of Toksook and Umkumiut those *iqalluaqs*, tomcods are pretty small. But when they get close to the mouth of Toksook River, the fish start getting a little bit bigger. And when they go in, go in, the fish are about, most of them are about that long [approximately 12 inches]. Big tomcods, that's what we like to catch. So we, people from Nightmute try to stay close to that mouth of the river and people from Toksook Bay learned that there is bigger fish over there, they start going to those.

19. Hereinafter, *smelt*.

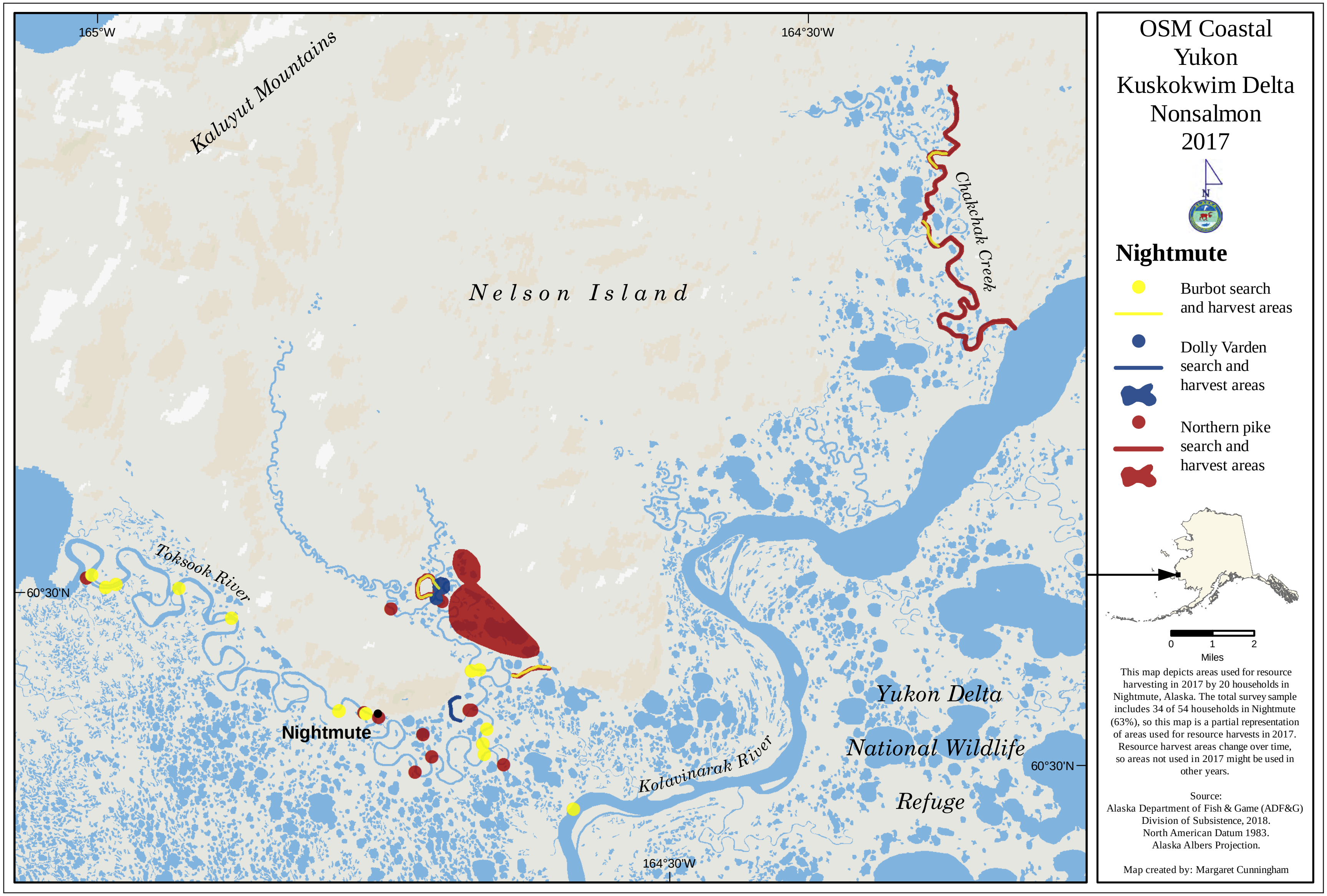


Figure 3-12.–Burbot, chars, and northern pike fishing areas, Nightmute, 2017.

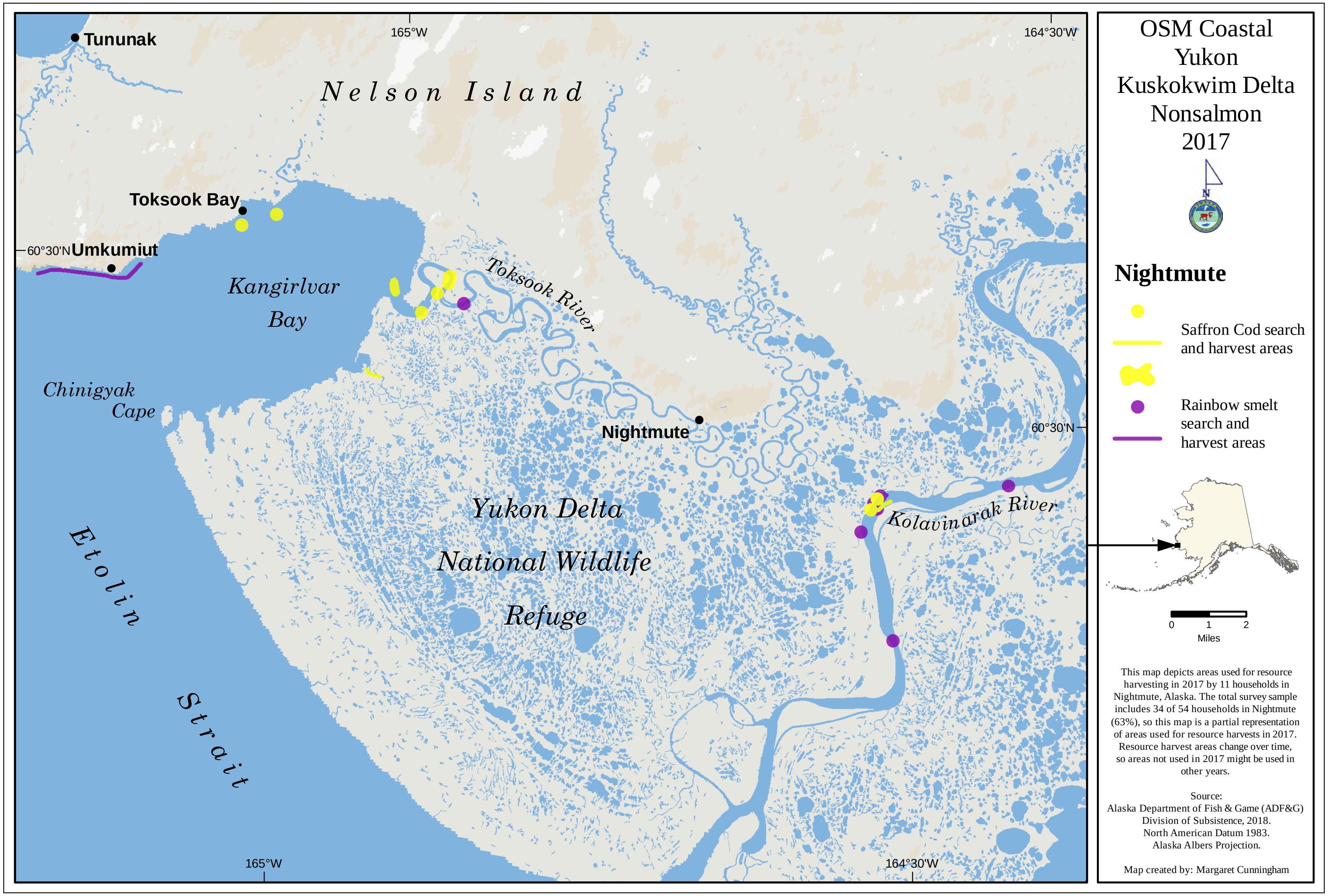


Figure 3-13.–Saffron cod and rainbow smelt fishing areas, Nightmute, 2017.

> So those ones, they're tastier, and they have more meat, the ones in the river and they are bigger. And they dry them and ferment them and freeze them. That's how we eat them. (031618NME01)

In addition to one location near the mouth of the Toksook River and a three-mile-long stretch of water immediately in front of Umkumiut, search and harvest areas for smelt were distributed along the Kolavinarak River.

> Most of it [smelt fishing], it's only in fall time. It's when they are easier to catch. And that's when swarms of them are coming into the Kolavinarak, that big river out there…It's when they are all down there, a bunch, use a dip net and haul them out and load up maybe eight, nine sled loads. Take them home, share it to everybody. (031618NME01)

Sculpins and flounders were harvested within Kangirlvar Bay and in the Bering Sea (Figure 3-14). These two kinds of fish were common incidental catches while fishers conducted their halibut fishing.[20] Capelin were harvested from only one location situated approximately one mile downstream of the community. Although this particular species is relatively scarce in the Nightmute area, a key respondent discussed harvest methods at the location.

> It's just this one, the one that I know where I usually go, it's just right below this village, there is if you go down and turn around on the river there is a river, small river about this wide, you go into that river and get to that intersection and that's where we catch them, when after it first freeze-up. Maybe when we start, able to go across, and take our dip nets and maybe a small bag, take a couple of people and start dipping. You start making noise and the fish will start herding toward, start running all the way and then we'll start seeing 'em. That's what they do. Like get a, fill up a tub for the whole village because we hardly catch those. (031618NME01)

The same respondent discussed other traditionally used capelin search and harvest areas.

> They used to show up right in front of Umkumiut, but nowadays, we have to go down to Uluruk past that waterfall…Go by boat or Honda. And we used to catch those, they used to beach right in front of Umkumiut. Just go down, take a bucket, dip net it, fill up a bucket. (031618NME01)

According to one elder, the presence of jellyfish in areas where capelin tended to congregate prevented them from beaching and spawning. (110518NME02)

The search and harvest areas for halibut, Pacific cod, and walleye pollock were largely concentrated along the southern coast of Nelson Island between Umkumiut and Cape Vancouver and extended several miles into Etolin Strait including one location approximately four miles from the northeast coast of Nunivak Island (Figure 3-15). Several household respondents indicated that both Pacific cod and walleye pollock were not targeted but were common incidental harvests during halibut fishing. Therefore, the search and harvest area depicted in Figure 3-15 is primarily a representation of halibut fishing locations. However, one lifelong fisher commented about the increasing prevalence of Pacific cod as well as salmon sharks (*Lamna ditropis*), which fishers have observed while halibut fishing (031618NME01).

This same fisher also provided details about his choice location for halibut fishing.

> There's one, one spot that I found that has one current. Even the water changes, that current stays the same…That's the spot I go, and I don't go anywhere [else]. And that's the hot spot. It has only one current, I don't know why it's always like that. It's always, I'm always, my boat is always toward Nightmute, even the boat next to me would turn this way, my boat would stay. I don't know why it's like that, it has that one current for some odd reason. On the other side, it would turn

20. C. McDevitt field notes, March 2018.

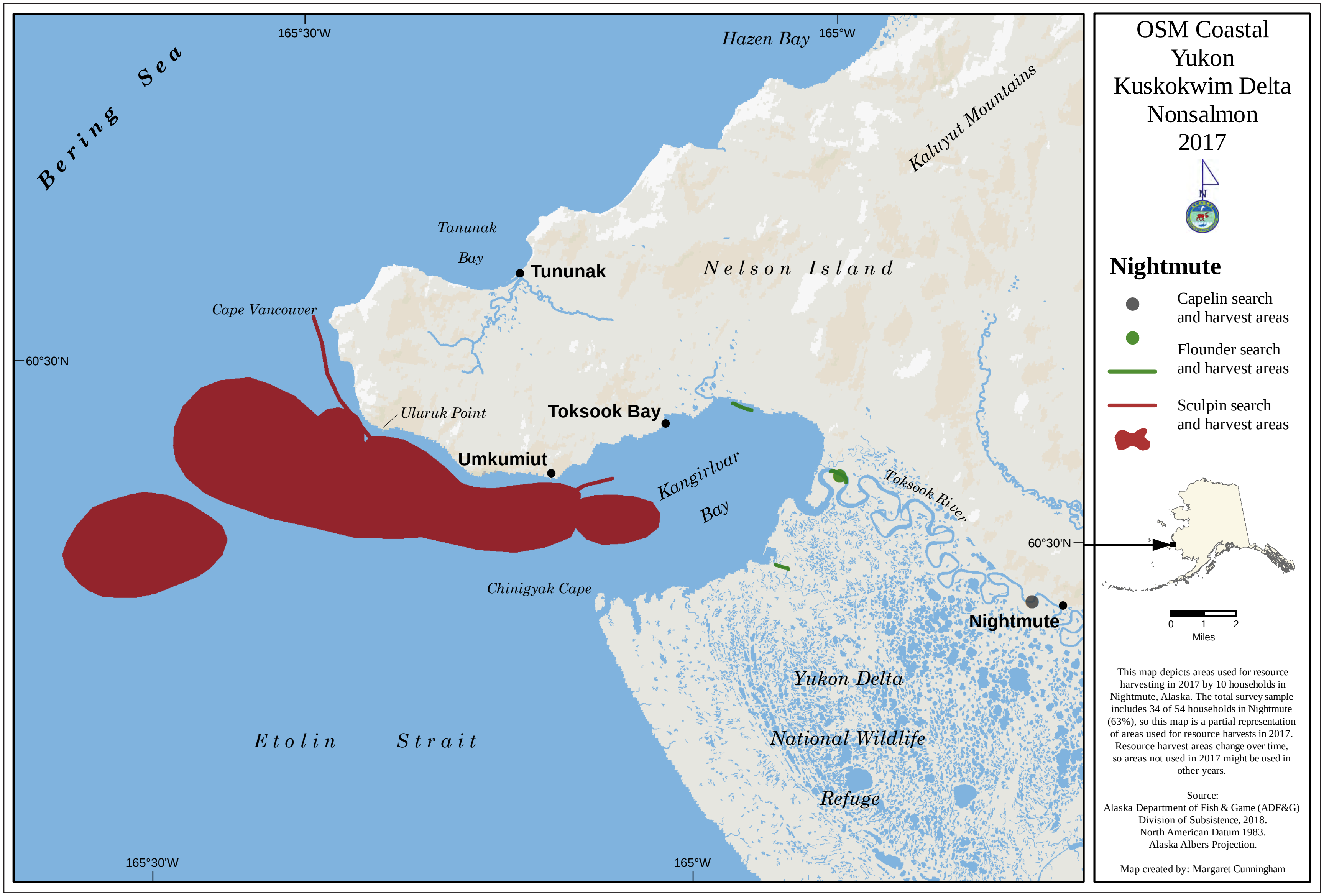


Figure 3-14.–Capelin, flounders, and sculpins fishing areas, Nightmute, 2017.

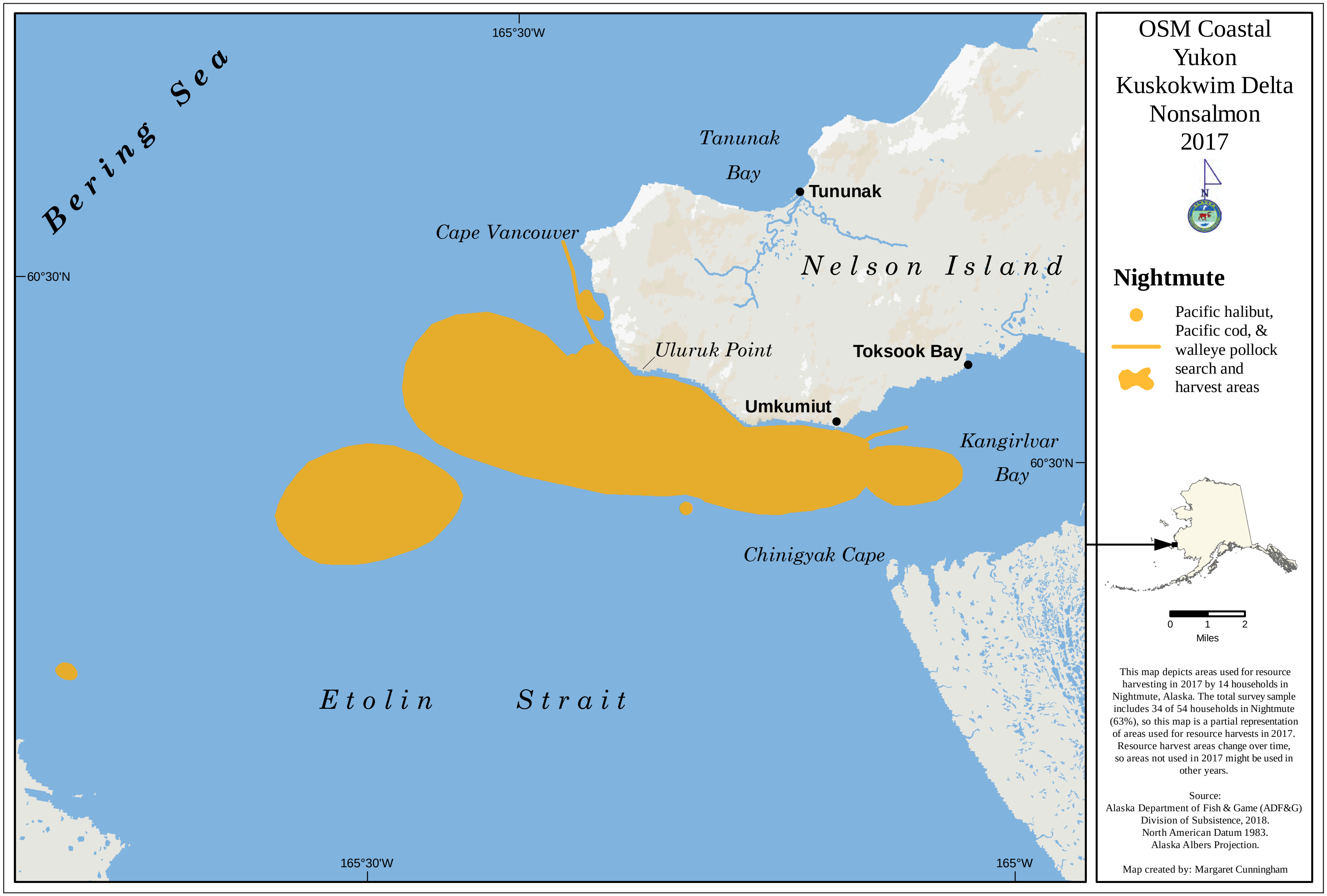


Figure 3-15.–Pacific halibut, Pacific cod, and walleye pollock fishing areas, Nightmute, 2017.

Plate 3-5.–Umkumiut, approximately four miles southwest of Tooksook Bay and 22 miles west of Nightmute, is a traditional herring camp used by many residents of both communities.

> in front of me, do a turn. And that one area is kind of like that…and the bottom part [sea floor] when you dip your hook down and the weight touches the bottom, it will be like if something's sucking. Really soft bottom. And it's fun to fish there because you always catching, right away. That's the only area that I like to fish. (031618NME01)

Nightmute fishers harvested herring and herring roe on the north and south sides of Kangirlvar Bay. The traditional herring camp at Umkumiut is situated adjacent to a highly productive spawning and migratory pathway for this extremely important nonsalmon species (Plate 3-5).

Herring and herring roe were also harvested along the western and northern coasts of Nelson Island from Uluruk Point to an area approximately 11 miles northeast of Tununak, within Hazen Bay. One key respondent described the somewhat unpredictable nature of the spring herring run. He discussed prevailing conditions during more recent runs as well as the possible effects of ice conditions and water temperature on herring migratory patterns and distribution.

> So each kind of patterns are changing, seems like, with the herring. And they're, they're not coming in front of the Toksook [Bay] as many as there used to be. They used to spawn in that area, that's where we used to catch our herring eggs but nowadays we have to go out…or even across Tununank because they are hardly coming in and most of these elders are saying I think that the bay is getting shallower and getting warmer; that's why they are hardly coming in the bay. So, that's what I, that's what I experienced. That's what I saw…seems like the herrings are moving north. They are starting to spawn on the north side [of Nelson Island] instead of Uluruk [point] and Cape Vancouver…in front of Cape Vancouver too on those rocks, there used to be pile of 'em, but we don't see them anymore. So we're starting to catch our herring eggs back there. That's the only area we're starting to go. I don't know, I think there is something wrong on this side, in this bay [Kangirlvar]. The fish are not, they don't want to go in. Maybe like I said, I think it is getting shallower and getting warmer. (031618NME01)

Nightmute residents focused most of their harvest efforts for marine invertebrates in shallow areas adjacent to the coastline on the southside of Kangirlvar Bay (Figure 3-16). The search and harvest area extended from the southern coastline roughly three miles north into Kangirlvar Bay. The easternmost extent of this area was approximately five miles southwest of the Toksook River mouth, and the westernmost extent of the area terminated near the mouth of Kangirlvar Bay. According to survey respondents, these areas, which are characterized by extensive sandy shoals, provided the best habitat for various types of marine invertebrates. Respondents indicated that marine invertebrates were most easily harvested during periods of low tide in these areas.[21]

In addition to the area mentioned above, residents harvested marine invertebrates, especially chitons, from two smaller locations near Umkumiut. According to one key respondent, chitons are removed from exposed rocks at low tide by using a "knife or a crowbar to pry them off" (031618NME01).

Observations of Changes Affecting Nonsalmon Fisheries

Survey respondents were asked whether they have observed any changes in local environmental conditions as well as changes to nonsalmon fish and invertebrate resources. Surveyors documented the kinds of changes that respondents reported observing and how these changes may have affected their households' use of these resources. Following is a summary of observed changes and their effects on households' harvest and use of subsistence nonsalmon fish and invertebrates. Some households did not offer any additional information during the survey, so not all households are represented in the summary.

Respondents shared with researchers several observations regarding environmental changes that have affected both nonsalmon fish as well as fishers' ability to search for and harvest these important resources. Approximately three-quarters of surveyed households (26 of 34) provided responses when asked if they had observed any environmental changes in recent times (Table 3-10). Many household respondents offered multiple observations of environmental change. The most frequent responses were related to the effects of climate change. These included comments about increasingly warming air and water temperatures as well as fluctuating water levels. Respondents also noted an increase in the severity of storms, lack of precipitation in winter, and poor ice conditions. Twenty-one households provided responses about the effects of environmental changes on their nonsalmon resource harvests. Respondents most frequently said that environmental changes affected the abundance, distribution, and health of nonsalmon resources. One active fisher explained that several different environmental factors affected capelin abundance and distribution.

> If it's too warm this winter, capelins, they are not going to show up. That's what I'm learning, starting to see. And if our winter was kind of snowy from, let's say, from December to here [March]—it already snowed—capelins will come. And if we have less snow like this year, the snow comes in late, I don't know. Capelins, I don't think they gonna show up like last year. Last year, there was hardly any snow, capelins, they didn't show up because it was warm all winter…but seems like the water start getting shallow and warmer and those capelins, they can't come up that warm water. I think those are cold water fish. If it's above 70, I don't think they'll come up to the bay…They're like that out here, those capelins. If you go up on the mountain [near Cape Vancouver] you'll see a very super long line [of capelin]. (031618NME01)

The same respondent explained that environmental changes also affected herring timing and distribution.

> I think they come in at the right time, but the ice out there, I think they kind of hold them a little bit longer to come in because the ice, even it's not frozen that much, it goes out a little bit later. But this here [referring to map location near Umkumiut], it's not frozen. And one time, herrings didn't come in, none, and I don't know what happened. But that time the ice went out super late. We still had ice in July. So it's things like that, we never observed before. And last year [2017], when they [local fishers], they said they [herring] came, but I think they kinda missed the ending part…the herring just disappeared after that. But later on…we start hearing people,

21. C. McDevitt field notes, March 2018.

Table 3-10.–Observations and observed effects of changes in environmental conditions, Nightmute, 2017.

Observations	Effects
Low snow levels past 5–6 years	
Floods, lots of rain	May have affected
More warm weather last year and seems to be warmer this year, and windier	
Warm weather, have to go farther out	Travel farther for halibut
Weather, warmer water, low water	Access—couldn't get to usual spots
More bad weather between Feb and March, more storms	Going out less due to bad weather
up. Late summers cause us to catch less because we are missing out on the [berry] picking season.	Catch less or miss berries in late summer
Early spring earlier warm up and thaw	Everything comes in early (or some late). Their migration changed and we keep missing the peak so we have to fish longer.
More wind and stormy. More trash scatter, late wind and late summer	Going out later
1. Late winter/ early spring, 2. Flooding	1. Affects timing so it's hard. 2. Blackfish trap stays in longer, til February or March
Warmer water	Sick fish, spots and pus
High water, fall flood. Blackfish move around	Less abundance
Higher swift water, more river cutoffs. Warmer weather.	Less abundance
1. Weather 2. Stormy weather. 3 High tides in fall that with storms floods a lot of land and tundra	1. Less harvest of all species. 2. Didn't go halibut fishing 3. No explanation
Way warmer than previous	With illness there are certain fish that will further harm eating smelt
River changing warmer climate	More diseased whitefish—throw some back. Less capelin going up shore and on beach—no idea—but harvest less or go without
Global warming	Less fish
Warmer weather, water	Less fish
Warm, lots of rain—big floods. Low snow level, thin ice on river.	Doesn't see many capelin anymore—declined in the 1980s? May affect abundance, less fish
Warmer	Less abundance of lush [burbot]
See more trash in the river. Climate change raising water on coast, less snow	Maybe affect the health of fish
Global warming	Less fish
Sudden weather changes	Caught fish that they have never caught
Pus, black and green spots. Deformed round [whitefish]. Rash on whitefish	
Hotter. Hot water may affect fish	
Warmer, thin ice early spring	

Source ADF&G Division of Subsistence household surveys, 2018.

> "They're starting to show up again." We quickly went down and caught more. (031618NME01)

The respondent also talked about the effect of these changes on access and timing for smelt.

> But, recently since what, four or five years, majority of our people quit going there because, because of the late season. It freezes up later after all those are long gone. So we hardly catch them anymore. Sometimes somebody would go and try and get less than a half a bag. Back then, when we used to go down and do our smelting in October, that used to be a perfect month. October or September. But nowadays we hardly catch them because the freeze-up is too late and we miss the peak. So the best time to catch smelt here is in September or October. And this year it froze up in December, so we couldn't catch any smelt. No, it's been like that for the past, what, five years, something like that. Sometimes we try to catch them but they are, we can't find them. (031618NME01)

Respondents were also asked about changes with the resources themselves and if these changes affected their harvest activities. A total of 26 responses were provided to researchers, all of which were related to fish health (Table 3-11). These included observations of unfamiliar physical abnormalities among harvested fish that respondents believed to represent poor health. One key respondent detailed his own observations.

> We, at first, we start just seeing these black spots before we started seeing pusses or little red spots, around the mouth or around the facial area. Then later on the green stuff start coming in and after that green stuff start coming, we seen this green stuff on the parts where it's easy to see later on. I think it was around maybe mid-90s or early part of 90s we started seeing pus on the whitefish. (031618NME01)

Although most respondents indicated that they do not eat fish with the physical conditions described above, and instead feed it to dogs or discard it into the water, one respondent shared a story that was contrary to how most fishers thought about these situations.

> And I asked Dad, "What are these [abnormalities on fish]? How come these go like that?" He said "Sometimes fish deform like that." And when kids, when they are young and they, before they start moving, if a little child eat that deformed fish or that bones are somewhat, for some odd reason, they will be healthy and their bones will grow really strong, they'll be hard to break. That's what they used to say. (031618NME01)

In addition to the observations mentioned above, some respondents noted that erosion along the banks of the Toksook River near the community dump resulted in trash getting into the river (Table 3-12). Other respondents shared concerns about sewage leaching into the Toksook River from the nearby lagoon.

Respondents were also asked if there were any species of nonsalmon fish that they used in the past but no longer used in recent times, or if there were any nonsalmon resources that they use now but did not use in the past (Table D3-11). Two respondents explained that they no longer use Pacific cod. In addition, four respondents indicated that they recently started using sheefish, and one respondent explained that he recently started to use skates. In addition, two respondents said that they recently started to use saffron cod and burbot.

Another respondent talked about the increased presence of Pacific cod and salmon sharks and a decrease in wolffish abundance and usage. The respondent claimed that wolffish was both observed and harvested more in the past.

> But lately these younger kids, they say these cods are getting too much, even sharks. They said nowadays they start catching sharks and cods, and I told them, "When we were younger there was hardly cods, hardly sharks. Mostly, mostly were halibut and *arnaqusaraq* [wolffish]." Those ones [wolffish] were kinda a little bit more back then and nowadays we hardly catch 'em. (031618NME01)

Local Comments and Concerns

Following is a summary of local observations of nonsalmon fish populations and trends, as well as related comments and concerns that were described during the surveys and ethnographic interviews. At the end of each household survey, respondents were asked if they had any comments or concerns they would like to share. A small number of survey respondents provided comments and concerns to researchers (Table 3-13). Most of the comments and concerns pertained to fish health and abnormal weather, although other topics were also noted.

Survey comments included concerns about fish health such as observations of pustules and sores on different whitefish species. Abnormalities were not exclusive to any one species of fish, according to one key respondent. The respondent described how he has witnessed physical abnormalities on different whitefish species and on saffron cod.

Table 3-11.–Observations and observed effects of changes in nonsalmon fish and marine invertebrates, Nightmute, 2017.

Observations	Effects
Pus and spots, bulging eyes. Smelt, lush [burbot], whitefish, and tomcod	Not keeping, dig hole and put in tundra (per elders, don't throw back in = bad luck)
Whitefish with tumors	Doesn't eat
Purple skin and sores. Whitefish and lush have mouth sores. Deformed spines. Last year so many sores in Chakchak [Creek]. Only 10% are healthy	Don't want to keep them. Set aside bad ones. The disease comes once in a while then it's gone
Broads [whitefish]—white patchs, bruised. Lush—lumps on lips and head, bruise on stomach	Doesn't eat—dog food
Few years ago white spots on scales of whitefish, even on halibut	Put them back—means we're bringing less home
Sores on whitefish	
Deformed lush. Some fish has pus on the meat on red salmon. And caught a fish they never caught	
But if the fish is wounded not to eat it because it will further cause illness	
Capelin are less. Diseased broad whitefish and round whitefish	
White spots on broad whitefish and lush	Doesn't eat
White spots on whitefish	Not keeping
Rash on lush and qaurtuq	Doesn't keep, dog food
Sick fish (lush) white spots.	Can't keep them
Unhealthy tomcods	Doesn't eat
Broad whitefish, glowing green 3 years ago	
Whitefish—Bering cisco and humpback cisco = sores	Doesn't eat them, dog food
White spots, mold, sheefish	Used to eat when young, not anymore
Broad whitefish have growths	Dog food
Sores on whitefish. Yellow / green spots on tomcods	Doesn't eat them.
Red boils on broads and naptaqs. Green smelts	Doesn't eat
Changed migration timing due to weather. Changing abundance, seems like everything is less	
Spots of wounds on fish. The worst I saw was black spots, puffy face. Sometimes I catch deformed fish. If kids eat deformed fish, they get healed	It really doesn't. Food to kids
Fishing for lush and it's been warm so it's been hard to find them. Radiation must have affected the fish (Fukushima)	
Green and black spots on tomcod. Black spots on lush. Broad [whitefish]—brown fungus, boils	Doesn't eat
Deformed whitefish mouth. Black spots on lush fish and tomcod	
More deformed fish than there are usually.	
Whitefish spots—just let them go	Harvest less.

Source ADF&G Division of Subistence household surveys, 2018.

Table 3-12.–Additional observations, Nightmute, 2017.

Observations
Trash in river, eroding river banks near dump
Late for the pick season
Leeching from lagoon into Ook River

Source ADF&G Division of Subsistence household surveys, 2018.

> The last time I went to go *manaq* [fish through the ice] I saw this, there was a pus in one of them…and one of the [tomcod] was deformed…stuff that I that I never seen before. Some of them are deformed, some parts are missing, like those little fins that are like rotting away. Rotting away alive. Some of them are like that. (031618NME01)

Another household respondent talked about abnormal weather events, specifically fall flooding in the Nightmute area; the flooding's severity has intensified in the past two to three years.[22] Some Nightmute residents explained that the fall floods displace certain anadromous and freshwater nonsalmon species due to the inundation of saltwater into freshwater habitats.

Other comments shared by respondents included one concern about commercial trawlers "fishing too close to the coast." Both during the survey work as well during informal conversations, several fishers talked about witnessing what they believed were commercial trawlers in close proximity to the Nelson Island coastline as well as near Nunivak Island. These sightings occurred while fishers were halibut fishing in coastal waters near the two islands. One fisher explained that that he had witnessed one such vessel about 15 years ago[23] in the area mentioned above. The fisher described the vessel as having "foreign writing on the side" and emphasized that it "was very quiet, no noise, no nothing" as it moved through the water.[24]

Additional comments and concerns included an observation of "smaller dead lush floating down the river," which, according to the respondent, had been occurring for two consecutive years. One respondent noted that there are no life preservers available in town for boaters and added that the state sponsored "Kids Don't Float" program had "dwindled off" in Nightmute. One respondent asked about the effects of human waste on fish and added that there are concerns about the community sewage lagoon leaching into the Toksook River.

Acknowledgments

The results of this research could not have been achieved had it not been for the graciousness and hospitality offered by Nightmute residents and Tribal representatives to Subsistence Division staff. The author would like to personally thank Tribal Administrator Nick Tom, all other staff at the Nightmute Traditional Council, and Traditional Council members for their willingness to share their extensive knowledge about the community and about nonsalmon fishing. The author would like to thank Timothy Jumbo for showing him around the community and introducing him to several Nightmute residents. Lastly, the author would like to personally thank Nightmute residents John George and David Tulik for their help with the household surveys as well as all of the translation work they provided for researchers. A special thanks to John George for going above and beyond. Quyana cakneq, John.

22. Survey notes, March 2018.
23. C. McDevitt field notes, March and November 2018.
24. C. McDevitt field notes, March and November 2018. John George, Nightmute resident, personal communication with author, August 9, 2019.

Table 3-13.–Respondent comments, Nightmute, 2017.

Past 2–3 years big flood fall time, storm—not normal. Toksook River swifter (from river cutoffs), clarity down. Warmer water—global warming. More trash in river. Traffic (Sno-gos, boats) disturbing fish and animals. 2016—very few blackfish, pike, humpbacks etc. Maybe due to flood.
The big concern is the sores.
Just wonder why the survey is being done. [Name] explained they are just gathering information.
Whatever it maybe the ship are being seen on our area. Comment about trawlers fishing too close to the coast.
Lots of pus on broad whitefish—lots more—getting better in spring. Bering whitefish are travelers—they get around. In Indian country—fish are going bad due to mining. Most broad whitefish have pus, worse in summer then they get better. Decrease abundance.
No life preservers in town. Nobody wears them—many deaths. Kids don’t float program "dwindled off". Musk oxen being poached. More wolves, moose past few years. Less rabid foxes and more beavers.
Smaller dead lush floating down river past 2 years.
Can human waste affect the fish?
Due to work, I haven't gone out much.

Source ADF&G Division of Subsistence household surveys, 2018.

Plate 4-1.–Aerial view of Kipnuk in winter with an open Bering Sea in the background.

4. KIPNUK

Anna R. Godduhn

In March of 2018, three Division of Subsistence staff worked with four local research assistants to conduct nonsalmon subsistence harvest surveys with households in Kipnuk (Figure 1-1; Plate 4-1; Plate 4-2). Researchers surveyed 98 of 146 (67%) randomly selected households about their harvest and use of nonsalmon fishes and marine invertebrates (Table 1-7), and the average survey length was 21 minutes (Table 1-8). The total nonsalmon fish and marine invertebrate harvest for the community of Kipnuk translated to about 167 lb per capita in 2017 (Appendix D, Table D4-1).

In addition to the household surveys, ADF&G researchers conducted five key respondent interviews with seven knowledgeable Kipnuk subsistence fishers. Key respondents shared their observations, experiences, comments, and concerns, and they provided researchers with vital information regarding subsistence activities associated with nonsalmon fish, including seasonal harvest patterns and related changes over time. This information helped to contextualize the quantitative harvest and use data collected in the surveys.

Community Background

Kipnuk (*Qipneq)*[1], a Central Yup'ik community, is in the southwest corner of the Yukon-Kuskokwim Delta (YKD), approximately four miles up the Kuguklik River from its mouth, surrounded by the tidal wetlands and subarctic tundra (Fienup-Riordan and Rearden 2012; Himes-Cornell et al. 2013). *Canineq*, the Kuskokwim coastal area between Kuskokwim Bay and Nelson Island, has been occupied by the *Caninermiut* (Pratt

1. Qipnek is the Central Yup'ik name for the community; the name means "bend in the river" (Breu 2009). Unless otherwise noted, Yup'ik place-name spellings in this chapter come from Yup'ik Environmental Knowledge Project Atlas: Exchange for Local Observations and Knowledge of the Arctic (ELOKA). n.d. "Yup'ik Environmental Knowledge Project Atlas." Accessed March 19, 2019. http://eloka-arctic.org/communities/yupik U.S. Geological Survey (USGS) spellings are also provided.

Plate 4-2.–Abandoned water tank turned into the Search and Rescue building in Kipnuk.

2012)[2] for thousands of years (Andrew 2008; Jack 2002). The Kuguklik River and the Kinak River flow into Kinak Bay, which is sheltered by a series of barrier islands. The shoreline of this portion of the YKD is characterized by wide mud and sand flats. Low gradients result in shallows that extend for miles offshore and subject the community to severe flooding (AECOM 2016; Coastal and Ocean Resources 2015) that brings saltwater inland (Fienup-Riordan and Rearden 2012:43). The Kuguklik River (*Qukaqliq*) is known to be salty (Fienup-Riordan and Rearden 2012:154,225); a key respondent said of broad and humpback whitefish, "Those are freshwater fishes so we don't have them here" (041217KPN1). Although many Kipnuk families routinely fished for salmon along the Kuskokwim River after the introduction of motorized boats (Jack 2002:5), they are generally more focused on the rivers, lakes, creeks, and smaller bays of the delta coast, and Etolin Strait.

ADF&G Division of Subsistence has conducted few studies in Canineq communities. Kipnuk residents participated in subsistence herring surveys in 1985 and 1987 (Pete 1991b; Pete et al. 1987). Several authors have written qualitative descriptions of subsistence use in the area. School teacher Etta Jones documented life in 1930s Kipnuk (Breu 2009), and Jack (2002) describes the Caninermiut worldview with respect to western style natural resources management. Additional qualitative information about Canineq is drawn from a 1982 ADF&G project focused on coastal ecology and resource use (Stickney 1984). Finally, Andrew (2008) provided detailed, first-hand descriptions of 20th century subsistence surrounding Kwigillingok, a nearby community on the northside of Kuskokwim Bay.

Canineq was likely first populated during the regional population expansion that resulted from the use of nets some 2,400 years ago, first to catch fish and, later, birds and mammals (Shaw 1998). Because of difficult access and lack of resources, Caninermiut were isolated from direct Russian and Euroamerican influence and documentation until well after the U.S. purchase of Alaska in 1867 (Jack 2002:6). However, the Alaska purchase followed nearly a century of Russian fur trading and widespread epidemics in the region, both of which disrupted and diminished populations across southwest Alaska (VanStone 1984:229). The first documented contact along the Kuguklik River was in December 1878, at *Cal'itmiut* (Nelson 1882:668; USGS Chalit), a few miles upstream from where Kipnuk was later settled.

2. With variations in spelling, Jack (2002) and Andrew (2008) identify the people of the southern YKD as Caninermiut, including the contemporary communities of Kipnuk, Chefornak (Cevv'arneq), Kwigillingok (Kuigilnguq), Kongiganak (Kangirnaq), and Tuntutulaik (Tuntutuliaq).

The Caninermiut was one of at least a dozen essentially self-sufficient Central Yup'ik groups on the YKD; members of these groups moved freely about their respective territories (Fienup-Riordan and Rearden 2012:16). Prior to contact and through at least the 1930s, the people were seminomadic and moved between seasonal camps for the efficient procurement of resources (Breu 2009). This broad context describes what Etta and Foster Jones found when they arrived at Kipnuk in September 1932 as the first schoolteachers:

> The villagers did not live under tribal rule. There was no chief. They seemed to be just a group of people who happened to live near each other, and they were constantly moving from village to village…In the fall, they chose a spot for a house, made a sort of framework of driftwood by fastening the longer poles together, tent fashion, then covered it with sod and moss, leaving a square opening in the roof for smoke to escape, but making a wooden covering for the opening to keep out storms. (Breu 2009:79)

The 1930s diet was made up of "a little tea, fish, seal meat, seal oil, and whale when they can get it" (Breu 2009:95). Although Jones was under the impression that no more than two weeks of food was kept (Breu 2009:80), she included "fish cooked, raw, and dried" in a list of foods served at celebrations (Breu 2009:84).

Seal hides were prepared as pokes for storing foods such as walrus flippers, fish, or greens in seal oil; the pokes were stored in shallow pits on the tundra (Andrew 2008:87). Storage caches were dug or made in depressions. People lined the bottom with wood; they layered the contents with grass and moss to protect from mold and sometimes layered with multiple levels of wood to protect from marauding animals. Although the "skin bottles" (pokes) were stored "sometimes miles and miles from their winter dwellings," the caches were never disturbed (Breu 2009:82). Parkas were mostly made of reindeer or bird skin; a few were made of ground squirrel, but "only the most affluent could afford those" (Breu 2009:80).

The U.S. Bureau of Indian Affairs (BIA) intended to build a school at the larger winter settlement of *Cicing* (Cheeching)[3], on a hillside several miles to the north of Kipnuk (Breu 2009). However, delivery of materials could not be made to that location nor to Cal'itmiut. The winter villages of Cicing and Cal'itmiut were relatively far inland, likely because early winter storms sometimes carried ice miles onshore; the historical frequency of these events is unknown, but Nelson described that, in late December of 1878, Cal'itmiut "narrowly escaped being razed by the ice [up to four feet thick] which was carried about it by the water" (Nelson 1882:668). School construction was underway at Kipnuk when the Jones' arrived, and the location became a permanent community (Breu 2009; Jack 2002:5). Adults as well as children attended class, and all exhibited high attention to detail along with mathematical and linguistic aptitude.

Moravian missionaries built a chapel at Kipnuk in 1937 (Henkelman and Vitt 1985:66), and consolidation of the population from the surrounding area continued through the 1950s, especially in winter (Jack 2002). "It was also during this period that some of the sailing fishing boats powered by inboard motors were introduced to Canenermiut [sic] villages to be used for transporting families to the Kuskokwim River for summer [salmon] fish camps" (Jack 2002:5).[4]

Few details of Kipnuk's history are readily available, although commercial fishery records provide some information about the community's economy. Fishers from Kipnuk have had opportunity to participate in commercial fisheries for Pacific salmon species[5], Pacific herring[6], and Pacific halibut[7] since perhaps as long ago as the 1940s, and have done so with variable intensity; relatively recent research identified commercial fishing as "important" and subsistence as "fundamental" to the economy in Kipnuk (Himes-Cornell et al.

---

3. Cicing is about 10 miles north of Kipnuk, on the east side of *It'kiliq* (USGS Cheeching Mountain); the historic settlement is in a different place on USGS maps (as Cheeching) than on the the Yupik Atlas (*Cicing*).
4. Jack (2002) describes salmon along the coast as "seldom harvested because of their excessive fat content."
5. Hereinafter, *salmon*.
6. Hereinafter, *herring*.
7. Hereinafter, *halibut*.

2013). Records back to 1980 show that participation in commercial salmon fishing never occupied a majority of fishers, but residents fished 20 or more salmon permits from 1980 to a (post-1980) peak of 31 permits in 1992.[8] Kipnuk fishers held declining numbers of salmon permits through the 1990s and participation fell even faster, especially after 1996; from 2000 to 2015, Kipnuk residents fished about half of the continually decreasing numbers of salmon permits.

Although Kipnuk fishers were among those who resisted the commercialization of herring fisheries (Pete 1984), this fishery dominated commercial participation for Kipnuk fishers in the 1990s. Kipnuk fishers consistently held more permits than they fished.[9] Between 1988 and 2000, Kipnuk residents fished between 60 and 100 commercial herring permits; this was followed by a steep decline, and no herring permits have been active since 2005. Operation of a halibut processing plant built at Kipnuk in 2002 was hindered by logistical problems (Himes-Cornell et al. 2013) and became a buying station in 2011 (Coastal Villages Region Fund 2011), when 22 of 26 commercial halibut permits issued to Kipnuk residents were fished. The numbers of permits fished in subsequent years declined, presumably because the fish had to be delivered across Kuskokwim Bay to Platinum. In 2017, Kipnuk residents held no halibut permits, and fished none of five herring permits; they did fish four of 12 salmon permits, in Bristol Bay. Survey data indicated that 30% of Kipnuk households have at least one member who usually fishes commercially, but only 3% reported the activity in 2017.

Despite its remote location, Kipnuk is well connected to its neighboring communities. Local residents establish snowmachine trails to Chefornak (20 miles), Kwigillingok (35 miles), and Tuntituliak (77 miles) each winter. A gravel airfield enables daily scheduled service to Bethel; for local travel, residents use snow machines in winter, boats in summer, and all-terrain vehicles year-round.[10] There is no dock infrastructure at Kipnuk, but barges deliver cargo from Bethel each summer.[11] Kipnuk has a clinic, a post office, a landfill, a sewage lagoon, and a diesel-generator power plant. The community is a member of the Chaninik Wind Group,[12] which is working to reduce the cost of power in the region; wind turbines have been installed at Kipnuk and are expected to be fully operational by the autumn of 2019.[13] Kipnuk is increasingly threatened by riverbank erosion and permafrost degradation: damages could exceed $30 million over the next 40 years (U.S. Army Corps of Engineers, Alaska District 2009). Following environmental clean-up of an old sewage lagoon and other facilities in 2011, the Chief Paul Memorial School was remodeled (Seely 2012).

Seasonal Round

Traditional and evolving subsistence fisheries in coastal communities of the Yukon-Kuskokwim Delta are not well documented. This first attempt to quantify nonsalmon fisheries in Canineq collected timing data during about half of the surveys. The timing data are not complete, and no timing data were collected for sheefish (*ciiq*)[14], round whitefish (*cev'eq*), or mussels (*qapilaaq*) harvests. However, the data provide a basis for the following description of Kipnuk's contemporary annual cycle of nonsalmon fishing, which is augmented by key respondent comments and some historical details from research around Kwigillingok (Andrew 2008; Stickney 1984) and the YKD region in general (Fienup-Riordan and Rearden 2012).

8. Commercial Fisheries Entry Commission, n.d. "Fishery Statistics – Participation & Earnings." Accessed August 9, 2019. https://www.cfec.state.ak.us/fishery_statistics/earnings.htm Hereinafter *CFEC n.d.*

9. CFEC n.d.

10. A. Godduhn field notes.

11. ADCCED n.d.

12. Intelligent Energy Systems. 2015. "Chaninik Wind Group Smart Metering." Accessed August 9, 2019. http://www.iesconnect.net/category/projects/

13. Tara O'Hanley, Intelligent Energy Systems, personal communication with A. Godduhn, April 23, 2019.

14. Yup'ik fish names in this chapter are from Jacobson (2012) and were verified as locally prevalent by key respondents (041217KPN1, 041217KPN2) and Sophie Paul, Yup'ik language teacher at Kipnuk's Chief Paul Memorial School.

Nonsalmon fishes provide fresh food throughout the winter (041217KPN1). Even in January and February, Kipnuk fishers are active, primarily jigging smelts (*qusuuq*) through ice and occasionally catching saffron cod (*ceturrnaq* or "tomcod") or sculpins (*nertuli*). Some fishers check Alaska blackfish[15] (*can'giiq*) traps, or dip fine mesh nets for sticklebacks (*quarruuk*; 041217KPN1, 031218KPN7, 041217KPN2). In March, when the days are longer but trails and ice are still safe, some residents also fish for northern pike[16], but most households prepare for hunting. Residents focus on hunting and processing seals in April (Andrew 2008). After the ice breaks, fishers begin to catch Bering cisco (*imarpinraq*), flounders (*naternaq*), and sculpins in the Kuguklik River and small coastal creeks. In May, herring (*iqalluarpak*) run along the coast in their northward migration and fishers harvest both the fish and the eggs (*melucuaq*) that they leave behind. In recent years, herring is fished on day trips from Kipnuk (041217KPN1, 041417KPN6). These activities increase in June, when fishing is most active. Although salmon fishing was not queried in this survey, many respondents mentioned them; one key respondent said that he had gone to Quinhagak for salmon in 2017 (041217KPN1). Locally, summer catches comprise salmon (*neqaraq*) and Bering cisco, occasional flounders or sculpins, and rare Dolly Varden (*iqalluyagaq*). Additionally, many fishers adopted halibut (*naternarpak*) into the seasonal round over the last several decades; ocean fishing for halibut, with incidental catches of Pacific cod and walleye pollock, is also most active in June. Fishers might also travel to Nelson Island or Dall Lake to fish for broad whitefish (*akakiik*), and humpback whitefish (*cingikeggliq*), especially after the salmon and halibut catches are dried and stored (Stickney 1984).

In the fall, Bering cisco and saffron cod become abundant in coastal creeks. These are the primary local targets from September into November; flounders and sculpins are often caught incidentally (031218KPN7). One key respondent said that she likes to catch saffron cod as the weather begins to freeze to avoid rainfall while the fish are drying. She said that saffron cod are processed similarly to herring: either dried "really dry" for dry storage, or partially dried to be packed in seal oil. These fish can be allowed to age a bit as they freeze and thaw a few times; the respondent explained that freeze-drying results in a softer dried fish (041417KPN6). Historically, sticklebacks (locally "needlefish") were harvested in the fall and throughout the winter (041217KPN1). Jones described activities in Kipnuk in the 1930s that are captured in archival photographs from about 1950 (Plate 4-3):

> Their main article of diet was the needlefish, so called because of its sharp needle-like spines. The whole fish did not exceed an inch in length, and were eaten raw. In the fall, we noticed them putting little nets in tiny running streams to catch these fish. Children finding these nets would sit down on the ground and greedily munch the wriggling fish like our children eat peanuts. In the winter, holes were cut in the ice, and these fish were scooped up by a net attached to a long handle. Needlefish seemed to run in schools, and if the schools were running another way, there was no food that day. But usually they were lucky. The fish were dumped in heaps on the ice where they soon froze. Gunny sacks were filled with the frozen fish and stored for future use. As fishing continued, I have seen children run from pile to pile, choosing from the freshest pile, which were the most wriggly, then eating rapidly with grins of satisfaction. There was a particular way of swallowing them so the spines did not stick them going down. Two fish were put into the mouth at once, head first, and, with a crack of the strong teeth and a few crunches, the deed was done, grinding the backbone, making it harmless. White men have lost dogs who ate these fish. Evidently the dogs did not know the correct way to eat them. (Breu 2009:80)

Jones' impression that sticklebacks were the "main article of diet" may have been less than fully informed. Itta Jones' writing shows little indication that she knew how much fishing occurred away from the community, or the volume of seal and walrus meat consumed. Jones does not mention herring, sculpins, floun-

15. Hereinafter *blackfish*.

16. Hereinafter *pike*.

Plate 4-3.–Needlefish soup; child eating needlefish (top right); men dipping needlefish (bottom right).

ders, saffron cod, smelts, or blackfish by name, but all these fish were locally available (Jack 2002:7). Alternatively, she may have witnessed especially difficult times in Kipnuk, where sticklebacks are popular in part because they could always be caught in the immediate vicinity when no other food was available (041217KPN2). Additionally, large volumes of sticklebacks and blackfish were harvested for dog teams prior to the arrival of snowmachines in the 1960s. This respondent said that dog mushers "carry [sticklebacks] around with dog teams, when they get tired they feed them a little bit, handful, all of 'em, and after they eat, they start go faster" (041217KPN2).

Historically, during the late summer and fall, Caninermiut (primarily women) stayed in the summer camps and fished saffron cod along coastal creeks with *qalurpiit*: large bag-shaped nets with no handle or frame known as fyke nets (Andrew 2008:13). Two people would hold the net open while others went upstream and slapped the surface of the water with paddles to chase fish into the net (031218KPN7). Families without school-aged children could stay in camp longer; those families trapped for blackfish and furbearers at a fall camp until December (Andrew 2008:15). After they stored their traps and other equipment along with a cache of blackfish at the camp, they returned to the winter village. When the last fishers returned, there was a feast. Fishers retrieved the equipment and most of the fish later, and they shared the fish with those in need throughout the winter. In 2017, these activities were carried out on day trips from Kipnuk, and methods for fishing saffron cod had evolved: fishers, often men, used similar bag-shaped nets to catch saffron cod before freeze-up by dragging them with homemade trawling configurations (041217KPN2, 041417KPN5, 031218KPN7).

Historically, ice formed in October and careful travel was possible by November (Fienup-Riordan and Rearden 2012:187). Usually snow fell in abundance after a quick freeze-up and was known as important for the abundance of fish and berries. As mentioned above, early winter storms can bring high winds and storm surge tides that carry ice miles on to shore (Fienup-Riordan and Rearden 2012:310; Nelson 1882:668). Key respondents interviewed for this project described these kinds of events as more frequent, more severe, and "scary" (041417KPN6). Beyond distracting from harvest activities, the storms are destructive: in 2016, a late fall flood destroyed much of the food this key respondent's family had put up the prior summer. However, the seasonal round of fishing continues, and people adapt to changing conditions (041217KPN1). In 2017, saffron cod was the primary target in October, along with smelts, Bering cisco, flounders, and blackfish. In November and December, Kipnuk fishers jigged for smelts (sometimes from a boat or riverbank instead of through ice); they occasionally caught saffron cod; and they trapped blackfish.

Population Estimates and Demographic Information

Surveys conducted in March, 2018 for the 2017 study year recorded demographic and nonsalmon fish harvest and use information from a sample of all Kipnuk households that were residing in the community for at least six months of the study year. Surveyors attempted a 100% sample of households and achieved a sample of 67% (Table 1-7), and demographic data were expanded to estimate a total population for the community. Survey results estimated a total population of 654 individuals residing in 146 households in 2017 (Table 4-1; Figure 4-1) The first U.S. Census record for Kipnuk shows 144 residents in 1939[17]; the population grew steadily to 644 in 2000, and has been stable since then (Figure 4-2). The U.S. Census Bureau identified 153 households in Kipnuk in the 2010 Decennial Census (2010 Census) with a total population of 639 (Table 4-1). The U.S. Census Bureau American Community Survey (ACS) estimated a five-year

Table 4-1.–Population estimates, Kipnuk, 2010, 2013–2017, and 2017.

	Census	5-year American Community Survey (2013–2017)		This study (2017)	
	(2010)	Estimate	Range[a]	Estimate	Range[b]
Total population					
Households	153	154.0	136 – 172	146.0	
Population	639	659.0	590 – 728	654.0	611 – 697
Alaska Native					
Population	626	657.0	588 – 726	635.6	591 – 680
Percentage	98.0%	99.7%	88.6% – 100.0%	97.2%	90.3% – 100.0%

Sources U.S. Census Bureau (2011) for 2010 estimate; U.S. Census Bureau for American Community Survey (ACS) 2017 estimate (5-year average); and ADF&G Division of Subsistence household surveys, 2018 for 2017 estimate.
Note Division of Subsistence household survey elegiblity requirements differ from those used by ACS.
a. ACS data range is the reported margin of error.
b. No range of households is estimated for division surveys.

17. ADCCED n.d.

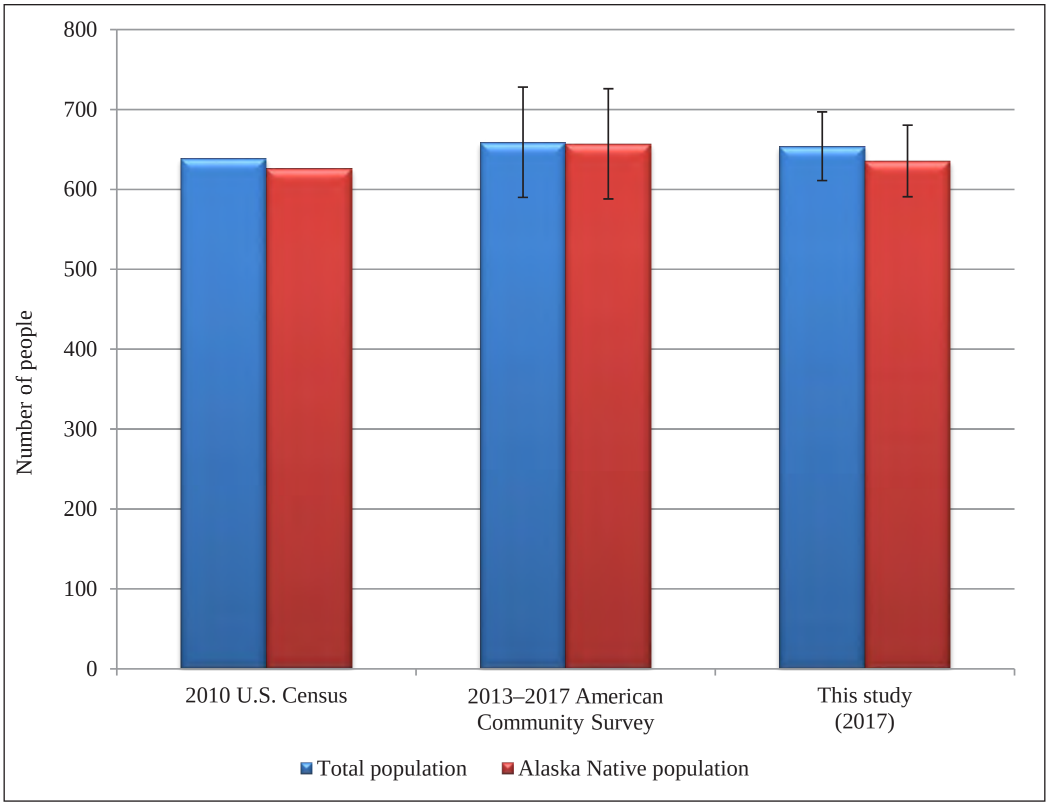


Figure 4-1.–Alaska Native and overall population estimates, Kipnuk, 2010, 2013–2017, and 2017.

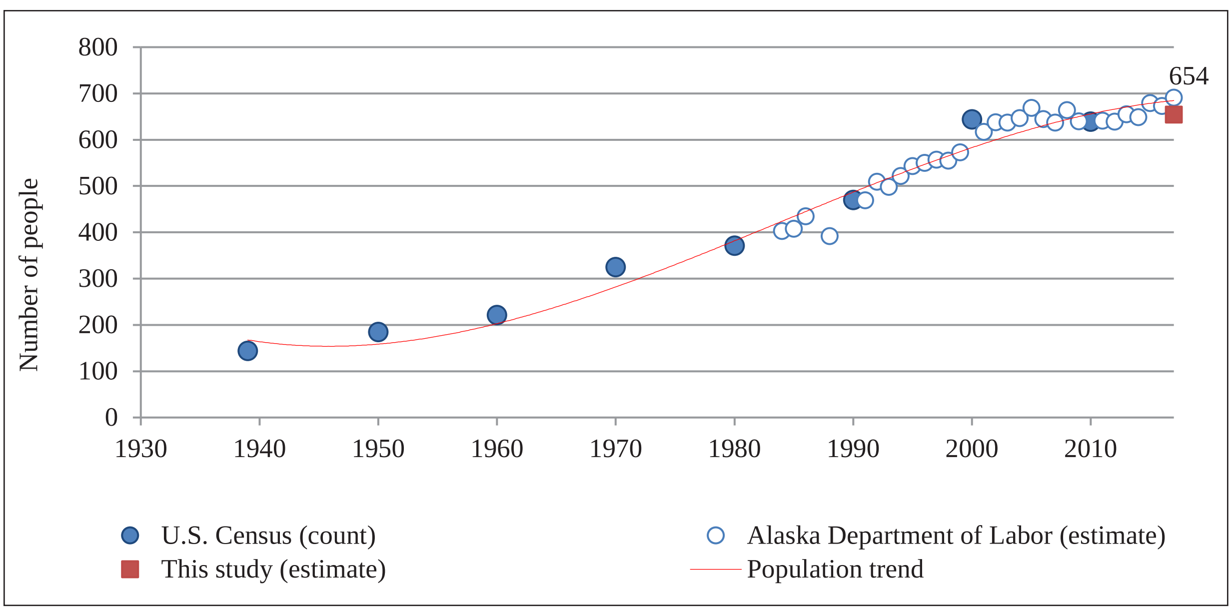


Figure 4-2.–Population estimates, Kipnuk, 1939–2017.

(2013–2017) average of 154 occupied households and a five-year average population of 659, figures that are statistically similar to this study's findings.[18]

Average demographic characteristics were also calculated from the data, as shown in Table 4-2. The average age of Kipnuk residents was estimated at 22 years (ranging from less than one to 91 years). However, ages of 21% of the sampled population were not provided (Figure 4-3; Table D4-2).[19] Kipnuk's population is about 97% Alaska Native, and about 94% of households have at least one Alaska Native head (Table 4-2).

Kipnuk was the birthplace for about 60% of household heads; 6% of household heads came from outside Alaska, 5% from Kwigillingok, and the rest from other Alaska communities from Kasigluk to Fairbanks (Table D4-3). A greater portion of the total population was born to women living in Kipnuk (68%), with smaller portions from other communities (Table D4-4).

Summary of Harvest and Use Patterns

Harvest and Use of Nonsalmon Resources at the Household Level

Figure 4-4 shows the percentages of households that attempted to harvest, actually harvested, and used[20] nonsalmon fish and marine invertebrates in 2017. All Kipnuk households that went fishing caught fish. Nonsalmon fish were shared such that nearly all surveyed households reported using them. Likewise, all 41% of households that tried to collect shellfish found some, and about 59% used them.

Table 4-3 summarizes nonsalmon fish and marine invertebrates harvest and use characteristics for Kipnuk in 2017 at the household level. The average harvest was 748 pounds usable weight (lb) per household. This study found that Kipnuk households harvested an average of five different kinds of nonsalmon fish and marine invertebrates and used an average of nine kinds of nonsalmon fish. The maximum number of resources used by any household was 19. In addition, households gave away an average of four kinds of nonsalmon fish. Overall, at least 26 types of nonsalmon fish and marine invertebrates were used by Kipnuk households (Table D4-5). Additionally, 80% of households harvested and 98% of households used nonsalmon fish resources.

Harvest Quantities and Composition of Nonsalmon Fish

In 2018, surveyors recorded the nonsalmon fish and marine invertebrate resources harvested and used by members of responding households in 2017, and the data were expanded to estimate harvests and uses for the whole community. Table 4-4 lists the nonsalmon resources used by the highest percentages of households, and Figure 4-5 shows the species with the highest harvests during the study year. The graphics include many of the same species, but the order of ranking varies. For example, rainbow smelt was the most

18. Differences between population estimates and counts by the Division of Subsistence, U.S. Census Bureau decennial census (2010 Census), American Community Survey (ACS), and the Alaska Department of Labor and Workforce Development (ADLWD) are likely due to differences in sample sizes and variations in methods of expansion from sampled to unsampled households. For example, the 2010 Census count is based upon the total number of individuals who considered Kipnuk to be their principal place of residence on April 15, 2010, whereas the Division of Subsistence population estimate is based upon a quantitative expansion of the number of individuals who resided in responding households in Kipnuk for at least six months during the study year. Different population estimates are considered to be significantly similar if one estimate falls within the range of error calculated for another estimate.

19. Because it can be time consuming, respondents in households with many children often did not provide all children's birth years (A. Godduhn field notes, March 15, 2018), which explains the bulk of "missing" ages. A priority was placed on attaining an accurate count of individual members in each household. Thus, the actual mean and median ages might be lower than these estimates.

20. Any resource harvested or received by a household is "used" by that household, whether it is consumed, preserved, given away, fed to dogs, used as bait, or lost to spoilage.

Table 4-2.–Sample and demographic characteristics, Kipnuk, 2017.

	Community
Characteristics	Kipnuk
Sampled households	98
Eligible households	146
Percentage sampled	67.1%
Sampled population	439
Estimated community population	654.0
Household size	
Mean	4.5
Minimum	1.0
Maximum	13.0
Age	
Mean	21.6
Minimum[a]	0
Maximum	91
Median	24.0
Length of residency	
Total population	
Mean	16.9
Minimum[a]	0
Maximum	87
Heads of household	
Mean	31.1
Minimum[a]	1
Maximum	87
Alaska Native	
Estimated households[b]	
Number	137.0
Percentage	93.8%
Estimated population	
Number	635.6
Percentage	97.2%

Source ADF&G Division of Subsistence household surveys, 2018.

a. A minimum age of 0 (zero) is used for infants who are less than 1 year of age.

b. The estimated number of households in which at least 1 head of household is Alaska Native.

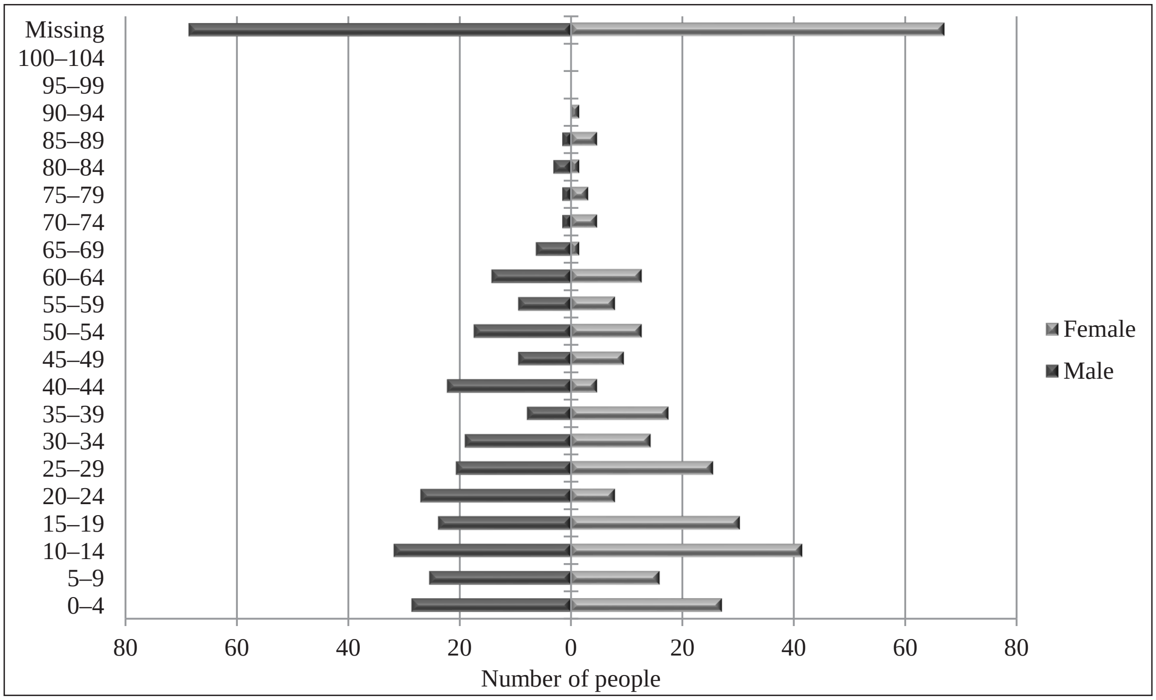


Figure 4-3.–Population profile, Kipnuk, 2017.

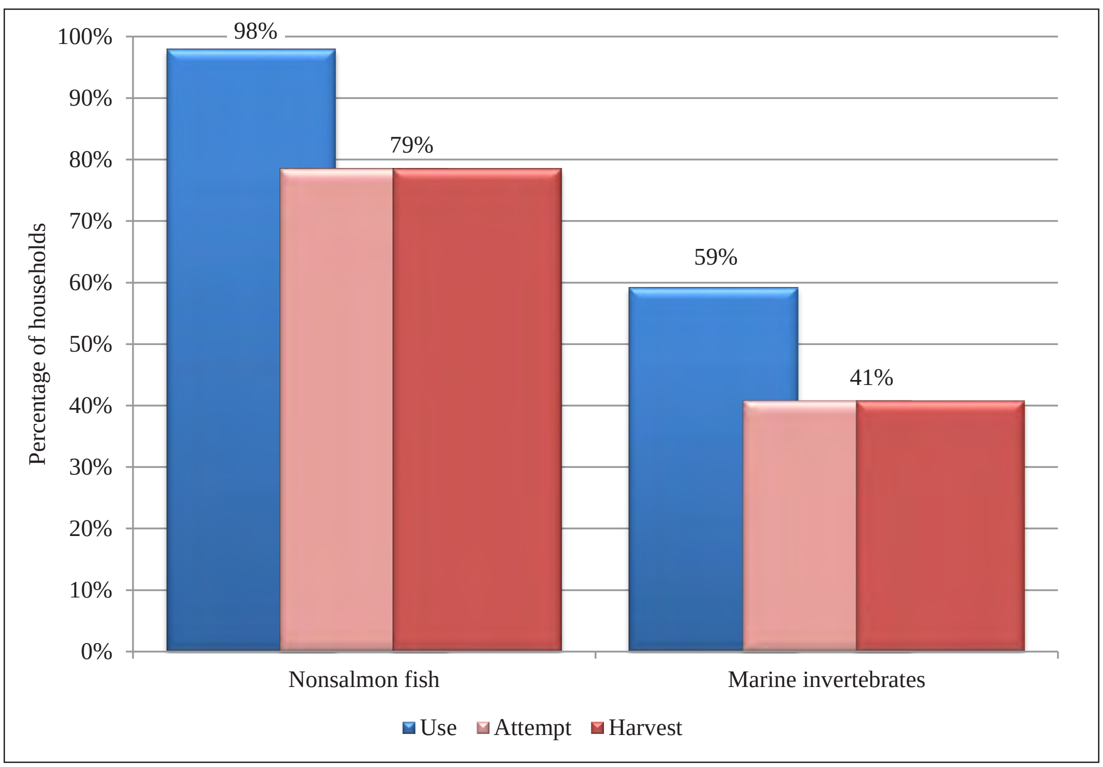


Figure 4-4.–Percentages of households using, attempting to harvest, and harvesting nonsalmon fish and marine invertebrates, Kipnuk, 2017.

Table 4-3.–Nonsalmon fish and marine invertebrate harvest and use characteristics, Kipnuk, 2017.

Characteristic	
Mean number of resources used per household	**8.9**
Minimum	0
Maximum	19
95% confidence limit (±)	5.6%
Median	10.0
Mean number of resources attempted to harvest per household	**4.7**
Minimum	0
Maximum	17
95% confidence limit (±)	10.2%
Median	4.0
Mean number of resources harvested per household	**4.6**
Minimum	0
Maximum	17
95% confidence limit (±)	10.2%
Median	3.5
Mean number of resources received per household	**5.1**
Minimum	0
Maximum	16
95% confidence limit (±)	9.3%
Median	4.0
Mean number of resources given away per household	**3.7**
Minimum	0
Maximum	16
95% confidence limit (±)	12.9%
Median	2.0
Household harvest (pounds)	
Minimum	0
Maximum	10,700
Mean	747.5
Median	323.0
Total harvest weight (lb)	109,141.3
Community per capita harvest (lb)	166.9
Percentage using any resource	98%
Percentage attempting to harvest any resource	80%
Percentage harvesting any resource	80%
Percentage receiving any resource	91%
Percentage giving away any resource	67%
Number of households in sample	98
Number of resources asked about and identified voluntarily by respondents	33

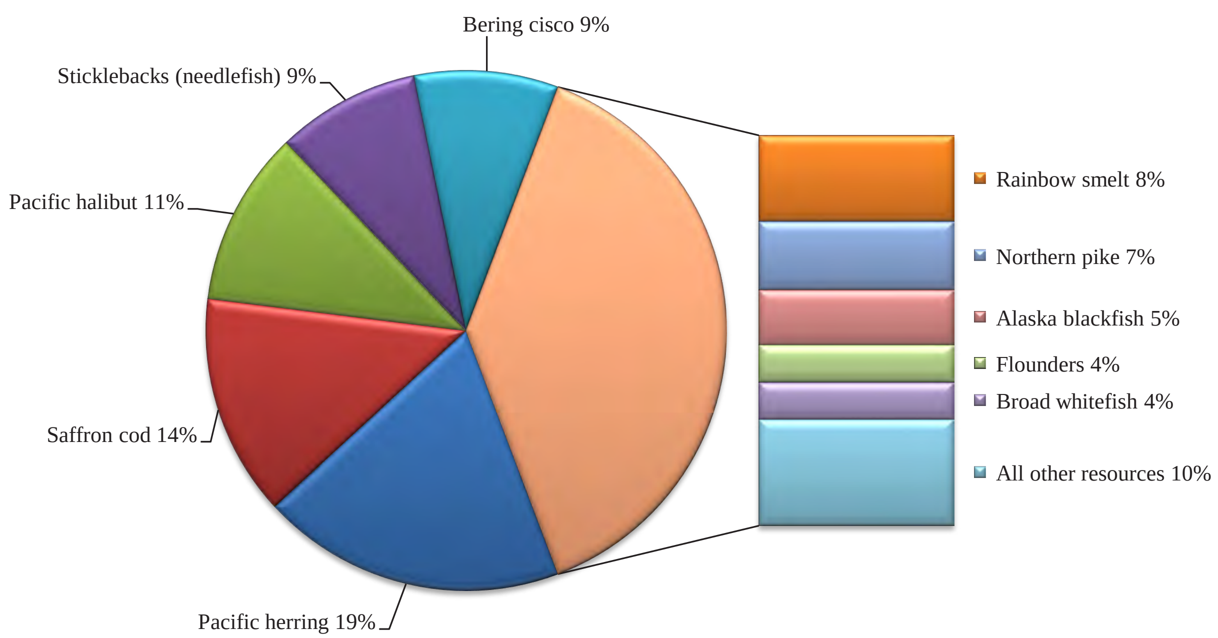
Source ADF&G Division of Subsistence household surveys, 2018.

Table 4-4.–Top ranked nonsalmon fish and marine invertebrates used by households, Kipnuk, 2017.

Rank[a]	Resource	Percentage of households using
1.	Rainbow smelt	84.7%
2.	Bering cisco	81.6%
3.	Pacific herring	78.6%
4.	Pacific halibut	78.4%
5.	Alaska blackfish	75.3%
6.	Saffron cod	74.5%
7.	Pacific herring roe	46.9%
8.	Burbot	45.4%
8.	Northern pike	45.4%
10.	Unknown clams	44.9%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Resources used by the same percentage of households share the lowest rank value instead of having sequential rank values.



Note The "all other resources" category represents all species that contributed less than 1% to the total harvest.

Figure 4-5.–Top nonsalmon fish and marine invertebrates harvested by percentage of total harvest weight, Kipnuk, 2017.

widely used resource, by 85% of Kipnuk households, however it provided only 8% of the total estimated harvest by weight. Herring was the largest harvest (19% of the total weight) and the third most widely used resource (79% of households). The composition of Kipnuk's 2017 nonsalmon fish harvest shows high diversity: similar amounts of many different resources (Appendix D, Figure D4-1).

Table 4-5 reports estimated subsistence nonsalmon fish and marine invertebrate harvests and uses by Kipnuk residents in 2017. All edible resources are presented in pounds usable weight (see Appendix C for conversion factors), and results are organized first by general category and then by species. The harvest column shows percentages of households in which any member of the surveyed household harvested a resource during the study year. The use column shows percentages of households that took or used a resource, including resources acquired from other harvesters or given away. Purchased foods are not included. Fish retained from commercial fishing would have been included, but no fish were reported as retained from commercial fishing during the surveys. Differences between harvest and use percentages reflect sharing among households, which results in a wider distribution of wild foods.

Kipnuk residents harvested an estimated 107,989 lb of nonsalmon fish (165 lb per capita) and 1,150 lb of marine invertebrates (2 lb per capita) in 2017 (Table 4-5). The table shows very little difference between attempting and harvesting, indicating that most fishers were able to catch their targets. Nearly all of the weight (96%) comprised 13 resources that each contributed over 2,000 lb of food. Many of the heavily harvested fish are small enough that the catch is generally measured in gallons: herring (3,438 gal), saffron cod (2,513 gal), sticklebacks (1,627 gal), smelts (1,546 gal), and blackfish (985 gal). Together, these small fish provided 60,646 lb, or 56% of the total estimated harvest weight. Other fish, like halibut, can be very large, but these fish vary widely in size, so fishers report the harvest in pounds. The estimated community harvest was nearly 12,000 lb of halibut or 18 lb per capita; about 11% of the harvest. An elder identified halibut with enthusiasm: "my favorite!" (041217KPN2).

Kipnuk residents must travel to fish for many of the nonsalmon fish they target: most whitefishes, pike, burbot, and halibut. These fish are present in traditional Canineq territory, but not in the Kuguklik River or the immediate vicinity of Kipnuk. Some of the fish received by households may have come from people in other communities, closer to areas where those resources are abundant. Sharing resources is common practice in the Canineq region, but many fishers prefer to be self-reliant. For example, one key respondent said "It embarrasses me to ask. I'd rather go after them myself" (041217KPN1).

Kipnuk fishers use a variety of equipment for nonsalmon fishing and no single type captured a majority of the fish in 2017 (Figure 4-6 and tables 4-6 and 4-7; Plate 4-4). Fishers used set nets to catch about 63% of the herring (by weight) and nearly all the whitefishes. A few Bering cisco and broad whitefish were caught on jigging lines through ice and about one half of a few sheefish was caught by "other methods." The main "other method" identified by Kipnuk fishers was small homemade trawls, designed to more easily drag large, bag-shaped nets[21] up or down the muddy coastal creeks and sloughs. Historically, this was done by foot and hand; fishers started making trawls in the 1980s.[22] Kipnuk fishers used this method to catch about 75% of the saffron cod and about one third of the herring. Flounders, sculpins, and smelts are caught incidentally to these efforts. Some fishers target flounders and sculpins around the sandbars outside of Kinak Bay; they also keep the larger flounders and sculpins that they catch on hooks cast for halibut. Smelts are targeted with jigging hooks through the ice near Kipnuk (031218KPN7).

Nonsalmon fish are preserved in a variety of ways, in part depending on the season of harvest. Most fishing occurs in the summer, such that drying is the dominant method of preservation. Herring is a prime example of fish caught during warm weather for use mostly the following winter; because freezer space is limited, the catch must be dried. A key respondent described following traditional methods to put these fish away: she lets her herring sit in a cool place for a one to four days, then she guts and cleans the fish, and she braids them into grass ropes that she hangs to dry. The duration of drying varies: "Depending on your choice of how you want the meat: soft, hard. People from here mostly have no teeth so they mostly prefer

21. These nets are also known as fyke nets and are classified as fish traps in regulation.
22. A. Godduhn field notes, January 30, 2019.

Table 4-5.–Estimated harvest and use of nonsalmon fish and marine invertebrates, Kipnuk, 2017.

	Percentage of households					Harvest weight (lb)			Harvest amount			
Resource	Using	Attempting harvest	Harvesting	Receiving	Giving away	Total	Mean per household	Per capita	Total	Unit	Mean per household	95% confidence limit (±) harvest
All surveyed resources	**98.0**	**79.6**	**79.6**	**90.8**	**67.3**	**109,141.3**	**747.5**	**166.9**	**109,141.3**	**lb**	**747.5**	**21.7**
Nonsalmon fish	**98.0**	**78.6**	**78.6**	**89.8**	**66.3**	**107,991.0**	**739.7**	**165.1**	**107,991.0**	**lb**	**739.7**	**21.9**
Pacific herring	78.6	46.9	46.9	37.5	40.2	20,625.1	141.3	31.5	3,437.5	gal	23.5	22.6
Pacific herring roe	46.9	19.6	19.6	31.3	16.5	3,136.7	21.5	4.8	522.8	gal	3.6	37.8
Capelin (grunion)	9.3	4.2	4.2	6.3	3.1	420.1	2.9	0.6	70.0	gal	0.5	69.5
Rainbow smelt	84.7	59.8	59.8	37.9	37.9	9,273.6	63.5	14.2	1,545.6	gal	10.6	31.6
Pacific (gray) cod	24.7	18.6	18.6	8.3	11.5	728.8	5.0	1.1	227.8	ind	1.6	30.9
Saffron cod	74.5	43.3	43.3	43.8	32.0	15,077.4	103.3	23.1	2,512.9	gal	17.2	24.4
Walleye pollock (whiting)	4.1	4.1	4.1	0.0	2.0	60.8	0.4	0.1	43.4	ind	0.3	82.7
Flounders	30.9	18.8	18.8	16.7	11.5	4,021.0	27.5	6.1	3,655.4	ind	25.0	46.8
Pacific halibut	78.4	44.8	42.7	43.2	32.3	11,877.4	81.4	18.2	11,877.4	lb	81.4	21.7
Sculpins	22.7	16.7	16.7	5.2	9.5	444.8	3.0	0.7	444.8	ind	3.0	52.7
Stickleback (needlefish)	29.9	9.4	9.4	20.8	13.5	9,764.1	66.9	14.9	1,627.4	gal	11.1	104.3
Alaska blackfish	75.3	17.7	17.7	63.2	25.5	5,907.7	40.5	9.0	984.6	gal	6.7	47.8
Burbot	45.4	11.3	11.3	35.1	12.5	2,104.2	14.4	3.2	501.0	ind	3.4	58.7
Unknown chars	7.2	6.3	6.3	2.1	1.0	103.2	0.7	0.2	31.3	ind	0.2	60.3
Arctic grayling	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Northern pike	45.4	12.5	12.5	35.4	13.7	7,379.0	50.5	11.3	2,236.0	ind	15.3	46.5
Sheefish	7.1	4.1	4.1	3.1	2.0	49.2	0.3	0.1	8.9	ind	0.1	65.0
Rainbow trout	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Broad whitefish	37.8	15.3	15.3	26.8	17.5	3,985.6	27.3	6.1	996.4	ind	6.8	39.8
Bering cisco	81.6	56.1	56.1	46.4	47.4	9,761.5	66.9	14.9	6,972.5	ind	47.8	26.7
Least cisco	3.1	2.0	2.0	1.0	2.0	362.8	2.5	0.6	518.2	ind	3.5	112.2
Humpback whitefish	31.6	10.2	10.2	22.4	14.3	2,310.3	15.8	3.5	1,320.2	ind	9.0	72.5
Round whitefish	5.1	5.1	5.1	0.0	5.1	476.7	3.3	0.7	476.7	ind	3.3	79.2
Unknown whitefishes	3.1	1.0	1.0	3.1	1.0	121.1	0.8	0.2	74.5	ind	0.5	113.8
Unknown nonsalmon fish	3.1	0.0	0.0	3.1	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0

-continued-

Table 4-5.–Continued.

Resource	Percentage of households: Using	Attempting harvest	Harvesting	Receiving	Giving away	Harvest weight (lb): Total	Mean per household	Per capita	Harvest amount: Total	Unit	Mean per household	95% confidence limit (±) harvest
Marine invertebrates	**59.2**	**40.8**	**40.8**	**24.5**	**23.5**	**1,150.3**	**7.9**	**1.8**	**1,150.3**	**lb**	**7.9**	**22.6**
Butter clams	2.0	2.0	2.0	0.0	2.0	17.9	0.1	0.0	6.0	gal	0.0	80.1
Razor clams	1.0	1.0	1.0	0.0	1.0	13.4	0.1	0.0	4.5	gal	0.0	113.8
Unknown clams	44.9	32.0	32.0	18.6	15.8	1,023.1	7.0	1.6	341.0	gal	2.3	25.3
Unknown cockles	13.3	6.1	6.1	7.1	5.1	68.2	0.5	0.1	22.7	gal	0.2	57.3
Red king crab	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Unknown mussels	2.0	2.0	2.0	0.0	0.0	27.7	0.2	0.0	18.5	gal	0.1	97.0
Shrimps	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	gal	0.0	0.0
Unknown marine invertebrates	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	gal	0.0	0.0

Source ADF&G Division of Subsistence household surveys, 2018.

Note Resources where the percentage using is greater than the combined received and harvest indicate use from resources obtained during a previous year.

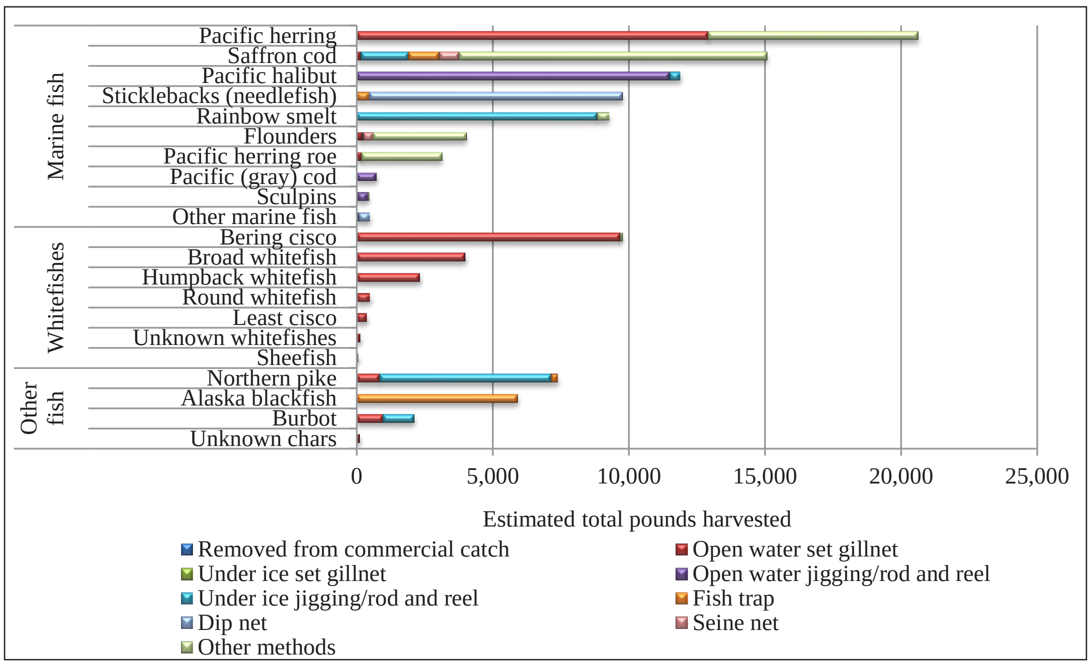


Figure 4-6.–Estimated harvest of nonsalmon fish by gear type, Kipnuk, 2017.

Table 4-6.–Estimated harvest of nonsalmon fish by gear type, Kipnuk, 2017.

				Subsistence methods																			
		Removed from commercial catch		Open water set gillnet		Underice set gillnet		Open water jigging/rod and reel		Under ice jigging/rod and reel		Fish trap		Dip net		Seine net		Other method[b]		Subsistence gear, any method		Any method	
Resource	Units	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds
Nonsalmon fish	**lb**		**0.0**		**32,294.3**	**0.0**	**0.0**		**12,702.3**		**18,412.5**		**7,725.3**		**9,737.3**		**1,087.6**		**26,031.7**		**107,991.0**		**107,991.0**
Pacific herring	gal	0.0	0.0	2,151.1	12,906.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,286.5	7,718.7	3,437.5	20,625.1	3,437.5	20,625.1
Pacific herring roe	gal	0.0	0.0	30.1	180.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	492.7	2,956.1	522.8	3,136.7	522.8	3,136.7
Capelin (grunion)	gal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	70.0	420.1	0.0	0.0	0.0	0.0	70.0	420.1	70.0	420.1
Rainbow smelt	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,470.3	8,822.1	0.0	0.0	0.0	0.0	0.0	0.0	75.3	451.5	1,545.6	9,273.6	1,545.6	9,273.6
Pacific (gray) cod	ind	0.0	0.0	1.5	4.8	0.0	0.0	221.6	709.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	14.9	227.8	728.8	227.8	728.8
Saffron cod	ind	0.0	0.0	24.8	149.0	0.0	0.0	0.0	0.0	292.3	1,753.5	187.5	1,124.8	0.0	0.0	121.7	730.0	1,886.7	11,320.1	2,512.9	15,077.4	2,512.9	15,077.4
Walleye pollock (whiting)	ind	0.0	0.0	0.0	0.0	0.0	0.0	43.4	60.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43.4	60.8	43.4	60.8
Flounders	lb	0.0	0.0	172.0	189.2	0.0	0.0	44.7	49.2	0.0	0.0	0.0	0.0	0.0	0.0	325.0	357.6	3,113.7	3,425.0	3,655.4	4,021.0	3,655.4	4,021.0
Pacific halibut	lb	0.0	0.0	0.0	0.0	0.0	0.0	11,500.1	11,500.1	377.2	377.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11,877.4	11,877.4	11,877.4	11,877.4
Sculpins	ind	0.0	0.0	26.8	26.8	0.0	0.0	373.3	373.3	7.4	7.4	0.0	0.0	0.0	0.0	0.0	0.0	37.2	37.2	444.8	444.8	444.8	444.8
Sticklebacks (needlefish)	gal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	74.5	446.9	1,552.9	9,317.2	0.0	0.0	0.0	0.0	1,627.4	9,764.1	1,627.4	9,764.1
Alaska blackfish	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	984.6	5,907.7	0.0	0.0	0.0	0.0	0.0	0.0	984.6	5,907.7	984.6	5,907.7
Burbot	ind	0.0	0.0	229.2	962.7	0.0	0.0	0.0	0.0	271.8	1,141.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	501.0	2,104.2	501.0	2,104.2
Unknown chars	ind	0.0	0.0	28.3	93.4	0.0	0.0	3.0	9.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.3	103.2	31.3	103.2
Arctic grayling	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Northern pike	ind	0.0	0.0	254.6	840.2	0.0	0.0	0.0	0.0	1,906.9	6,292.9	74.5	245.8	0.0	0.0	0.0	0.0	0.0	0.0	2,236.0	7,379.0	2,236.0	7,379.0
Sheefish	ind	0.0	0.0	4.5	24.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5	24.6	8.9	49.2	8.9	49.2
Rainbow trout	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Broad whitefish	ind	0.0	0.0	994.2	3,976.6	0.0	0.0	0.0	0.0	2.2	8.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	996.4	3,985.6	996.4	3,985.6
Bering cisco	ind	0.0	0.0	6,906.5	9,669.1	0.0	0.0	0.0	0.0	6.4	8.9	0.0	0.0	0.0	0.0	0.0	0.0	59.6	83.4	6,972.5	9,761.5	6,972.5	9,761.5
Least cisco	ind	0.0	0.0	518.2	362.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	518.2	362.8	518.2	362.8
Humpback whitefish	ind	0.0	0.0	1,320.2	2,310.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1,320.2	2,310.3	1,320.2	2,310.3
Round whitefish	ind	0.0	0.0	476.7	476.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	476.7	476.7	476.7	476.7
Unknown whitefishes	ind	0.0	0.0	74.5	121.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	74.5	121.1	74.5	121.1
Unknown nonsalmon fish	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source ADF&G Division of Subsistence household surveys, 2018.

a. The harvested number of each resource is measured by the unit in which the resource harvest information was collected; the unit of measurement is provided for each resource.

b. Other method primarily includes small trawls.

Table 4-7.–Estimated percentages of nonsalmon fish harvest weight by gear type, Kipnuk, 2017.

			Subsistence methods									
Resource	Percentage base	Removed from commercial catch	Open water set gillnet	Under ice set gillnet	Open water jigging/rod and reel	Under ice jigging/rod and reel	Fish trap	Dip net	Seine net	Other method[a]	Subsistence gear, any method	Any method
Nonsalmon fish	**Gear type**	**0.0%**	**100.0%**	**0.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
	Resource	**0.0%**	**29.9%**	**0.0%**	**11.8%**	**17.1%**	**7.2%**	**9.0%**	**1.0%**	**24.1%**	**100.0%**	**100.0%**
	Total	**0.0%**	**29.9%**	**0.0%**	**11.8%**	**17.1%**	**7.2%**	**9.0%**	**1.0%**	**24.1%**	**100.0%**	**100.0%**
Pacific herring	Gear type	0.0%	40.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	29.7%	19.1%	19.1%
	Resource	0.0%	62.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	37.4%	100.0%	100.0%
	Total	0.0%	12.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	7.1%	19.1%	19.1%
Pacific herring roe	Gear type	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	11.4%	2.9%	2.9%
	Resource	0.0%	5.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	94.2%	100.0%	100.0%
	Total	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.7%	2.9%	2.9%
Capelin (grunion)	Gear type	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.3%	0.0%	0.0%	0.4%	0.4%
	Resource	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%	0.4%	0.4%
Rainbow smelt	Gear type	0.0%	0.0%	0.0%	0.0%	47.9%	0.0%	0.0%	0.0%	1.7%	8.6%	8.6%
	Resource	0.0%	0.0%	0.0%	0.0%	95.1%	0.0%	0.0%	0.0%	4.9%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.0%	8.2%	0.0%	0.0%	0.0%	0.4%	8.6%	8.6%
Pacific (gray) cod	Gear type	0.0%	0.0%	0.0%	5.6%	0.0%	0.0%	0.0%	0.0%	0.1%	0.7%	0.7%
	Resource	0.0%	0.7%	0.0%	97.3%	0.0%	0.0%	0.0%	0.0%	2.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	0.7%
Saffron cod	Gear type	0.0%	0.5%	0.0%	0.0%	9.5%	14.6%	0.0%	67.1%	43.5%	14.0%	14.0%
	Resource	0.0%	1.0%	0.0%	0.0%	11.6%	7.5%	0.0%	4.8%	75.1%	100.0%	100.0%
	Total	0.0%	0.1%	0.0%	0.0%	1.6%	1.0%	0.0%	0.7%	10.5%	14.0%	14.0%
Walleye pollock (whiting)	Gear type	0.0%	0.0%	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
	Resource	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
Flounders	Gear type	0.0%	0.6%	0.0%	0.4%	0.0%	0.0%	0.0%	32.9%	13.2%	3.7%	3.7%
	Resource	0.0%	4.7%	0.0%	1.2%	0.0%	0.0%	0.0%	8.9%	85.2%	100.0%	100.0%
	Total	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	3.2%	3.7%	3.7%
Pacific halibut	Gear type	0.0%	0.0%	0.0%	90.5%	2.0%	0.0%	0.0%	0.0%	0.0%	11.0%	11.0%
	Resource	0.0%	0.0%	0.0%	96.8%	3.2%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	10.6%	0.3%	0.0%	0.0%	0.0%	0.0%	11.0%	11.0%
Sculpins	Gear type	0.0%	0.1%	0.0%	2.9%	0.0%	0.0%	0.0%	0.0%	0.1%	0.4%	0.4%
	Resource	0.0%	6.0%	0.0%	83.9%	1.7%	0.0%	0.0%	0.0%	8.4%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.4%
Sticklebacks (needlefish)	Gear type	0.0%	0.0%	0.0%	0.0%	0.0%	5.8%	95.7%	0.0%	0.0%	9.0%	9.0%
	Resource	0.0%	0.0%	0.0%	0.0%	0.0%	4.6%	95.4%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	8.6%	0.0%	0.0%	9.0%	9.0%
Alaska blackfish	Gear type	0.0%	0.0%	0.0%	0.0%	0.0%	76.5%	0.0%	0.0%	0.0%	5.5%	5.5%
	Resource	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	5.5%	0.0%	0.0%	0.0%	5.5%	5.5%

-continued-

Table 4-7.–Continued

Resource	Percentage base	Removed from commercial catch	Subsistence methods: Open water set gillnet	Under ice set gillnet	Open water jigging/rod and reel	Under ice jigging/rod and reel	Fish trap	Dip net	Seine net	Other method[a]	Subsistence gear, any method	Any method
Burbot	Gear type	0.0%	3.0%	0.0%	0.0%	6.2%	0.0%	0.0%	0.0%	0.0%	1.9%	1.9%
	Resource	0.0%	45.8%	0.0%	0.0%	54.2%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.9%	0.0%	0.0%	1.1%	0.0%	0.0%	0.0%	0.0%	1.9%	1.9%
Unknown chars	Gear type	0.0%	0.3%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
	Resource	0.0%	90.5%	0.0%	9.5%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
Arctic grayling	Gear type	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Resource	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Northern pike	Gear type	0.0%	2.6%	0.0%	0.0%	34.2%	3.2%	0.0%	0.0%	0.0%	6.8%	6.8%
	Resource	0.0%	11.4%	0.0%	0.0%	85.3%	3.3%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.8%	0.0%	0.0%	5.8%	0.2%	0.0%	0.0%	0.0%	6.8%	6.8%
Sheefish	Gear type	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%
	Resource	0.0%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Rainbow trout	Gear type	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Resource	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Broad whitefish	Gear type	0.0%	12.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.7%	3.7%
	Resource	0.0%	99.8%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	3.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.7%	3.7%
Bering cisco	Gear type	0.0%	29.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	9.0%	9.0%
	Resource	0.0%	99.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.9%	100.0%	100.0%
	Total	0.0%	9.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	9.0%	9.0%
Least cisco	Gear type	0.0%	1.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.3%
	Resource	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.3%
Humpback whitefish	Gear type	0.0%	7.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.1%	2.1%
	Resource	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	2.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.1%	2.1%
Round whitefish	Gear type	0.0%	1.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.4%
	Resource	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.4%
Unknown whitefishes	Gear type	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
	Resource	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
Unknown nonsalmon fish	Gear type	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Resource	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Other method primarily includes small trawls.

theirs soft" (041417KPN6). However, she said, "I don't like mine soft. I put mine very dry." Much of the dried fish is stored in seal oil as "oily fish," to be consumed through the winter (Plate 4-5). "Sometimes there's herring that won't even dry they are so fat" (041417KPN6). Because they do not dry completely, these fish continue to age a bit longer; also stored in seal oil, they are called *nin'amayuk* (041417KPN6). Similarly to herring, Bering cisco are targeted all summer and into the fall; if the harvest is to be stored, most of it must be dried. However, one elder said "Just cook. Cooked is how I like it, better that way" (041217KPN2). Like most other fish, Bering cisco can be consumed in a variety of ways: "boiled, fried, frozen." Some people ferment them a little, as is commonly done with broad whitefish in communities where those fish are abundant and in Kipnuk when they can get it (041217KPN2).


A. Godduhn

Plate 4-4.–Fishing gear in Kipnuk is designed for fish of many sizes: the wire and twine scoops are for needlefish and blackfish, and the large hooks are for halibut.

Nonsalmon fish are sometimes used as bait, usually for other nonsalmon fish. For example, key respondents described checking blackfish traps prior to jigging for pike, so that live blackfish can be used as bait (031218KPN7). Historically, dog teams provided winter transportation, especially for fur trapping, and families primarily used sticklebacks, capelin, and blackfish to feed the dogs (031218KPN7, 041217KPN1). In 2017, about 5,500 lb of nonsalmon fish was fed to dogs, almost entirely sticklebacks (Table 4-8).

Kipnuk residents harvested 1,150 lb of marine invertebrates, including 1,054 lb of clams (89% of the harvest; Table 4-5; Figure D4-2). About half of the 41% of households that collected shellfish shared the harvest, such that about 60% of households used the resource (Table 4-5).

Sharing of Nonsalmon Resources

Carl Jack identifies sharing of subsistence resources as a defining characteristic of Caninermiut: "The reciprocity of giving and sharing meals goes all through the year and it's done without asking for payment in return…It was and is what sustains the community and its people and is rooted in a value system that at the end benefits everyone" (Jack 2002:12–13). The practice of sharing subsistence resources is well demonstrated by the survey data.


A. Godduhn

Plate 4-5.–Oily fish lunch

More households reported receiving nonsalmon fish (90%) than giving them away (66%) and nearly all fish species were shared on some level in 2017 (Table 4-5). Households often reported receiving fish species that they also had harvested and given away. Resources were shared whether they were obtained locally or far away. Smelts, the most widely used nonsalmon resource in Kipnuk, is fished in the immediate vicinity of the community

Table 4-8.–Estimated harvest of nonsalmon fish for consumption by dogs, Kipnuk, 2017.

Resource	Amount	Pounds
Nonsalmon fish		
Rainbow smelt	3.0 ind	17.9 lb
Sticklebacks (needlefish)	895.1 gal	5,370.7 lb
Bering cisco	86.4 ind	121.0 lb
Total		**5,509.6 lb**

Source ADF&G Division of Subsistence household surveys, 2018.

and was the only resource fished by more than half of Kipnuk households (60%); survey data indicate that the same portion of households gave away and received these fish: 38%. However, resources harvested farther away were generally the most widely shared. In six cases (sticklebacks, pike, blackfish, broad whitefish, humpback whitefish, and burbot), more households gave fish away than harvested them; i.e., some households that did not harvest a specific fish shared the fish they had been given. Harvesting these species is somewhat specialized, requiring travel or particular equipment.

Household Specialization in Resource Harvesting

Previous studies (Wolfe 1987; Wolfe et al. 2010) have shown that in most rural Alaska communities, a relatively small portion of households produces most of the community's fish and wildlife harvests, which they share with other households. A recent study of 3,265 households in 66 rural Alaska communities found that about 33% of the households accounted for 76% of subsistence harvests (Wolfe et al. 2010). Wolfe et al. (2010) observed that factors frequently associated with higher levels of subsistence harvests included larger households with a pool of adult male labor, higher wage income, involvement in commercial fishing, and community location. Recent Division of Subsistence studies in 16 YKD communities also recorded that a minority percentage of households in each community commonly produced a majority percentage of the wild food harvest. This was true for a variety of resource categories, including nonsalmon fish (Brown et al. 2013; 2015; Ikuta et al. 2014; 2016; Runfola et al. 2017; 2018).

This specialization in fishing and widespread distribution of harvests was well demonstrated in Kipnuk in 2017. Although 80% of households harvested some kind of nonsalmon resource, 71% of the total nonsalmon fish and marine invertebrate harvest, as estimated in pounds usable weight, was harvested by 18% of the community's households (Figure 4-7). Blackfish was the most extreme example of this specialization: only

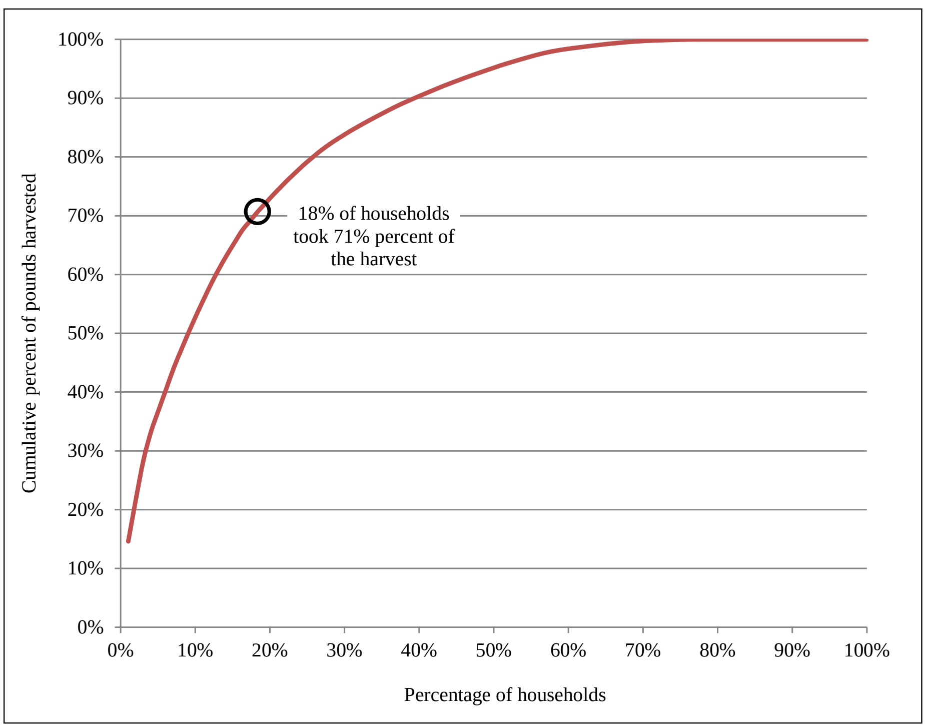


Figure 4-7.–Household specialization, Kipnuk, 2017.

18% of households harvested the blackfish, 26% gave some away, and 64% received some, such that 75% of households used blackfish. Burbot shows a similar pattern: 11% of Kipnuk households harvested burbot, and four times as many households (45%) used it (Table 4-5). Further analysis of the study findings, beyond the scope of this report, might identify characteristics of the highly productive households in Kipnuk and the other study communities.

Comparing Harvests and Uses in 2017 with Previous Years

Harvest Assessments

During the surveys, researchers asked respondents to assess their use of whitefishes and sheefish, other nonsalmon fishes, and marine invertebrates in two ways. First, they asked whether the household had used more, less, or about the same amount of the resources during 2017 as compared to the last few years; if there was a change in use, researchers asked why. Second, researchers asked respondents if they got enough of the resource in 2017; if they had not gotten enough, they were asked why, how severe the impact had been, and if they had done anything differently to compensate for not getting enough.

Overall, most Kipnuk households reported using about the same or more of these resources than they did during the last few years (Figure 4-8; Table D4-6). The use of whitefishes and sheefish was the most consistent. However, nearly a quarter of Kipnuk households said that they had used less other nonsalmon fish and marine invertebrates. Survey respondents reporting that they had used less of these resources gave various reasons for the decreased harvest (Table D4-7). For whitefishes and sheefish, respondents most commonly reported that they had received less; for other nonsalmon fish, they cited less sharing the same number of times as having put in less effort. For marine invertebrates, a decline in the availability of

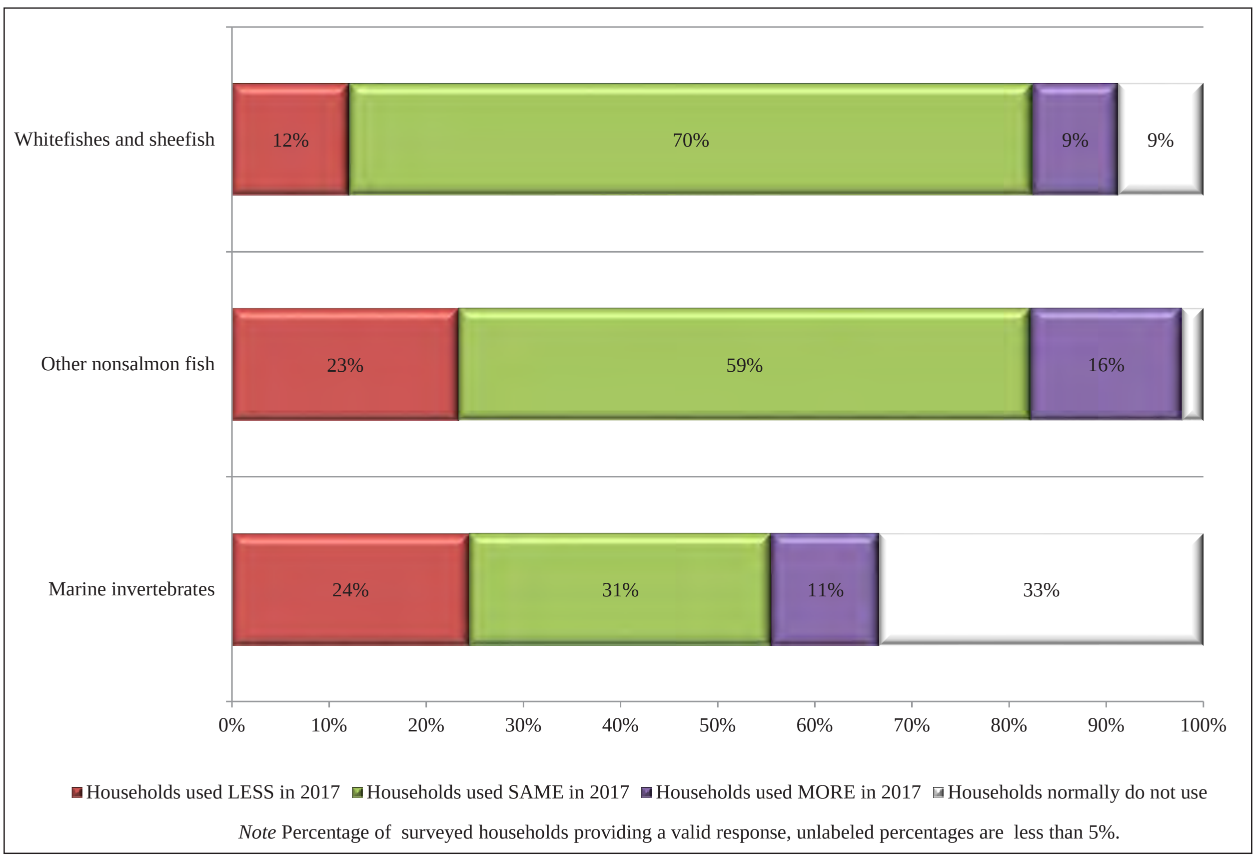


Figure 4-8.–Changes in household uses of nonsalmon fish and marine invertebrates compared to recent years, Kipnuk, 2017.

resources was named most often. Respondents gave reciprocal reasons for using more of these resources: primarily that they had received more, put in more effort, or simply been more successful (Table D4-8).

Likewise, most Kipnuk households reported getting enough of these resources in 2018 (Figure 4-9), although some households did not respond to the question (Table 4-9). Households reporting that they had not gotten enough mostly cited their own lack of effort as the reason, but they also gave other reasons (Table D4-9). Two households identified doing something differently because of shortfalls: using more commercial food (to replace "other" nonsalmon fish) and looking in new places (to replace marine invertebrates, noted as "other; Table D4-10). Most respondents who had not gotten enough said that the impact was minor. Some households reported not using a variety of nonsalmon resources that they have used in the past (Table D4-11).

Harvest Data

Changes in the harvest of resources can also be discerned through comparisons with findings from other study years; however, few prior harvest estimates exist for Kipnuk. The community participated in ADF&G subsistence herring harvest surveys for two study years (1985 and 1987). In 1985, Kipnuk subsistence fishers harvested an estimated 18,864 lb of herring, or 43 lb per capita (for 437 people estimated by the study).[23] In 1987, community fishers caught 28,878 lb, or 58 lb per capita (for an estimated population of 498). In 2017, approximately 20,625 pounds equated to about 32 lb per capita among the estimated population of 654 people (tables 4-1 and 4-5).

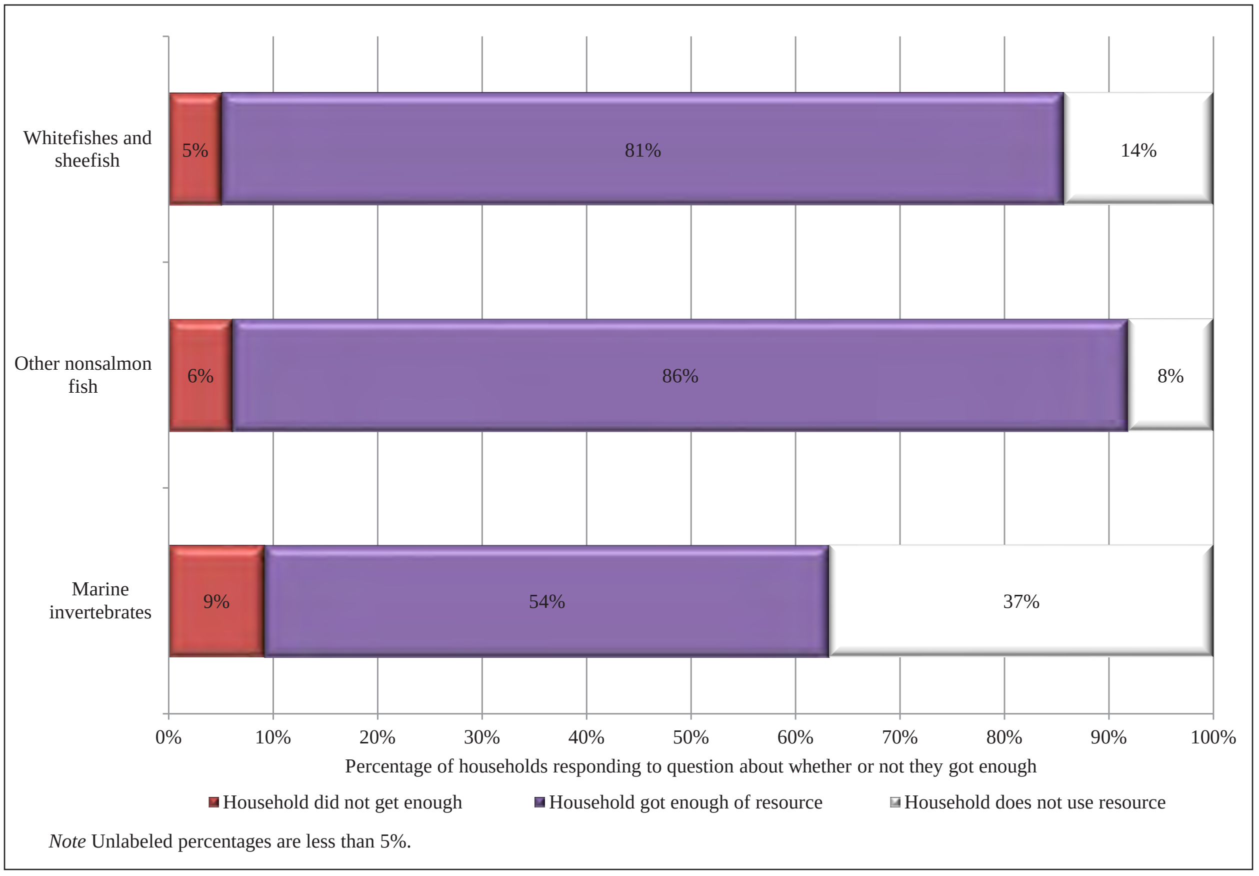


Figure 4-9.–Percentages of households reporting whether or not they got enough nonsalmon fish and marine invertebrates, Kipnuk, 2017.

23. Alaska Department of Fish and Game (ADF&G) Division of Subsistence, Juneau. "Community Subsistence Information System: CSIS." https://www.adfg.alaska.gov/sb/CSIS

Table 4-9.–Reported impact to households that did not get enough nonsalmon fish or marine invertebrates, Kipnuk, 2017.

		Households not getting enough _______ .				Impact to those not getting enough ______ .										
	Sample	Valid responses[a]		Did not get enough		No response		Not noticeable		Minor		Major		Severe		
Resource category	households	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	
Whitefishes and sheefish	98	84	85.7%	5	6.0%	0	0.0%	0	0.0%	4	80.0%	1	20.0%	0	0.0%	
Other nonsalmon fish	98	90	91.8%	6	6.7%	0	0.0%	2	33.3%	3	50.0%	1	16.7%	0	0.0%	
Marine invertebrates	98	62	63.3%	9	14.5%	0	0.0%	3	33.3%	6	66.7%	0	0.0%	0	0.0%	

Source ADF&G Division of Subsistence household surveys, 2018.

a. Includes households failing to respond to the question and those households that never used the resource.

One woman identified herring as a critical resource: "Herring is the main fish we have to have" (041417KPN6). Another respondent, explaining why his family uses a small mesh net to fish for herring, said, "We always try to go for the small ones right there because those big ones are, you know, they are rich—richer than these small ones right there" (041217KPN1). Some Kipnuk residents noted that herring stocks are still depleted from heavy fishing in decades past.[24]

Current and Historical Harvest Areas

During the surveys, researchers asked respondents to identify the places they had fished for nonsalmon fish or searched for marine invertebrates in 2017. In Kipnuk, 48 of 146 total households provided mapping information and documented the use of 7,394 square miles and 370 linear miles for fishing and collecting nonsalmon resources, primarily in the brackish waters in the vicinity of town. Kipnuk residents fished in locally in coastal creeks and rivers and around Cape Avinof. They also traveled north to the Kolavinaraq River and other places on Nelson Island, west across Etolin Strait, and east to a stretch of the Kuskokwim River between Bethel and the Johnson River (Figure 4-10). Kipnuk residents generally collected marine invertebrates close to the community (Figure 4-11). The maps are partial representations of harvest areas but include the most commonly used places. No maps or detailed descriptions of Kipnuk's historic fishing locations were found for comparison, although some relevant ethnography is included here.

The most heavily harvested species, herring, was taken relatively close to the community (Figure 4-11). Fishers used the lower Kuguklik River, the mouth of the Kinak River, at least one small coastal creek, Kinak Bay, and the area off the coast of Cape Avinof. Respondents identified the areas where they collect herring roe on kelp, often near the places where they fished. Some households went as far as Nelson Island to harvest roe on kelp, which is more abundant and less "muddy" along those rocky shores (041217KPN1).

Saffron cod, the second most harvested fish by weight, and smelts, the most widely harvested fish, were caught in coastal creeks and rivers (Figure 4-13). Fishers targeted saffron cod in the fall and smelts in the winter, and these species are often caught incidentally to each other.

In contrast, the third most harvested fish by weight, halibut, was caught exclusively offshore; the large search area extended north through Etolin Strait and west to Nunivak Island (Figure 4-14). A key respondent explained that fishers can target halibut close to shore shortly after breakup; as the shallow water warms, "they start going down," and by July fishers travel out toward Nunivak Island (041217KPN1). When commercial fishing for halibut was active in the 1990s and 2000s, boats from the southern YKD region would aggregate around the southeast corner of Nunivak Island where they could sell fish to a floating fish tender (Coastal Villages Region Fund 2007).[25] Pacific cod and walleye pollock are caught incidentally to halibut with increasing frequency. Some fishers return these less desirable fish to the water or give them away. One Kipnuk respondent said that dried Pacific cod are "hard to chew but they are very yummy." She said "[i]f people are going to throw theirs away, then I'll say, 'give them to me'" (041417KPN6).

Sticklebacks, blackfish, Bering cisco, and a few sheefish were caught mostly nearby to Kipnuk (figures 4-15 and 4-16). For other whitefishes, Kipnuk fishers usually travel to Nelson Island, especially *Cakaaq* (USGS Chakchak Creek; Figure 4-16), where they also catch burbot and northern pike. However, they mostly catch pike from the Kuskokwim River (Figure 4-17). Fishers made occasional catches of chars ("trout"), sculpins, and flounders while they fished for Bering cisco, salmon, and halibut; they reported catching smaller sculpins and flounders in coastal streams and bays and larger fish offshore (Figure 4-18; 031218KPN7, 041217KPN2, 041417KPN5, 041217KPN1). Fishers targeted capelin in the Kinak River, at the north end of Pingurbek Island, and near Nelson Island.

24. A. Godduhn field notes, January 31, 2019.

25. G. Christmas, Mekoryuk resident and former commercial fisher, personal communication with Anna Godduhn, January 11, 2019.

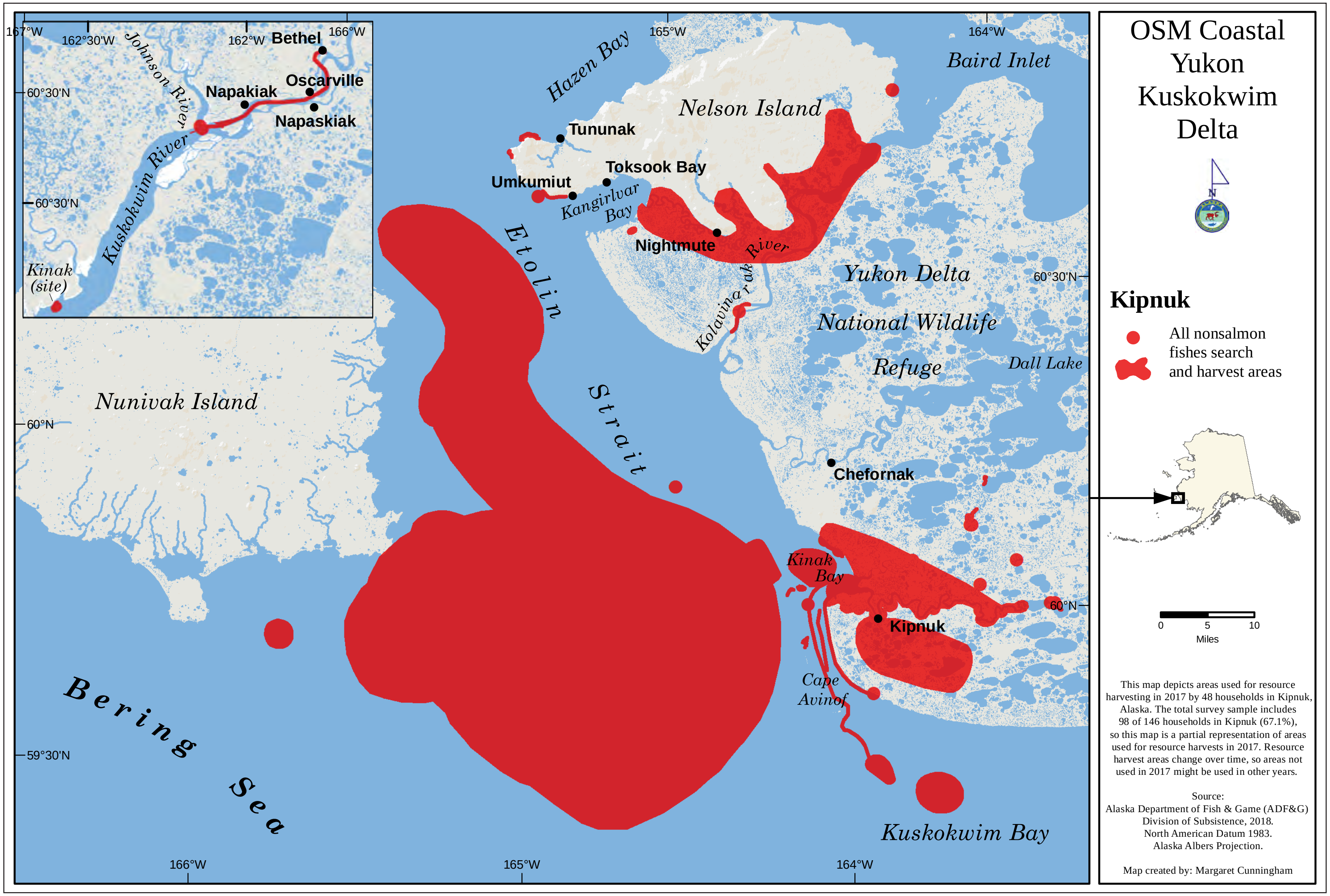


Figure 4-10.–Nonsalmon fishing areas, Kipnuk, 2017.

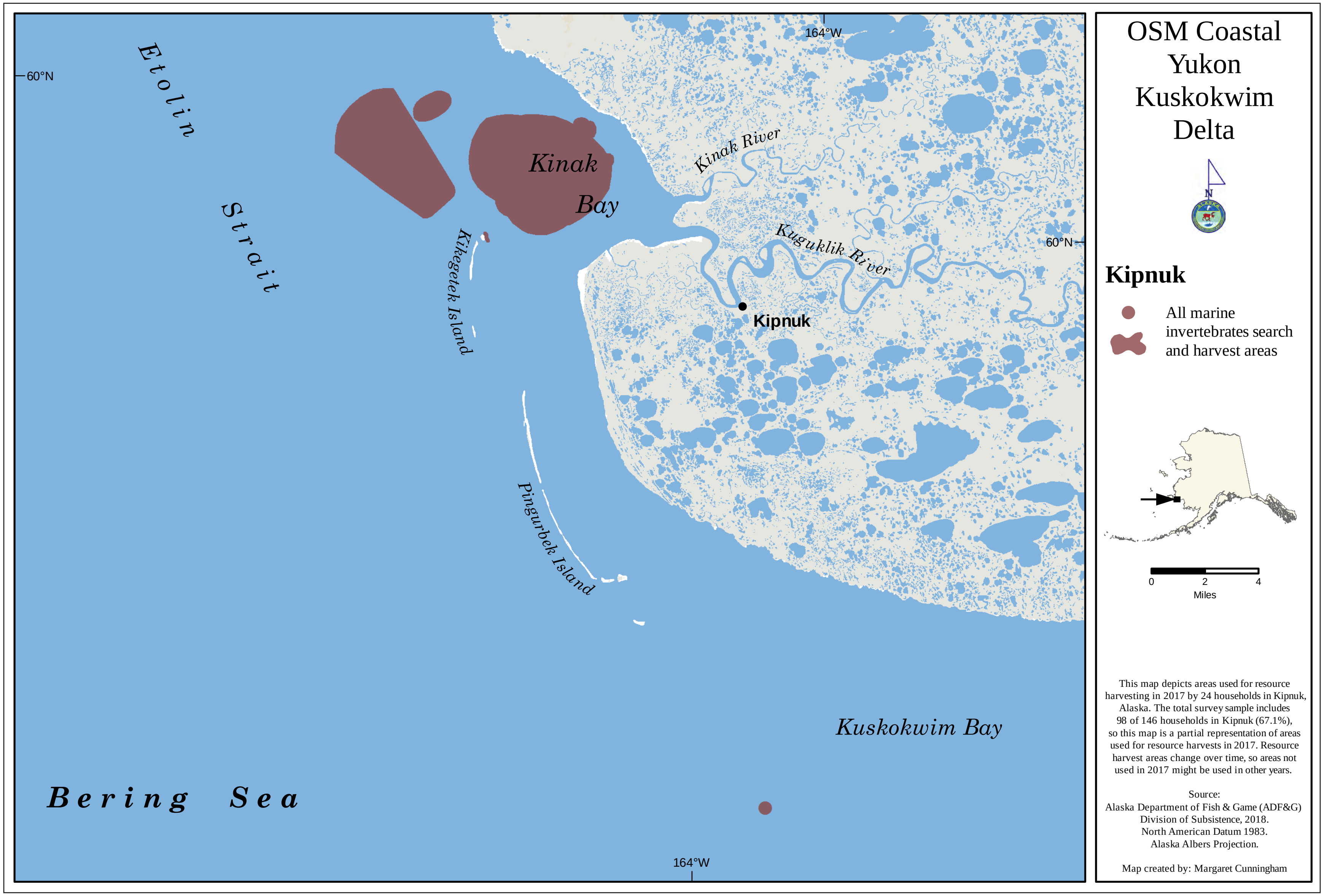


Figure 4-11.–Marine invertebrate collection areas, Kipnuk, 2017.

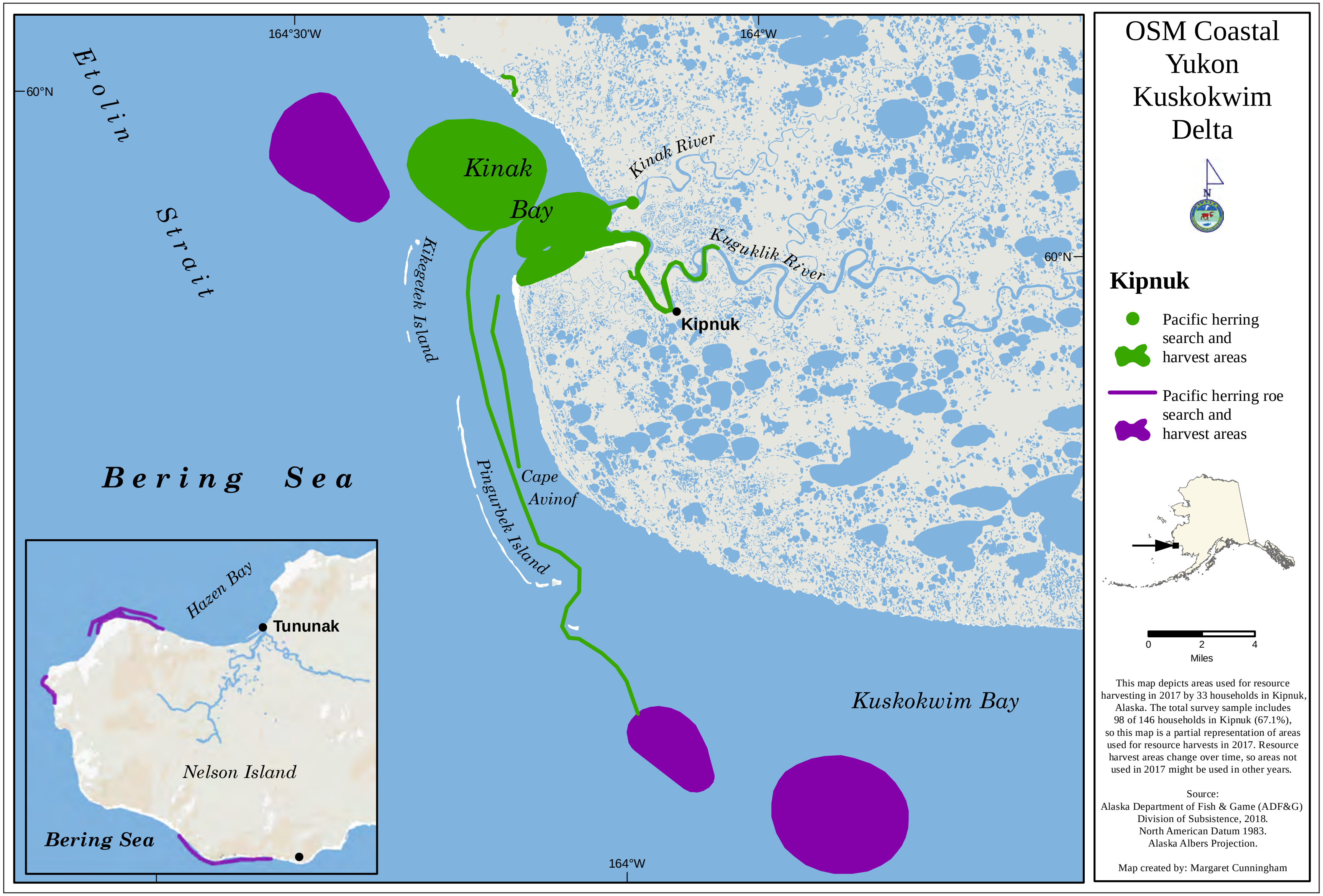


Figure 4-12.–Pacific herring and herring roe fishing areas, Kipnuk, 2017.

Figure 4-13.–Saffron cod and rainbow smelt fishing areas, Kipnuk, 2017.

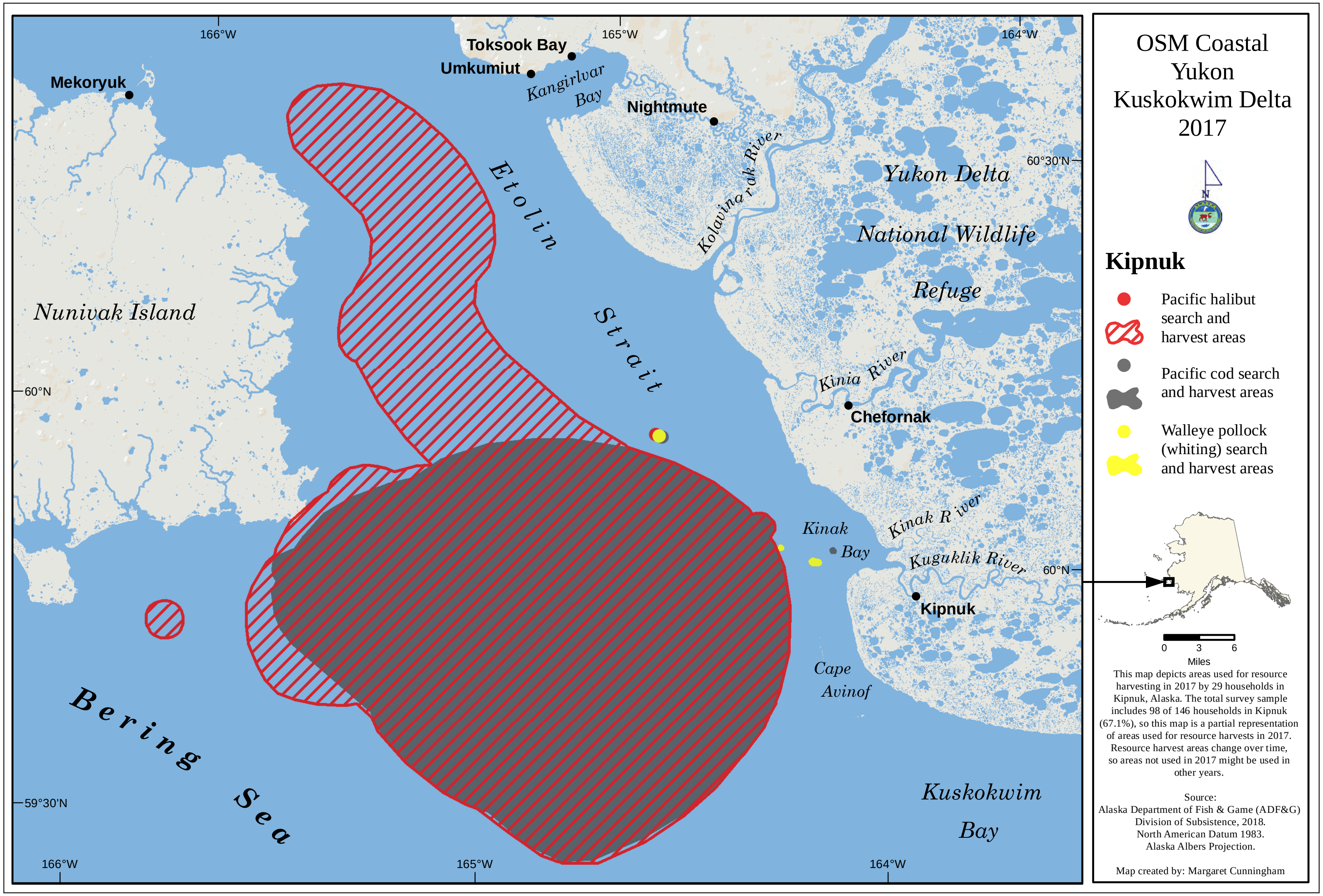


Figure 4-14.–Pacific halibut, Pacific cod, and walleye pollock fishing areas, Kipnuk, 2017.

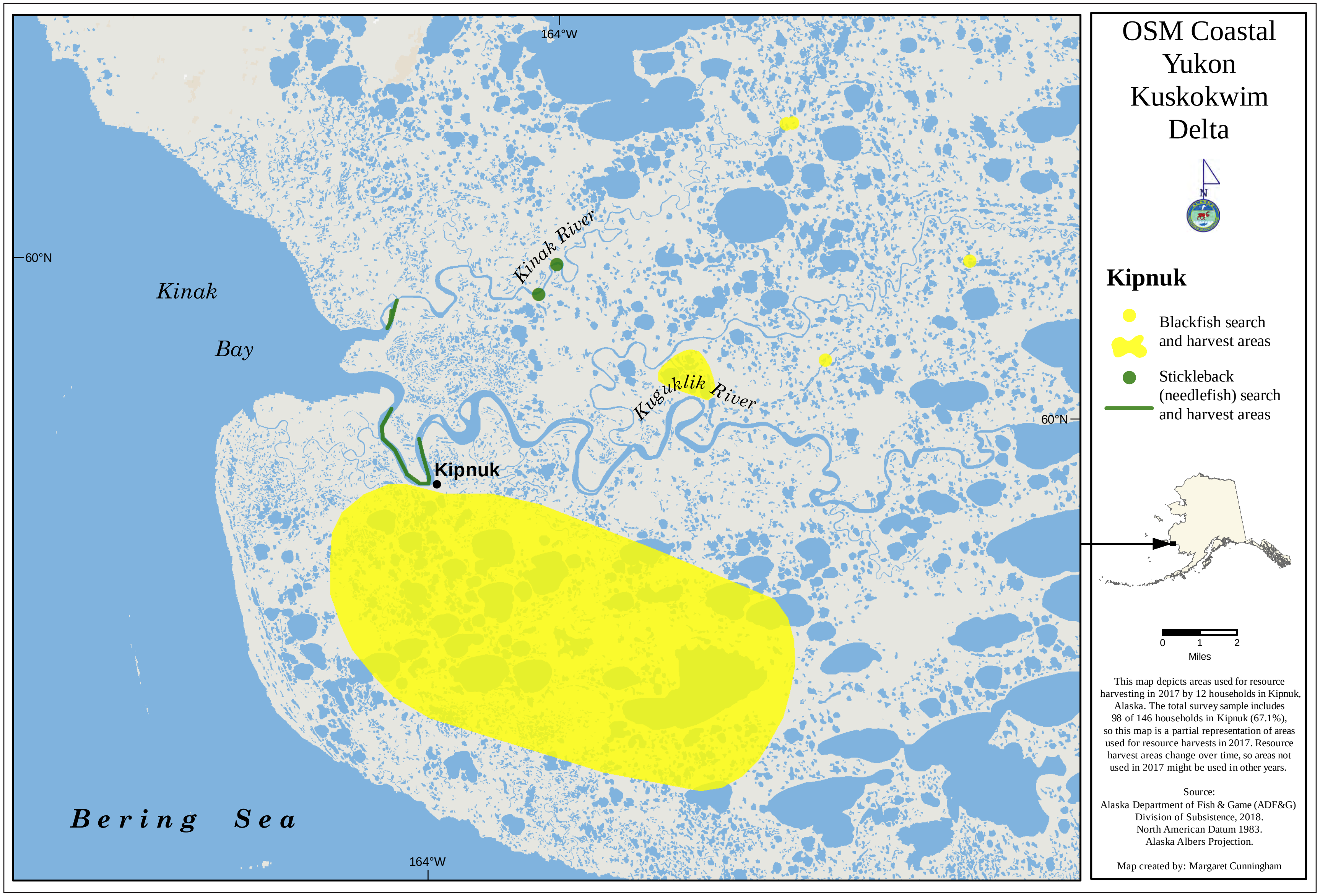


Figure 4-15.–Alaska blackfish and sticklebacks fishing areas, Kipnuk, 2017.

Figure 4-16.–Sheefish, ciscoes, and whitefishes fishing areas, Kipnuk, 2017.

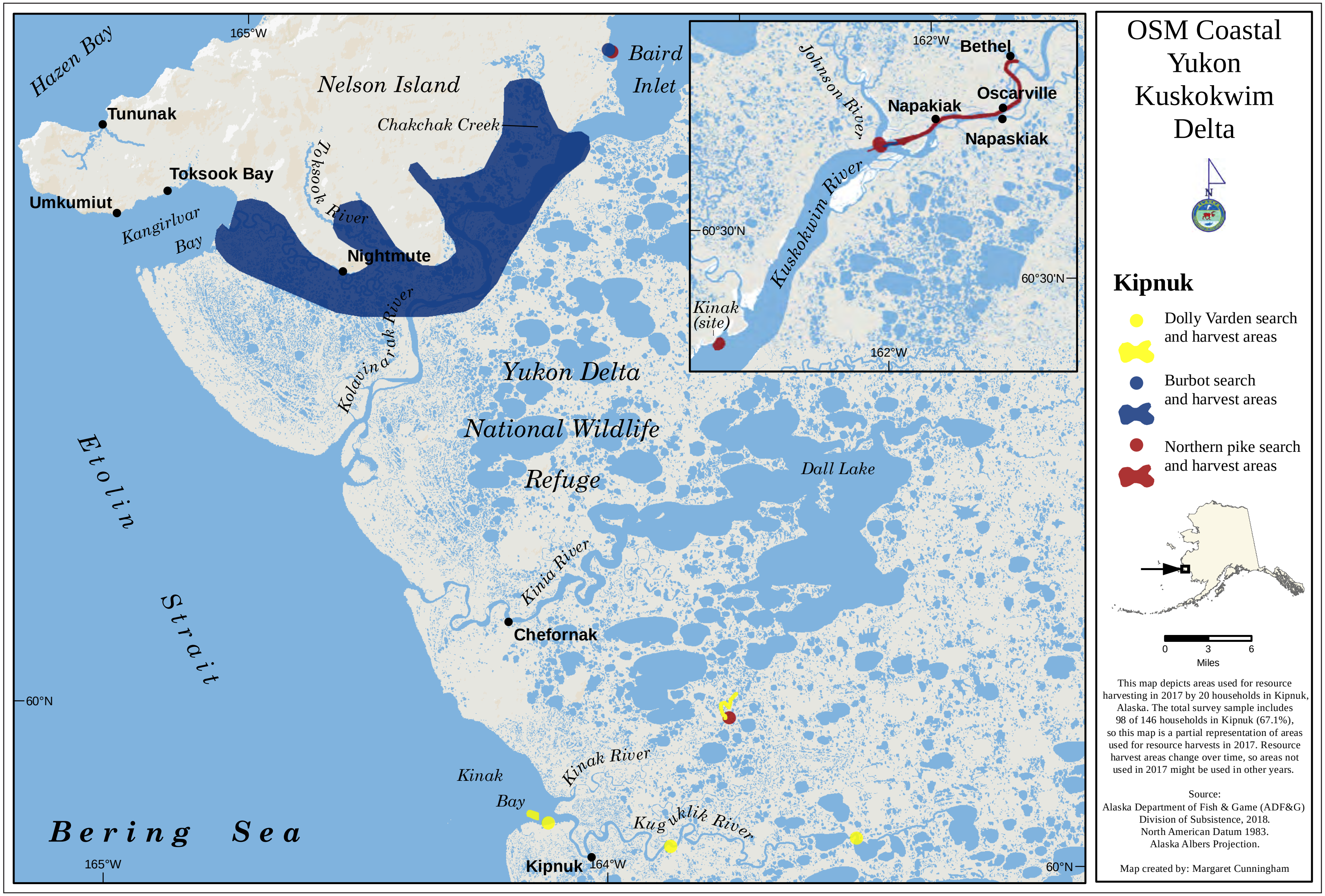


Figure 4-17.–Dolly Varden, burbot, and northern pike fishing areas, Kipnuk, 2017.

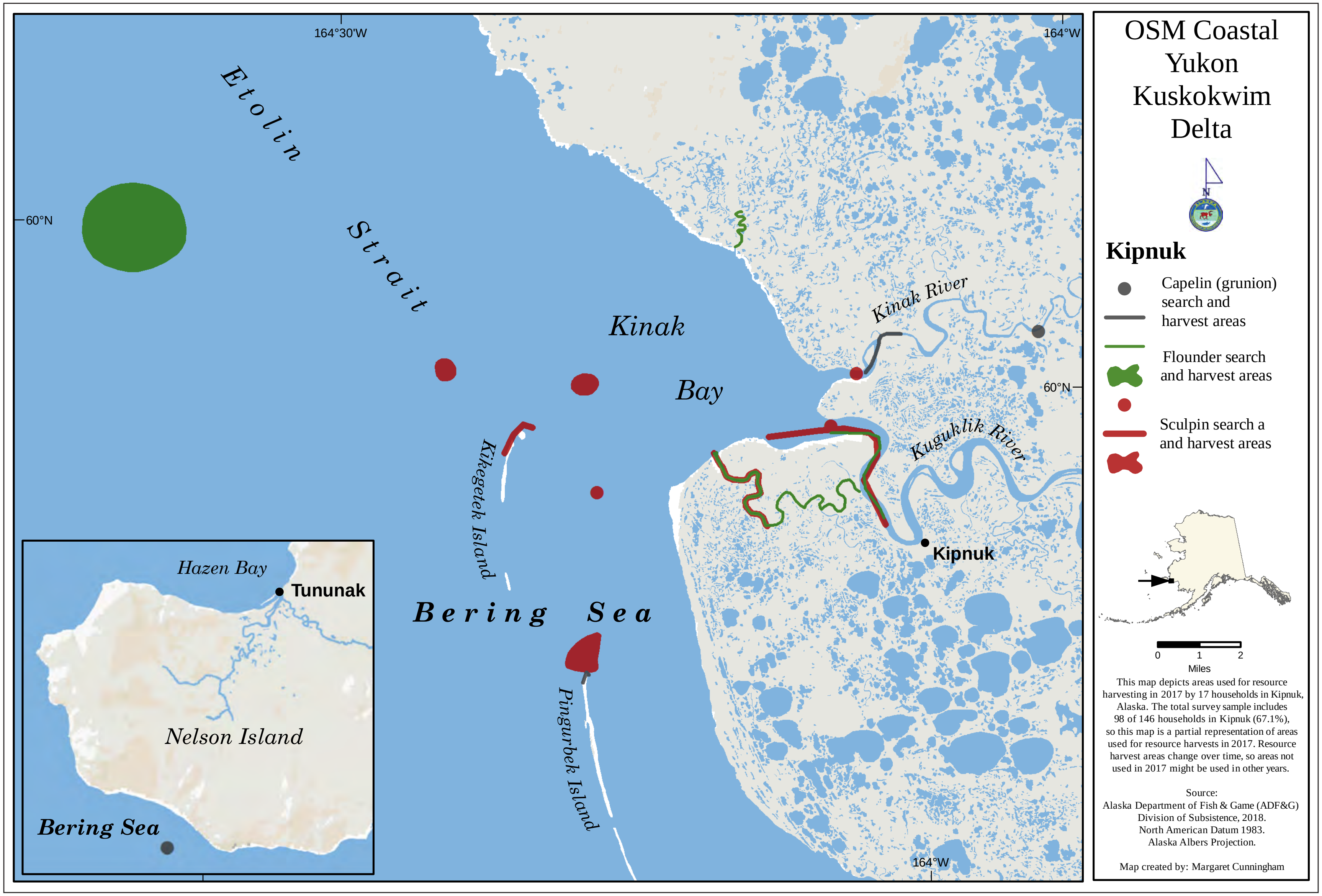


Figure 4-18.–Capelin, flounders, and sculpins fishing areas, Kipnuk, 2017.

Observations of Changes Affecting Nonsalmon Fisheries

Near the end of the survey, researchers asked respondents to describe changes that they had observed with respect to the harvest and use of nonsalmon fish and marine invertebrates. Researchers first asked about whether local environmental conditions changed and whether those changes had affected the household's fishing efforts. Researchers then asked about nonsalmon fish and marine invertebrate populations; again, if the respondent described changes, researchers asked about effects on the household's harvest and use of the resources. Finally, researchers asked respondents to describe any other changes that had affected their fishing. In Kipnuk, about one half of surveyed households responded to these questions.

Fifty respondents described changing environmental conditions; they identified increased temperatures and decreased predictability in the timing of seasons most often (Table 4-10). Respondents described warmer and windier weather, especially in the fall and winter. Many respondents mentioned a reduced snowpack, and some explained that precipitation in late fall and early winter increasingly falls as rain instead of snow. Fewer respondents shared a variety of other environmental observations: permafrost thaw, increased erosion, wider and muddier rivers, higher and shallower water, less calm weather, deteriorated ice conditions, a general flattening of the landscape, increased plant growth, and unhealthy fish.

Among the 50 respondents who shared observations of environmental change, about one third said that the changes have not affected subsistence fishing, or had not done so yet, and another third of respondents did not describe effects. Other surveyed households described multiple effects, including that poor ice and snow conditions limit access, especially in the late fall; some reported fishing from the riverbank instead of jigging through ice. Survey respondents did not necessarily identify this variation in method as a change to their fishing, but key respondents explained that more people are adapting by casting hooks from the riverbank until the river freezes, which takes longer in recent years (041417KPN6). Some respondents said that environmental change had affected fish run timing, which makes planning more difficult. For example, one respondent said that herring had arrived early in 2017 and that some fishers had missed the unexpectedly early opportunity. Other respondents described changes to the abundance, distribution, or condition of fish that may be related to the environmental changes they had described. For example, a respondent who said that lake water is warmer mentioned that blackfish have gotten bigger. Respondents also described effects from landscape changes: permafrost thaw and erosion are flattening the land and widening the rivers; the shallower water limits access to some places, and it scatters the fish, making them more difficult to catch. Respondents also described other ecological changes such as increases in the abundance of pollock, Pacific cod, jellyfish, beaver, or salmon shark.

Of 98 survey respondents, 45 responded when asked about changes to fish or invertebrate populations (Table 4-11). Most respondents who had already described changes to the abundance, distribution, or condition of fish did not respond to this question, but some gave additional descriptions of changes they have seen. Comments were mostly related to observations of unhealthy fish, primarily black or green spots on saffron cod and smelts. These spots, described as hard and about the size of a quarter, appear on a small but increasing portion of fish: about 5% according to one key respondent (041417KPN5). Another key respondent said that sometimes he sees "some on the lips too, big bubbles on their lips. Just throw those fish away. Feed them to the seagulls" (041417KPN6). Comments about the abundance, size, and distribution of fish were various, including that Bering cisco are smaller and that blackfish are bigger, and also that broad whitefish and pike are expanding into new areas. Many of the comments about timing were vague; one respondent indicated that unpredictable timing disorients the fish.

When asked how the identified changes to resource populations had affected the household's fishing, 21 respondents did not describe effects, four respondents stated that their fishing has not been affected and a fifth added "yet," and 23 others made comments. Most respondents simply stated that they do not eat or share unhealthy fish, sometimes articulating that they have a little less fish to eat. One respondent explained that Pacific cod and pollock are more abundant, which makes halibut harder to catch; another respondent said that increased uncertainty about timing complicates planning.

Table 4-10.–Observations and observed effects of change in environmental conditions, Kipnuk, 2017.

Observations	Effects
Late winter	
Climate change, weather	Current and water temperature are different
Warm. Couple years ago there were more foxes and more berries. Recently less foxes and less berries, foxes scare off the birds and allow the berries to grow more.	
Encountering more tomcods/ smelts with growth and discoloring on their bodies and seals with holes, white spots, abnormal. 5 or more years ago this started. Last October—[we've] got two good-sized sand bar that was dotted with red jellyfish. Never seen that kind, and ours are white. The red ones are large. Last year, [sea bird] living off mouth of river and they're dying and 2 kinds of unusual sea ducks that came trying to eat cemerliqs. Encountered them all winter and they were dying. Tens of those in one beach, dead while beach combing. The animals are telling us something's wrong. Lots of dead walrus, sick last year. These things I never encountered when younger. Even our plants, they're larger now, sourdock are larger now.	Inspect seals closer when harvesting. Fish too, put sick ones aside. Smelts, tomcod.
More erosion along banks of rivers	None
Hardly any snow	Not that I know of
Climate change	Hardly any walrus cause no ice down by the ocean
Coastline erosion, current is a mile or two faster, the tides are much higher than before. Ice thinner too. 5 years ago 5ft, 3 ft now.	
Less snow less cold water	
Water, oil spill. Contaminated	
River erosion, shallower each year with mud.	Even high tide south wind scatters the fish all over, harder to catch them
Less ice; permafrost used to be [found at] 8", now 3 feet down. River erosion, [have to] move infrastructure. Warmer water—kids swim early and late	Hard to say, more cod and pollock and sharks. [We are] fishing for smelts and needlefish later than we used to. Thin ice until December, not end of October
Back when he was younger had good weather now it seems always windy/ cloudy and warmer than usual.	
Tons of jellyfish around these days	Maybe keep salmons away
Less ice, less snow. Land looks different—marsh used to be fen, creeks and lakes filling with grass	No
Highwater, not much blackfish. Have to travel to different locations every year. Lakes high this year. Timing is changing, even berries. Less snow mostly rain in November December and January	Herring—some fishers miss early run. Hard to know when to go.
Weather changes—less snow	
Thawing land draining to rivers changing color to gold, brown, green. Some dry ground some wet. Not enough snow and ice, messing with plant schedule. Climate change	Unpredictable. Timing is off on both sides [spring and fall]. Fish are disorier
Smelt with dark spots	None
None have affected fishing	
Warm weather	Couldn't go out for lush [burbot] or blackfish in December because too warm to snow travel
Wind comes and goes. Weather change is getting to be an issue, hope there is ice out there for hunting	Got to go where wind is right
Beaver dams in lakes up river killing blackfish habitat and so in some places blackfish have been dying	Go to different spots
Boat and airplane sounds teasing seal and walrus—chases them. USFWS [float plate] and scare them away. Geese are scarce because with hunters	
Kuskokwim closures [salmon]	Fish camp, fish ruined from rain for fishing late
Everything changes—land is lower. Too much water to move around. Lakes drying up but still lots of lakes	
Early freeze or late freeze	Access—unsafe travel conditions
Permafrost melting and erosion are flattening the land, widening the river	Some parts can't get to—getting shallow
Winters are coming later	N/A
Winds have changed last 3–4 years. Less snow in winter	none
Erosion	no effect
Windier, winter coming later	no effect

-continued-

Table 4-10.–Continued.

Observations	Effects
Water is not as fresh—more sediments. Garbage from Japan and China	
Erosion	None
Later freeze up	Jigging starts later, Nov instead of October. Just have to wait
Past 3 years hardly any snow. Snows but then melts away. Warm weather, snow goes to east coast, Washington D.C.	Nothing yet
High water year round	
Land is getting low. Fall floods are getting higher and higher	Not yet
River banks going faster, moving very fast—erosion	No no
High tide changing—floods from the south	
Trash	[Trash] Gets caught in the fish net
Land is going down, high ground all flattened out now. Floods getting higher (fall)—sidewalk drifting away. Warming up hardly any snow, finaly snowed in February / March	Mostly warm, ice is thin—more dangerous. Hard to say
Higher water	None
Problem is erosion on the beach—North wind smashes on the beach. Warming up every year—even warmer than last year.	No, just losing land. In the future might be more problems
Warm weather	Halibut are further toward Merkoryuk now and less here
Depends on weather—changing, less predictable	Hard to know when to go
Ground is sinking at Dahl Lake, we see holes where permafrost is dripping. Lake waters more shallow, warmer. High water in fall seems like more	Blackfish are bigger
Not as cold as when we grew up. Cold spell 2 weeks not very cold, very short	No
Been weird winter. Warm cold warm cold. Seemed like no winter, very hot summer	Not that they know of
Seems less snow, less cold; early spring. Water is higher—high tide goes way up.	

Source ADF&G Division of Subsistence household surveys, 2018.

Table 4-11.–Observations and observed effects of changes in nonsalmon fish and marine invertebrates, Kipnuk, 2017.

Observations	Effects
Smelts, green stuff started 3 years ago	
More dead fish, birds, seals—look like they got cancer. Weird sores, purple lips.	Throw those back
Smelts have green spots. Started noticing 2–3 years ago	No effect
Dark/ black spots on smelts	
Cycles [are different]. Black stuff on smelts	
Two summers back 30 something rainbow trout, first time inflamed open sore/ cancer on smelt lips, more with green/ black spots too	
Sores on smelts recently Pacific cod with enflamed lips	
Herring came in April super early before breakup last year.	
Little worms in red salmon last couple years. Less likely in ocean bright fish	
Bering cisco—smaller this year	
Injuries/ sores/ lumps/ smell spoiled.	
Smelts and tomcods, green stuff (infection) on body and mouths. Some on the flatfish too. Halibut with red patches, seen on bottom side of fish for first time. Dark green/ black on the whitefish too.	
Scars on cisco, smelts, salmon sores—didn’t used to see, remind of seals (whitefish, salmon) smelts—it's swollen and black ever since Fukushima getting more every year. More sharks fishing for halibut but snapline last few years	
More diseases on the fish, growths or sores on all of them except the halibut, salmon, herring, and whitefish. 20 years in Bristol Bay, 15 years here.	Got to throw them away, worried for sea mammals
Green spots on smelts started 3 or 4 years ago.	Throw them away
Started to see, once in a while, new fish showing up. Rusty looking whitefish, maybe water changes their color. See sturgeon every once in a while. Sometimes sheefish show up.	Not yet
Black spots on smelts, tomcod, herring. More frequent last 5–10 years.	
Fish with spots (smelt, tomcod)	None
Bigger blackfish present, maybe from warmer water	
Smelts—green cysts on fish, 5 years	Don't keep those
Growths on smelt and tomcod. Black splotches at least a couple everytime go jigging	Throw affected smelt away
Blackfish had swollen lump on neck. Pus in salmon flesh	
Cycles. Sometimes less, sometimes more. Same fish every year.	
Smelts: spots (black) on their sides	
Smelts with spots	Discard those with spots
Black spots/ sores—maybe from that radiation or methane from permafrost melting. Less fish every year—storms blow them on shore water dalls, fish die on the ground	
Red salmon had worms in the meat last year. Smelts—black patches. More frequent last few years.	

-continued-

Table 4-11.–Continued.

Observations	Effects
Salmon and smelt having infections and cuts. One time infected tail on smelt, black and swollen. Some fish caught have healed cuts.	None
More smelt with black marks	Don't feed spotted ones to humans, for dogs
Fewer smelt around. Smelt look different	
Smelts have green spots along sides last few years. Blame it on Fukushima	Throw the ones with spots back
Some years runs come late or early	Less predictable, hard to know when to go
Smelts have black spots last couple of years.	Have to throw some back
Black spots, mouths, fins, tails, 2 or 4 / 100	Throw those back; wonder
Black spots on fish when ice fishing. Blackfish are bigger size now	Throw the fish with spots on them back
Black spots present on the smelts	Throw them back
Black spots or fungus appearing on herring, smelts, and even seals that eat them start balding.	You have to toss out the sick ones
More cod and pollock	Harder to catch halibut
Smelts are having black dots on scales and heads, some on whitefish too	Still get them
Timing off a lot of times	
Sometimes broad whitefish, even pike, seem like they are in new places	
Black spots, mostly on smelts	Throw them back
Black spots on smelts, little less this year	Throw those back
Black spots on smelts and tomcods. Started last 5 years.	Not much, just throw them back

Source ADF&G Division of Subsistence household surveys, 2018.

Table 4-12.–Additional observations, Kipnuk, 2017.

Observations
Heard Japanese Fukushima infected seal skins, fish with some kind of off color. If catch just throw away
More abundant in his younger years
Gas and airfare too much to go to Johhnson and Kusko
Getting old
This survey. New duck showing up, no more spectacled eider ducks
Husband died
Health, gas prices, equipment failure
Motor, erosion
Snow machine broken
[Grocery] stores

Source ADF&G Division of Subsistence household surveys, 2018.

The final question of this section was intended to elucidate information about "other" changes, primarily the socioeconomic conditions that surround fishing. At least two respondents mentioned changes that could be related to earlier questions: one expressed concern that seal and fish had been affected by nuclear radiation from Fukushima, and another said that fish had been more abundant in their younger years (Table 4-12). Respondents also mentioned socioeconomic changes including the cost of gasoline and airfare, the challenges of maintaining needed equipment, the presence of grocery stores, and personal details of health and family. One respondent identified "this survey" as a difference or a change, the meaning and effect of which is unclear.

Local Comments and Concerns

At the end of the survey, researchers asked respondents if they had any additional questions, comments, or concerns and took note of their responses. Many respondents had already spoken their concerns, as described above, and did not respond to this question. However, 26 households did respond (Table 4-13). End-of-survey comments were highly diverse and often echoed statements of change over time reviewed in the prior section. For example, comments such as: "never seen Pacific cod as a kid," and "Moose are starting to come around; Bering cisco swimming through slough in town and they never used to when [I was] younger" may have been prompted by the earlier questions. Some respondents followed prior comments with more detail or a question for future research. For example, "Someone should study where the red jellyfish come from." Respondents voiced concern about ecological changes such as new insects and more Pacific cod, unhealthy fish, and pollution. They also expressed opposition to Western wildlife management regulation of subsistence activities, and at least two respondents mentioned contentious salmon regulation on the Kuskokwim River in the years prior to the survey. Many Kipnuk residents have friends and family in Kasigluk, Nunapitchuk, and Atmautluak who fish on the Kuskokwim River. One key respondent said "We don't play games when we do subsistence. We just harvest what we need" (041217KPN1).

Several respondents identified the reduction and ultimate absence of local commercial fishing opportunities as an economic loss or indicated that they would participate in commercial fishing if opportunities were available. One respondent acknowledged the challenging logistics of maintaining ice-making equipment and industrial freezers in remote locations but did not seem to see that as justification for closing all the processing plants in the region. Several statements, mostly related to environmental change, indicated an increased level of uncertainty about the future. However, one respondent said, "fish still feeds the village."

Table 4-13.–Respondent comments, Kipnuk, 2017.

Caribou—when will they run here again? Heard from elders they used to come here from the north
Would commercial fish if it were open.
Would commercial fish if it were open.
Longline commercial fishers waste the small fish. See videos with dead fish. Maybe CVRF; subsistence users like the small ones.
Need commercial fishing for halibut
Need commercial fishing, help getting the halibut plant running. Closed because couldn't keep them cold enough.
Tell Fish and Wildlife to stay out of our bay and inland for geese. We only catch what we need. Feds can't provide us or hunt for us only fine us and not feed our familiy unless they're willing to hunt for us.
Fish still feeds the village
Herring eggs from the fish are dried and saved for feasts (memorial feasts) and for elders. Someone should study where the red jellyfish come from. The weather: The climate has changed river used to break up in June, Now April. The fall winds are stronger, fall floods are more common and extent is further in. Even smelts are left on ground, foxes and seagulls get them. Thanks to these new fall floods, geese and white fronted are more, nesting big time around here that never used to be around. We collect their eggs.
Fish regs (closures) shouldn't be there for subsistence users. The salmon is the food for YK Delta folks for the winter. Last summer could only fill half of the smoke house and most ruined due to closure and late season. Should allow subsistence at beginning of the run. Too many flies in July. Shouldn't be any closures for subsistence. I hope they let us fish the beginning of the run before last week of June–July.
Kusko; they took away some salmon that was caught by family.
Blackfish broth and seal oil are cure for people; like medicine
Free dipnets? Bring dipnet and hooks for smelts.
We've seen bugs we don't usually see—warmer than in the past
Never seen Pacific cod as a kid
Moose are starting to come around; Bering cisco swimming through slough in town and they never used to when younger.
More kings and reds than used to be around sandbars.
Mostly go for salmon. Please don't regulate these nonsalmon fish.
When things spill in rural areas people need to clean/ contain before it contaminates the wildlife. Dumpsters are dumped where they should be now.
Some people have sent in diseased fish and don’t hear back—what is happening? What is it? Is it dangerous? In Bethel area there's a story of a moose with soft meat fed to dog—next morning dog was dead.
They should do a survey on the fish getting the black/ green stuff on them and what's causing that to grow on certain parts of the fish.

-continued-

Table 4-13.–Continued.

Respondent comments
Farmers and zookeepers are the only ones who should be called Fish and Game. No sharing with us, locals are only ones that can do anything about it.
Magnetic field is changing, sometimes fish go the wrong way. Snow geese migrate farther north. We have birds we have never seen before. Planet X passes by every 3,600 years affecting everything; damages atmosphere, will pass between earth and sun.
Why are you doing this? Why no commercial? Kusko needs commercial fishing.
What is the purpose of surveys?
Devilfish have bigger heads and fins almost same color as rock sole. Snow and ice come late and not enough snow. Anti-mining. No mining! Bad for fish, birds, animals, people. "Mining is bum, so don't mine."

Source ADF&G Division of Subsistence household surveys, 2018.

Acknowledgments

ADF&G Division of Subsistence wishes to thank the Native Village of Kipnuk Traditional Council and residents of Kipnuk for participating in this project and for extending genuine kindness at every opportunity. Local research assistants Daniel Mann, Andrea Dock, Sheila Carl, and Janelle Carl each did a great job of describing the surveys to potential respondents; they also provided much helpful insight about how fishing works in Kipnuk to ADF&G staff. Additionally, nine individuals including David Carl and George Chuckwuk participated in six extended interviews; seven key respondents chose to remain anonymous. The author extends special thanks to David Carl for his generosity with detailed descriptions, experienced wisdom, and delicious samplings of local foods that were enjoyed at his table. Likewise, thank you Sheila and Darren, especially for that delicious ice water! Special thanks also to Sophie Paul, Yup'ik language teacher at the Chief Paul Memorial School who reviewed fish words and spellings with the author.

Quyana Qipneq!

Plate 5-1.–Mekoryuk and Cape Etolin from the air.

5. MEKORYUK

Anna R. Godduhn

In January of 2018, two Division of Subsistence staff worked with five local research assistants to conduct nonsalmon subsistence harvest surveys with households in Mekoryuk (Figure 1-1; Plate 5-1). Researchers surveyed 50 of 77 (65%) randomly selected households about their harvest and use of nonsalmon fishes and marine invertebrates (Table 1-7), and the average survey length was 32 minutes (Table 1-8). The total nonsalmon fish and marine invertebrate harvest for the community of Mekoryuk translated to 97 lb per capita in 2017 (Table D5-1).

In addition to the household surveys, Alaska Department of Fish and Game (ADF&G) researchers conducted five key respondent interviews with six knowledgeable Mekoryuk subsistence fishers. Key respondents shared their observations, experiences, comments, and concerns, and they provided researchers with invaluable information regarding subsistence activities associated with nonsalmon fish, including seasonal harvest patterns and related changes over time. This information helped to contextualize the quantitative harvest and use data collected in the surveys.

Community Background

Mekoryuk (*Mikuryarmiut*),[1] is a small Cup'ig community on Nunivak Island (*Nuniwar*), about 150 miles west of Bethel (Hout 1966). Shoal Bay lies across the mouth of the Mekoryuk River, and the long spit of

1. Mikuryarmiut, a Cup'ig word, is defined as "village of abundance" and also indicates the people of that place (Amos and Amos 2003:201). Lantis identified the Cup'ig place name as related to a gathering of people: "In 1940 they lived in seven villages, of which the largest was called appropriately *Miko'goyux* (more people), known to traders and officials as Mekoryuk" (1946:164). In this chapter, Cup'ig place name spellings come from Drozda and Kiokun (2002); the spellings are aligned with Amos and Amos (2003). Cup'ig is the Nunivak Island dialect of Central Alaskan Yup'ik (Jacobson 2012).

Plate 5-2.–Etolin Strait looking south, January 2018.

Cape Etolin forms the northernmost point of the island. Nunivak Island, the second largest island in the Bering Sea[2], is separated from Nelson Island and the mainland of the Yukon Kuskokwim Delta by Etolin Strait (Figure 1-1). The northward current runs strong in the shallow strait; the current resists freezing solid in winter and runs ice free from May to November (Drozda 2010; Kowalik 1999; Plate 5-2). The volcanic belt of Nunivak Island and Nelson Island provides some of the most substantial topographic relief in the Yukon-Kuskokwim Delta (YKD). The highest point on Nunivak Island is Roberts Mountain (*Ing'errlag*), at 1,675 feet of elevation. Much of the island is made up of rolling hills and small crater mountains; the volcanoes are geologically young but not active (Wood and Kienle 1992). Oral history maintains that a bucket thrown into one of the lakes later appeared on the shore of the island, such that people infer the existence of underground channels; respondents said some Nunivak Island lakes have fish, but were not confidently familiar with what kinds (011319MYU7; 011419MYU8).

Many historical details of contact and trade on Nunivak Island are documented elsewhere, most thoroughly reviewed by Griffin (2001). The archeological record affirms at least 2,500 years of continuous occupation, but knowledge of life before contact is limited (Griffin 2002; Shaw 1998). Dietary reconstruction based on analysis of human hair from an archeological site on the island dated to about 250 AD provides a glimpse of the past: the findings "confirm the antiquity of specialized sea mammal hunting" and demonstrate that the Norton Culture of that age was "fully capable of an intense focus on marine mammal hunting" (Britton et al. 2013). Other research finds that the traditional importance of caribou in prehistoric and historic times has been underemphasized (Pratt 2001), but development of land mammal hunting apparently came later than the specialized marine mammal use described by Britton et al. (2013). Additionally, ancient rubbish heaps on the island contain "large numbers of shells, particularly mussels of the genus Mytilus, indicating that shellfish were once an important part of the subsistence economy" (Pratt 2001).

Russian explorers who visited the island in 1821 and 1822 found that the Nuniwarmiut (people of *Nuniwar*) were already in possession of goods likely acquired from Aleksandrovskiy Redoubt at the mouth of the

2. Alaska Department of Commerce, Community, and Economic Development (ADCCED) Division of Community and Regional Affairs, Juneau. n.d. "Alaska Community Database Online: Community Information." August 27, 2019. https://dcra-cdo-dcced.opendata.arcgis.com/ Hereinafter *ADCCED n.d.*

Nushagak River through trade along the Kuskokwim River (VanStone 1989). In 1822, Russians explored the southeastern shores of Nunivak Island and estimated a total population of about 400 people. At that time and until the 1870s, there were caribou and wolves on the island; however, they were extirpated, likely following the introduction of firearms in 1889 (Pratt 2001; VanStone 1989).

At contact with Euroamericans and for decades beyond, the people were dispersed around the island in multiple seasonal villages that formed and dispersed differently each year (Lantis 1946:159). The villages consisted of semi-subterranean structures: usually a complex of a storehouse and multiple residences, built with driftwood and covered with sod; larger villages had two such complexes (Lantis 1946:157). Each housing complex was centered around a men's house (*kiiyar*; Amos and Amos 2003:170); this was the residence for men and older boys, where the youth learned the skills they would need later in life by example and practice (Lantis 1946:157–162). The men's house also served as a community center for dances and festivals with guests from elsewhere on the island and sometimes the mainland (VanStone 1989:5). Two or more smaller houses were connected to that structure: the residences of multiple generations of women, older girls, and small children. One key respondent remembers a stick dance on the west side of the island where she was raised: families came from all over the island, and it was crowded and warm "even though it was very cold outside" (011319MYU7). Winter villages were relatively large and located near the mouths of rivers; the river *Ellikarrmiut Kuigat* at what became Nash Harbor was favored by some because it did not freeze completely (Griffin 2002). In the spring and summer, families dispersed to smaller villages or camps that included "the usual semisubterranean houses, albeit they were not so well constructed or so nicely furnished as those in the winter village" (Lantis 1946:158).

Mudflats and shoals kept most explorers well off-shore, and interaction with Russians and Euroamericans was minimal across the delta until the late 1800s; this was in part because the coast, including Nunivak Island, lacked the salmon and gold of the Kuskokwim and Yukon rivers and held little draw for the newcomers (Griffin 2001; Khromchenko 1973:25; Lantis 1946:156). Although oral history includes references to solid ice across Etolin Strait (Lantis 1946:292), safe passage in historic times was limited to ice-free months (Griffin 2001), and Mekoryuk remains one of the most difficult communities to access in the region either by sea or by air (Drozda 2010). However, populations moved and mixed on the island, with complex affiliations to the mainland prior to and throughout the contact period (Griffin 2001; 2002). The Nuniwarmiut population was likely augmented by a faction of survivors from a battle at Arolik in the 17th century (Fienup-Riordan and Rearden 2016; Pratt 2013). In the 19th and 20th centuries, numerous epidemic events resulted in severe population declines that may have included whole villages as on the mainland, but the original population and levels of mortality were poorly quantified (Griffin 2001). Nuniwarmiut were linked into complex and dynamic indigenous trade networks through the 1930s and maintain ancient kinship connections to Hooper Bay and Nelson Island (Griffin 2001; Lantis 1946; Pete 1984).

In 1920, the Lomen Brothers of Nome established a reindeer herd and a trading post at Nash Harbor, which allowed opportunities for wage income (Griffin 2002), especially the production of crafts for resale (Griffin 2001). In 1929, Nunivak Island National Wildlife Refuge was established in a federal effort to reestablish extirpated muskoxen across their historic range in Alaska; in the mid-1930s, 31 muskoxen were brought to the refuge (Spencer and Lensink 1970). In 1980, the island was made part of the Yukon Delta National Wildlife Refuge, and the southern portion was protected as wilderness.[3]

The first school on Nunivak Island was established at Nash Harbor in 1923, but social change was more pronounced following the 1937 arrival to Mekoryuk of a Yup'ik missionary from Norton Sound representing the Evangelical Covenant Church (Griffin 2001). In 1940, the Nuniwarmiut occupied underground sod covered houses in at least 30 seasonal settlement sites dispersed around the island (Lantis 1946). Throughout the mid-20th century, stores, the school, and the mission trade drew the population north, and winter villages on the southern coast were abandoned (Griffin 2002; Lantis 1946; 1972). Teachers and missionaries encouraged the construction of above-ground housing, although the old houses had been much easier to

3. U.S. Fish and Wildlife Service. "Yukon Delta National Wildlife Refuge. History." Accessed August 28, 2019. https://www.fws.gov/refuge/yukon_delta/about/history.html

keep warm.[4] They also promoted a shift from traditional multifamily households to western-style nuclear family households (Griffin 2002) and discouraged other traditions, such as ritual festivals and dancing (Lantis 1946:206). The U.S. Bureau of Indian Affairs moved the school from Nash Harbor to Mekoryuk in 1940, and families with school-aged children either moved there or sent their children to live with relatives (Griffin 2002). A key respondent remembers staying with her married older brother in Mekoryuk when she was a child and returning to Nash Harbor for the summers; she described being away from her parents as difficult, "just like going, going out somewhere else and go high school now" (051417MYU4).

The construction of a slaughter house and transfer of the reindeer herd to local ownership in the 1940s, the realignment of local leadership following multiple epidemics that decade, and the ultimate amalgamation of wage employment and education with adaptive subsistence practices eventually led to relative prosperity for residents (Lantis 1972). The school at Nash Harbor reopened briefly in the 1950s; however, in 1957, an airfield was built at Mekoryuk and the Nash Harbor school closed permanently for insufficient enrollment, predicating Mekoryuk as the island's sole remaining permanent community. The Lomen Commercial Company usurped and augmented preexisting networks of trade to profit from local craftsmanship in basketry, sewing, and carving, and the Nuniwarmiut adapted to using commerce to support subsistence livelihoods (Griffin 2001; Lantis 1972; Nowak 1975).

Following consolidation at Mekoryuk, some families relocated to Bethel or elsewhere to avoid sending their high-school-aged children to boarding school; some families returned permanently in the late 1970s when a high school opened, while others "established a pattern of returning to the island in the summer to fish for salmon, halibut, Pacific cod and herring" (Pete 1991a:7).

Following some hesitation (Bista [*n.d.*]), Mekoryuk residents began to participate in commercial fishing for Pacific herring[5] and Pacific halibut[6] in the late 1980s.[7] Fishing rates varied dramatically from year to year in the 1990s: generally Mekoryuk fishers participated in one or the other fishery more heavily in alternating years, and a few Mekoryuk fishers participated in commercial salmon fishing in the 1990s, probably in the Kuskokwim River or Kuskokwim Bay. Commercial fishing for herring and salmon peaked in 1996, when 45 herring permits and three salmon permits were active; for halibut, the peak of 48 active permits was in 2000. Herring activity declined and ended by 2006; halibut continued but declined until no Mekoryuk fishers participated in commercial fishing in 2015 because of a lack of a fish processing plant. Contemporarily, the reindeer and muskox herds each provide for some economic activity on the island: residents sell and distribute reindeer meat as well as guide muskox hunts. The herds give residents a strong sense of food security, but nonsalmon fisheries remain vital as well.[8]

Seasonal Round

The rivers and rugged coast of Nunivak Island support important nonsalmon fisheries throughout the year. This section begins by summarizing historical seasonal round details documented in 1939–1940 (Lantis 1946), identifies major changes over time (Drozda 2010; Hout 1966), and ends with a generalized review of the contemporary seasonal round based on the 2017 study year.

In 1940, Nuniwarmiut used fish with a great disparity in size, ranging from approximately 30-inch halibut to "little needlefish" (Lantis 1946:179). On the north side of Nunivak Island, "the standby the year around was the tomcod [saffron cod]. However, satisfying quantities of salmon, trout, herring, [Pacific] cod, halibut, and lesser fish were caught, too" (Lantis 1946:158); Plate 5-3). During January and February, residents focused on the construction and repair of equipment and gear; "there was really no food getting except the spearing of tomcods through the ice," which was mostly done by women (Lantis 1946:174). Ice receded from the

4. A. Godduhn field notes, January 28, 2018.

5. Hereinafter *herring*.

6. Hereinafter *halibut*.

7. Commercial Fisheries Entry Commission, n.d. "Fishery Statistics – Participation & Earnings." Accessed August 9, 2019. https://www.cfec.state.ak.us/fishery_statistics/earnings.htm Hereinafter *CFEC n.d.*

8. A. Godduhn field notes, January 13, 2019.

Plate 5-3.–Photographs by Lantis during her 1939–1940 fieldwork on Nunivak Island. Clockwise from top left: Spools of sinew cord for a fish net; dipnet for trout and other fish; woman's parka showing narrow stripes of blackfish skin sewn down the center of strips of bleached sealskin sewn onto a denim park; carrying basket and coarse matting baskets containing tomcod on cache roof, with reindeer skull, for safe keeping; newly covered kayaks in spring; flounder and tomcod strung and hanging on a drying rack.

Mekoryuk coast in 1940 on May 1, and the month was extremely busy: intensive walrus and seal hunting extended until children first found shorebird eggs in the last week of the month, and fishing was active throughout the month (Lantis 1946:178). A lull in fishing at the end of May and into June allowed women to process the seal catch. However, later in June, "fishing was the main occupation" (Lantis 1946:180). Husband and wife pairs, who "shared responsibility and labor constantly" (Lantis 1946:160), seined salmon (primarily chum salmon [*mac'utar*] and also "salmon trout") in the river, along with herring (*iqalluarpag*) and sculpins (*kayur*); some fishers stayed at Cape Etolin catching Pacific cod and halibut (*cagir*), both of which were most abundant in late June and July. "Although the codfish were scarce this year, they still were four or five to every one halibut" (Lantis 1946:179). Fishers filled their kayaks with Pacific cod.

> In August the people lived principally on greens, mussels, and boiled salmon or trout. Dried meat and fish naturally were not eaten now but were being kept for winter, unless a person was traveling, in which case dried fish was the best transportable food. (Lantis 1946:180)

Also in August, husband and wife pairs would go upriver to check their fish traps, putting "more and more fish" into underground caches for winter use (Lantis 1946:180). In the second half of August, people collected fish eggs, but no details of type or methods of harvest are provided. In September, fishers focused on coho salmon, but they also caught and used other fish: "Flounders were almost abundant by the middle of September, caught by seine and by a special five-pronged spear. These little flounders and the tomcods could be dried; sculpin were eaten immediately; salmon were put away to become 'stink fish'" (Lantis 1946:180). In 1940, freezing nights began in September and snow fell in early October; despite the cold, fishing was active. "Tomcods became plentiful the first week of October, the big tomcods spawning. And there were smelts…The first week of November the river froze hard enough for fishing through the ice and tomcods were being hauled out literally by the bushel" (Lantis 1946:181).

By the 1960s, reindeer herding in late July had repatterned the seasonal round such that fishing for salmon ended in time to dry the catch before the move back to Mekoryuk. Additionally, motorized transportation had dramatically reduced the need for fish to feed dog teams, and Pacific cod were absent from Nunivak Island waters (Hout 1966:6). In the 1980s, Nunivak Islanders caught Pacific cod for the first time since the 1940s (Drozda 2010). In describing how the fish were readily readopted into the seasonal round, a key respondent to this study remembered the return of Pacific cod as recent:

> When I was growing up, I didn't know anything about cods. My parents used to tell me, tell me stories about how much cods there was before. And then I, I never knew anything about cods until, I don't know, a few years back. All of a sudden they just showed up and that's when we start catching 'em. And I, my mother was alive then and she taught me how to cut them and work on the heads to cut them in a certain way and all that. I was really amazed how hard they are to cut, [to] fillet to dry, because they're not like salmon, but I learned. (051417MYU4)

Also in the 1980s, local commercial fishing opportunities for herring and halibut developed (ADF&G 1987).[9] These activities both supported subsistence and promoted change: income enabled investment in larger boats with stronger motors and fishers became accustomed to fishing farther off shore than they had historically (051217MYU1).[10] Although equipment has changed and primary targets have shifted over decades, nonsalmon resources were caught or collected throughout 2017, most intensively in the summer. Day trips are easy with modern equipment, and families still participate in subsistence activities all around the island. Some distances are long, and people often camp in the places their families lived historically (051317MYU2; 051217MYU1; 051417MYU4). In the winter and early spring, with attention to currents and weather for the best fishing, many fishers jig hooks through the ice for saffron cod (locally "tomcod" or *iqalluar*) or chars, occasionally catching smelts, sculpins, or flounders. As the days grow longer and warmer, more fishers participate until the ice deteriorates. In contrast to previous years, respondents reported being unable to travel to the northwest corner of the island in February or March to jig for blue king crab; in recent years, ice conditions have not supported this activity.[11] Concurrent research described conditions in the study year:

> In early 2017, south winds created open water north of the island and the village, which used to be very unusual. Ice conditions are unpredictable now. The ice never used to move from the north side of the island in December, January, or February. It was rare to see open water at that time. Now, the ice can go away even in mid-winter. Even the bay in front of the village has had open water in wintertime in recent years. In the weeks prior to the interviews [January 13, 2017], people had been able to gather mussels from the beach, which was never possible in winter before. (Huntington et al. 2017)

Once the water is open, fishers pursue herring, sometimes catching chars while they wait for the herring run (012818MYU5; 051417MYU4). The herring effort was more important before and during commercial fishing of the 1970s and 1980s (Pete 1984; 1991; Plate 5-4). Residents also collect herring roe on kelp, shellfish (especially mussels), and a variety of marine invertebrates such as sea anemones. Summer-long

9. CFEC n.d.

10. A. Godduhn field notes, January 13, 2019.

11. Mekoryuk Tribal Council, data review meeting, January 10, 2019; A. Godduhn field notes, January 13, 2019.

Plate 5-4.–Fish drying, ca. 1949. In 2018, Mekoryuk residents identified these fish as herring.

relocations that were common for many decades were not reported in 2017, but each year families travel to numerous fish camps around the island; they often stay for weeks at a time to fish for salmon, halibut, and Pacific cod (051317MYU2; 051417MYU4; 051217MYU1). Activities such as trapping Alaska blackfish and spearing flounders are still occasionally practiced but no longer an integrated part of the contemporary seasonal round for most families.

As the season progresses, fishers go out to sea for halibut and Pacific cod, and they sometimes catch walleye pollock. Larger fish are caught farther from shore; the mix of species varies from year to year and even through the summer (051217MYU1). In late May, salmon begin to arrive, and fishers split their time throughout the summer between fishing for salmon or fishing for halibut and Pacific cod; they generally use the best weather to search for the offshore species (051217MYU1; 012818MYU5; 051417MYU4). Salmon fishers often catch other fish in their nets, especially chars, and hooks off-shore sometimes catch walleye pollock, ocean flounder, or Bering wolffish. The large, waterproof skin of wolffish was used historically for windows and rainboots (051417MYU3); these fish are still occasionally caught, but respondents did not report contemporary use.

Fishing activities peak in July; some families fish for coho salmon and chars in August, and some continue to collect shellfish. However, residents are more focused on picking berries, many of which are mashed with fish in the traditional delicacy, *akutar* (012918MYU6).[12] In September, many families are focused on hunting and processing reindeer and muskox. In recent years, because ice melts out once or twice in the early winter and does not firm up as early as it once did, ice fishing for saffron cod does not resume until December or January.

12. A. Godduhn field notes, January 28, 2018.

Population Estimates and Demographic Information

Surveys conducted in 2018 for the 2017 study year recorded demographic and nonsalmon fish harvest and use information from a sample of all Mekoryuk households that were residing in the community for at least six months of the study year. Surveyors attempted a 100% sample of all households and achieved a sample of 65% (Table 1-7); demographic data were expanded to estimate a total population for the community. Survey results indicate a total population of 196 individuals residing in 77 households in 2017 (Table 5-1; Figure 5-1). Other demographic characteristics were also calculated from the data, as shown in Table 5-2. For example, 93% of the population identified as Alaska Native, including at least one head in 93% of homes. Household size ranged from one to five individuals and averaged 2.5 members.

One of the first U.S. attempts to enumerate the total population of Nunivak Island occurred in 1891, when a census of villages and population counted 559 people in nine villages and numerous fish camps (VanStone 1989). Later research suggested that estimate may have been low (Pratt 1997). Lantis enumerated 218 individuals in seven occupied winter villages in 1939–1940, by which time infectious disease had diminished the population of the island:

> The following is the history of Mekoryuk in the past two generations: Fifty or sixty years ago, it was a sizable village. Forty or forty-five years ago, that is, just before 1900, there was an epidemic which nearly wiped it out. Again, in the decade 1910–1920, there was a serious epidemic which left only four families. Thereafter it remained small until the early 1930's when it was repopulated by people moving in from other villages. There seems little doubt that the population of the island as a whole is decreasing. (Lantis 1946:163)

Epidemic deaths continued in the 1940s (Lantis 1972). The U.S. Census record shows 225 people in 1940[13]; from 1950 through 2010, decennial census population counts ranged from 156 to 249 people (Figure 5-2).

The U.S. Census Bureau identified 70 households in Mekoryuk in the 2010 Decennial Census with a total population of 191 (Table 5-1; Figure 5-1). In 2018, the U.S. Census Bureau American Community Survey (ACS) estimated a five-year (2013–2017) average number of occupied households of 76 and a five-year average population of 217. These figures are statistically similar to this study's estimates.[14]

The population in Mekoryuk is split almost evenly between males (100) and females (96), but age cohorts less than 30 years old tend to have more females, and those in the 30–65-year-old range have more males (Figure 5-3; Table D5-2). Over 60% of household heads were born to families living in Mekoryuk, and 9% were born elsewhere on Nunivak Island. About 18% reported birthplaces elsewhere in Alaska, and 10% reported birthplaces elsewhere in the U.S. (Table D5-3). About 70% of the total population reported Mekoryuk as their birthplace (Table D5-4).

Summary of Harvest and Use Patterns

Harvest and Use of Nonsalmon Resources at the Household Level

Figure 5-4 shows the percentages of households that attempted to harvest, actually harvested, and used nonsalmon fish and marine invertebrates in 2017. Of the 50 surveyed Mekoryuk households, 82% reported

13. ADCCED n.d.

14. Differences between population estimates and counts by the Division of Subsistence, U.S. Census Bureau decennial census (2010 Census), American Community Survey (ACS), and the Alaska Department of Labor and Workforce Development (ADLWD) are likely due to differences in sample sizes and variations in methods of expansion from sampled to unsampled households. For example, the 2010 Census count is based upon the total number of individuals who considered Mekoryuk to be their principal place of residence on April 15, 2010, whereas the Division of Subsistence population estimate is based upon a quantitative expansion of the number of individuals who resided in responding households in Mekoryuk for at least six months during the study year. Different population estimates are considered to be significantly similar if one estimate falls within the range of error calculated for another estimate.

Table 5-1.–Population estimates, Mekoryuk, 2010, 2013–2017, and 2017.

	Census	5-year American Community Survey (2013–2017)		This study (2017)	
	(2010)	Estimate	Range[a]	Estimate	Range[b]
Total population					
Households	70	76.0	62 – 90	77.0	
Population	191	217.0	181 – 253	195.6	178 – 213
Alaska Native					
Population	185	217.0	181 – 253	181.7	165 – 199
Percentage	96.9%	100.0%	83.4% – 116.6%	92.9%	84.2% – 101.6%

Sources U.S. Census Bureau (2011) for 2010 estimate; U.S. Census Bureau for American Community Survey (ACS) 2017 estimate (5-year average); and ADF&G Division of Subsistence household surveys, 2018 for 2017 estimate.

Note Division of Subsistence household survey elegiblity requirements differ from those used by ACS.

a. ACS data range is the reported margin of error.

b. No range of households is estimated for division surveys.

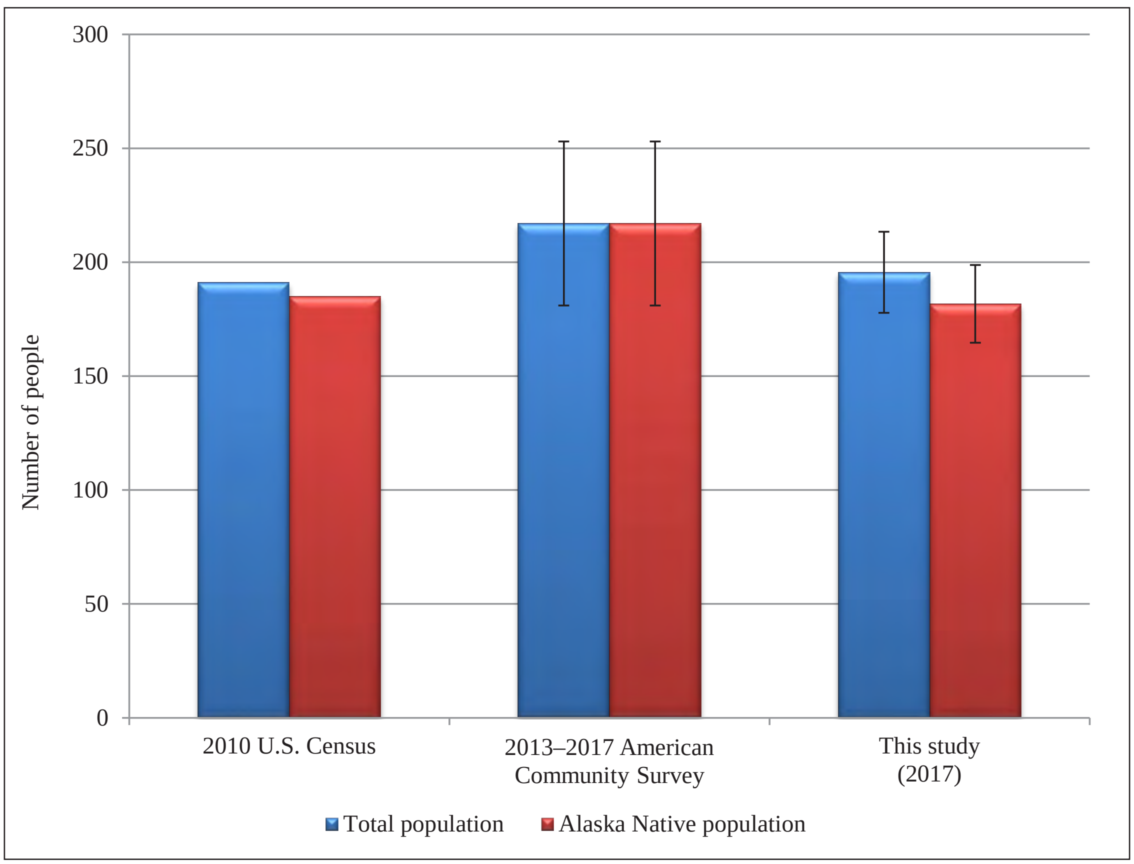


Figure 5-1.–Alaska Native and overall population estimates, Mekoryuk, 2010, 2013–2017, and 2017.

Table 5-2.–Sample and demographic characteristics, Mekoryuk, 2017.

Characteristics	Community Mekoryuk
Sampled households	50
Eligible households	77
Percentage sampled	64.9%
Sampled population	127
Estimated community population	195.6
Household size	
Mean	2.5
Minimum	1.0
Maximum	5.0
Age	
Mean	33.3
Minimum[a]	0
Maximum	89
Median	37.0
Length of residency	
Total population	
Mean	24.3
Minimum[a]	0
Maximum	89
Heads of household	
Mean	34.9
Minimum[a]	2
Maximum	89
Alaska Native	
Estimated households[b]	
Number	70.8
Percentage	92.0%
Estimated population	
Number	181.7
Percentage	92.9%

Source ADF&G Division of Subsistence household surveys, 2018.

a. A minimum age of 0 (zero) is used for infants who are less than 1 year of age.

b. The estimated number of households in which at least 1 head of household is Alaska Native.

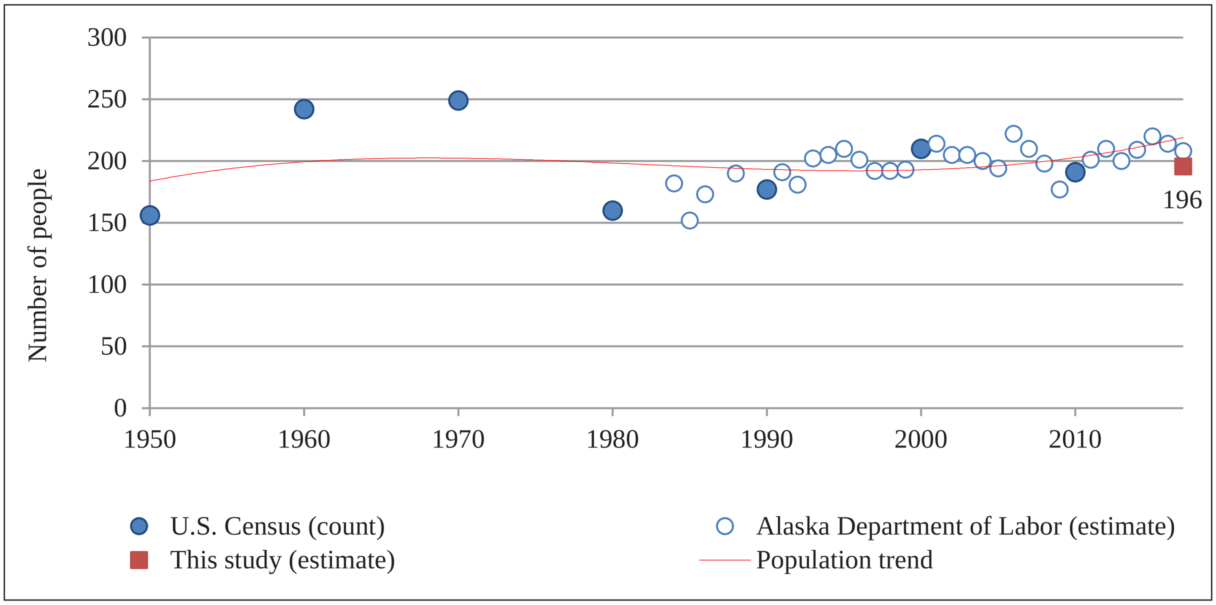


Figure 5-2.–Population estimates, Mekoryuk, 1950–2017.

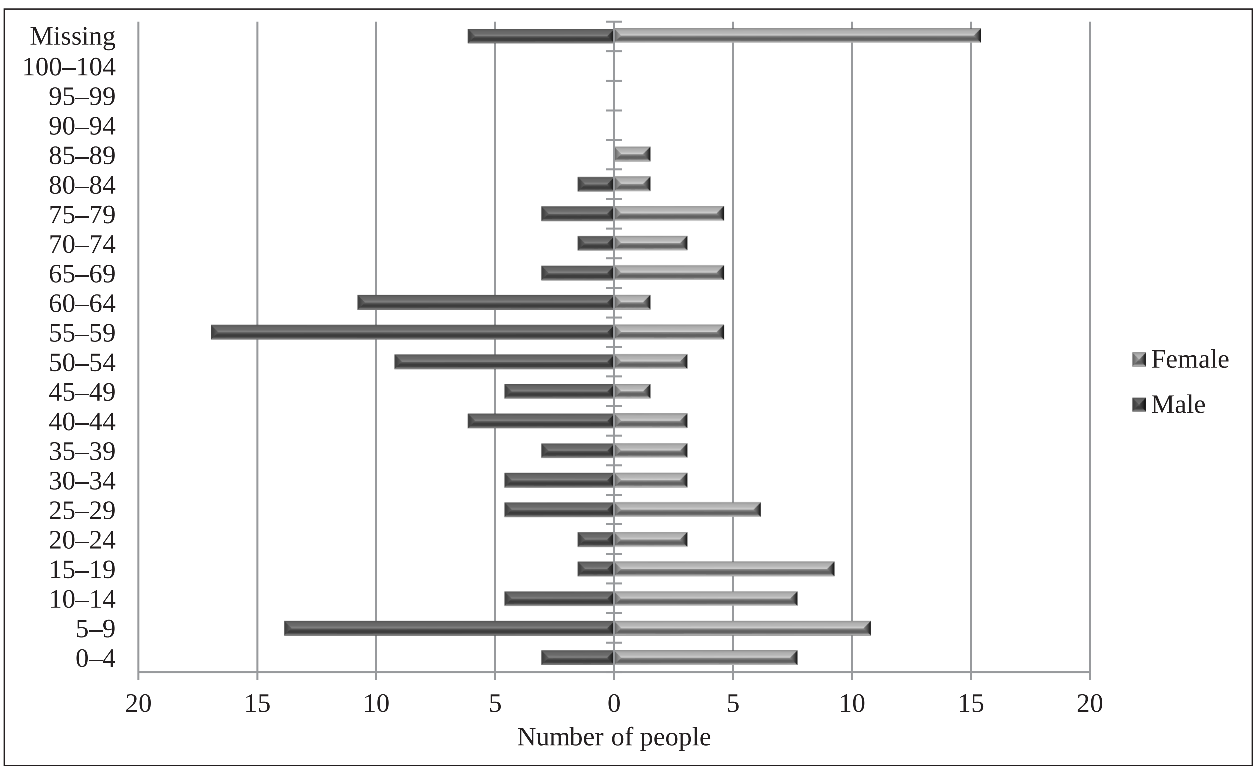


Figure 5-3.–Population profile, Mekoryuk, 2017.

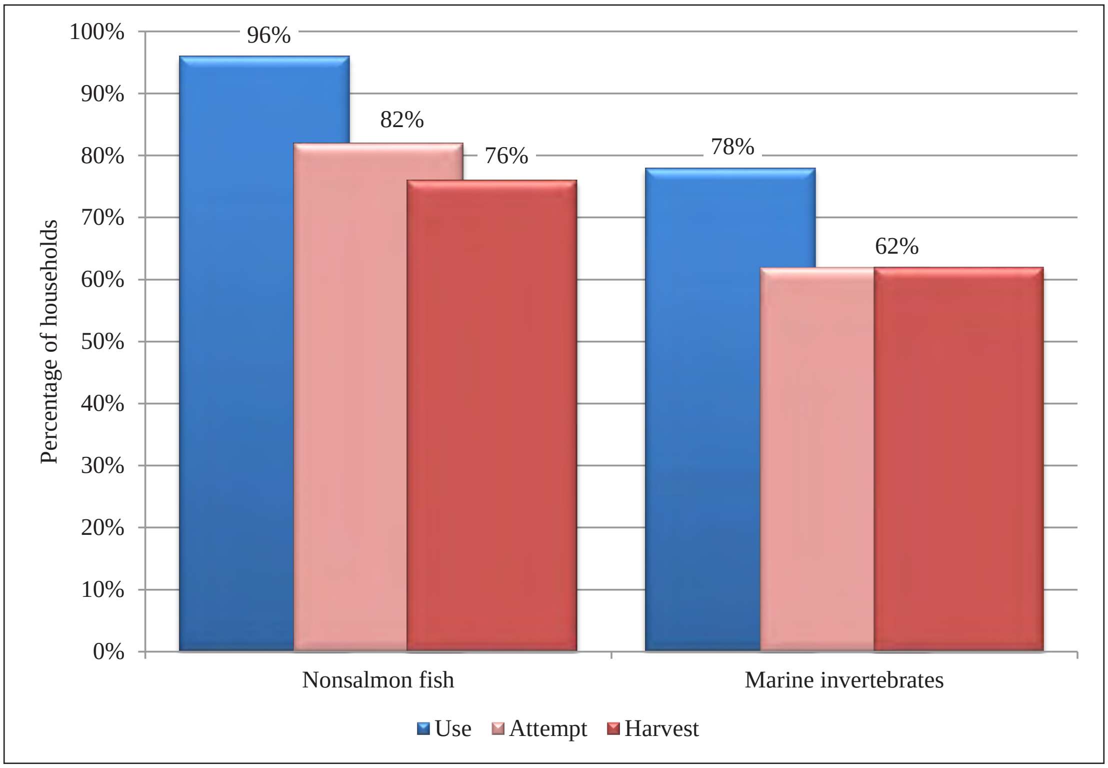


Figure 5-4.–Percentages of households using, attempting to harvest, and harvesting nonsalmon fish and marine invertebrates, Mekoryuk, 2017.

fishing for nonsalmon fish in 2017, 76% of households reported catching fish, and nearly all (96%) reported using nonsalmon fish. All 62% of households that looked for shellfish found some, and 78% of households reported using them.

Table 5-3 summarizes nonsalmon fish and marine invertebrate harvest and use characteristics for Mekoryuk in 2017 at the household level. The average harvest was 247 pounds usable weight (lb) per household. This study found that community households harvested an average of four different kinds of nonsalmon fish or marine invertebrates and used an average of six kinds of these resources. The maximum number of resources used by any household was 11. In addition, households gave away an average of two kinds of nonsalmon resources. Overall, at least 27 types of nonsalmon fish and marine invertebrates were used by Mekoryuk households (Appendix Table D5-5).

Harvest Quantities and Composition of Nonsalmon Fish

In 2018, surveyors recorded the nonsalmon fish and marine invertebrate resources harvested and used by members of responding households in 2017, and the data were expanded to estimate harvests and uses for the whole community. Table 5-4 lists the nonsalmon fish used by the highest percentages of households, and Figure 5-5 shows the species with the highest harvests (by weight) during the study year. Generally, these graphics show the same set of species, but the relative positions vary.

Halibut and Pacific cod are the primary nonsalmon fish for Mekoryuk residents. These fish, caught together at sea, supplied the highest harvests by weight (35% and 32% of the total harvest) and were also the most widely used nonsalmon fish (80% of households reported using each; Table 5-4; Figure 5-5). In contrast, the third and fifth most widely used resources were marine invertebrates that accounted for very little weight; mussels (used by 74% of households) and clams (used by 48%) each contributed about 1% of the total harvest weight. Unknown chars[15] was the third highest harvest by weight (14% of the total harvest), and

15. Hereinafter, char.

Table 5-3.–Nonsalmon fish and marine invertebrate harvest and use characteristics, Mekoryuk, 2017.

Characteristic	
Mean number of resources used per household	**5.8**
Minimum	0
Maximum	11
95% confidence limit (±)	8.9%
Median	6.0
Mean number of resources attempted to harvest per household	**4.1**
Minimum	0
Maximum	12
95% confidence limit (±)	12.2%
Median	4.0
Mean number of resources harvested per household	**3.9**
Minimum	0
Maximum	10
95% confidence limit (±)	12.6%
Median	3.5
Mean number of resources received per household	**2.6**
Minimum	0
Maximum	9
95% confidence limit (±)	16.7%
Median	2.0
Mean number of resources given away per household	**2.1**
Minimum	0
Maximum	7
95% confidence limit (±)	16.3%
Median	2.0
Household harvest (pounds)	
Minimum	0
Maximum	1,506
Mean	247.2
Median	103.7
Total harvest weight (lb)	19,033.6
Community per capita harvest (lb)	97.3
Percentage using any resource	96%
Percentage attempting to harvest any resource	88%
Percentage harvesting any resource	84%
Percentage receiving any resource	74%
Percentage giving away any resource	72%
Number of households in sample	50
Number of resources asked about and identified voluntarily by respondents	33

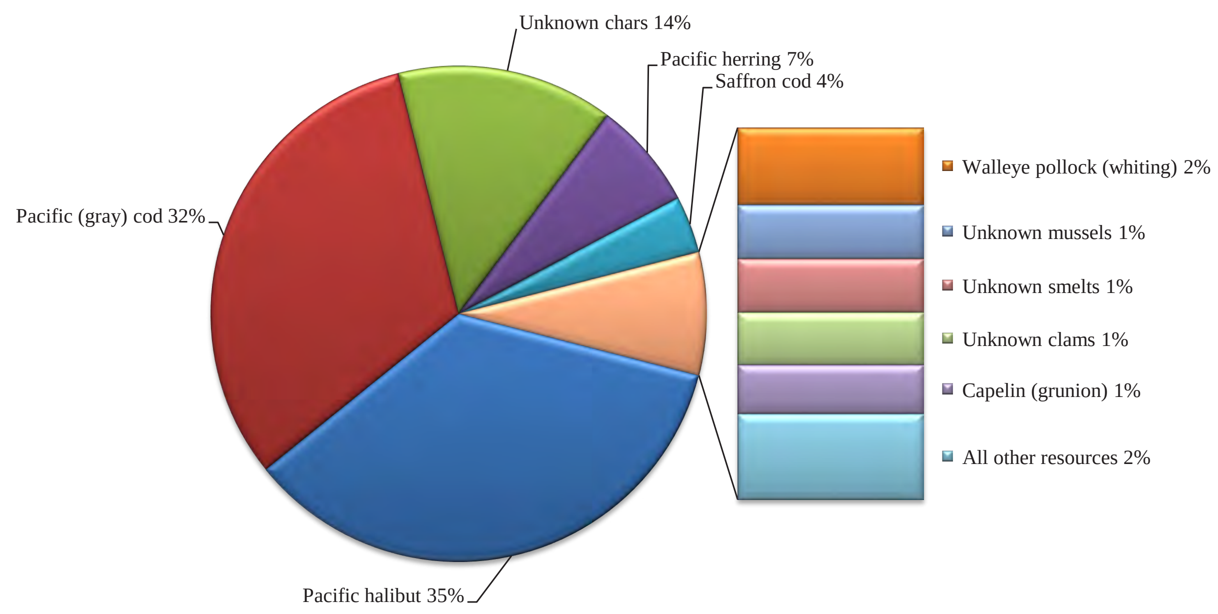
Source ADF&G Division of Subsistence household surveys, 2018.

Table 5-4.–Top ranked nonsalmon fish and marine invertebrates used by households, Mekoryuk, 2017.

Rank[a]	Resource	Percentage of households usin
1.	Pacific (gray) cod	80.
1.	Pacific halibut	80.
3.	Unknown mussels	74.
4.	Unknown char	64.
5.	Unknown clams	48.
6.	Saffron cod	46.
7.	Pacific herring	40.
8.	Walleye pollock (whiting)	26.
9.	Pacific herring roe	24.
10.	Unknown smelts	14.

Source ADF&G Division of Subsistence household surve 2018.

a. Resources used by the same percentage of households share the lowest rank value instead of having sequential ra values.



Note The "all other resources" category represents all species that contributed less than 1% to the total harvest.

Figure 5-5.–Top nonsalmon fish and marine invertebrates harvested by percentage of total harvest weight, Mekoryuk, 2017.

the fourth most widely used resource (64% of households). The fourth most harvested fish by weight was herring (7%), which was used by 41% of households. Herring roe, which provided less than 1% of the total harvest, was used by 24% of households; some of the roe was taken from fish by the harvesters and shared as sac roe[16].

Table 5-5 reports estimated subsistence nonsalmon fish and marine invertebrate harvests and uses by Mekoryuk residents in 2017; the proportional composition of the nonsalmon fish harvest is shown in Appendix D, Figure D5-1, and composition of the marine mammal harvest is shown in Figure D5-2. The table is organized first by general category and then by species. All edible resources are presented in pounds usable weight (see Appendix C for conversion factors), and results are organized into various categories. The harvest column shows percentages of households in which any member of the surveyed household harvested a resource during the study year. The use column shows percentages of households that took or used a resource, including resources acquired from other harvesters or given away. Purchased foods are not included, but fish retained from commercial fishing are included, whether they were the target species or caught incidentally. Differences between harvest and use percentages reflect sharing among households, which results in a wider distribution of wild foods.

About 6,695 lb of halibut and 6,071 lb of Pacific cod provided the great bulk of Mekoryuk's nonsalmon fish harvest in 2017. These offshore species are fished together at sea; thus, the 54% of households that fished for each are probably the same households. These two fish were also the most widely shared nonsalmon resources: 38% of households gave away halibut and 42% gave away Pacific cod, and 44% received halibut and 42% received Pacific cod. Walleye pollock (316 lb) are also occasionally caught during these fishing trips; no households reported a preference for these fish, but most keep what they catch. Altogether, halibut, Pacific cod, and walleye pollock made up about 69% of the total harvest.

Nearly as many households fished for char: 52% of households fished, and 50% of households caught char. The harvest of 816 individual fish provided an estimated 2,692 lb of food; these fish were also shared so that 64% of households used some. A small fraction of these fish were the only whole fish reported as fed to dogs in 2017 (Table 5-6). Pacific herring and their roe were more important historically, both for subsistence and as a commercial resource (Pete 1991a).[17] In 2017, 22% of households fished for herring, and 18% of households caught about 1,342 lb, which was shared such that 41% of households used herring. A key respondent described processing herring, which is harvested during the spawning migration:

> As they clean 'em they separate the roes and throw the gut away…And then they dry 'em. And when they dry they put, put them together [the fish and the eggs]. And wintertime they soak 'em and then eat 'em. Ooh yeah, they're good. (051217MYU1)

Fewer households harvested the roe[18]. Ten percent of households tried and 8% collected about nine gallons of herring roe; 18% of households received herring roe, some of which may have been sac roe removed from fish and shared (Table 5-6). Altogether, about 24% of households used herring roe.

The most widely attempted marine invertebrate harvest in 2017 was for mussels: 62% of households attempted to harvest mussels and all were successful; 22% of households reported giving some of their mussels away such that 74% of households used them (Table 5-5). The estimated harvest of 147 gallons of mussels provided only about 221 lb of food, just over one pound per capita. Clams were collected by 38% of households and used by 48%. Although the species identification of clams and mussels was not elucidated for these surveys, organisms of the nearshore environment, including plants and invertebrates, are well known to Nunivak Islanders (Numiwarmiut Taqnelluit and Griffin 2018).

16. A. Godduhn field notes, January 30, 2018.
17. CFEC n.d.
18. Herring roe harvest amounts in Mekoryuk should be considered a minimum, because researchers surveyed only roe on kelp.

Table 5-5.–Estimated harvest and use of nonsalmon fish and marine invertebrates, Mekoryuk, 2017.

	Percentage of households					Harvest weight (lb)			Harvest amount			
Resource	Using	Attempting harvest	Harvesting	Receiving	Giving away	Total	Mean per household	Per capita	Total	Unit	Mean per household	95% confidence limit (±) harvest
All surveyed resources	**96.0**	**88.0**	**84.0**	**74.0**	**72.0**	**19,033.6**	**247.2**	**97.3**	**19,033.6**	**lb**	**247.2**	**24.2**
Nonsalmon fish	**96.0**	**82.0**	**76.0**	**70.0**	**70.0**	**18,514.5**	**240.4**	**94.7**	**18,514.5**	**lb**	**240.4**	**24.8**
Pacific herring	40.8	22.4	18.4	26.5	20.4	1,342.1	17.4	6.9	223.7	gal	2.9	60.5
Pacific herring roe	24.0	10.0	8.0	18.0	4.0	50.8	0.7	0.3	8.5	gal	0.1	64.3
Capelin (grunion)	12.0	8.0	6.0	8.0	2.0	200.2	2.6	1.0	33.4	gal	0.4	70.2
Unknown smelts	14.0	12.0	12.0	4.0	0.0	220.6	2.9	1.1	36.8	gal	0.5	67.2
Pacific (gray) cod	80.0	54.0	48.0	42.0	42.0	6,071.3	78.8	31.0	1,897.3	ind	24.6	44.3
Saffron cod	46.0	40.0	38.0	22.0	20.0	709.0	9.2	3.6	118.2	gal	1.5	31.4
Walleye pollock (whiting)	26.0	18.0	18.0	10.0	12.0	316.6	4.1	1.6	226.2	ind	2.9	57.1
Eels	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Flounders	14.0	10.0	10.0	4.0	4.0	93.2	1.2	0.5	84.7	ind	1.1	70.1
Pacific halibut	80.0	54.0	48.0	44.0	38.0	6,694.5	86.9	34.2	6,694.5	lb	86.9	39.7
Sculpins	12.0	8.0	8.0	4.0	2.0	38.5	0.5	0.2	38.5	ind	0.5	71.1
Alaska blackfish	2.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	gal	0.0	0.0
Burbot	6.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Unknown chars	64.0	52.0	50.0	20.0	22.0	2,691.8	35.0	13.8	815.7	ind	10.6	31.6
Arctic grayling	2.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Northern pike	4.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Sheefish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Rainbow trout	2.0	2.0	2.0	0.0	2.0	43.1	0.6	0.2	30.8	ind	0.4	119.0
Broad whitefish	4.0	2.0	2.0	2.0	0.0	6.2	0.1	0.0	1.5	ind	0.0	119.0
Bering cisco	2.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Least cisco	6.0	6.0	6.0	0.0	0.0	36.7	0.5	0.2	52.4	ind	0.7	67.5
Humpback whitefish	2.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Unknown whitefishes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Unknown nonsalmon fish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0

-continued-

Table 5-5.–Continued.

Resource	Percentage of households: Using	Attempting harvest	Harvesting	Receiving	Giving away	Harvest weight (lb): Total	Mean per household	Per capita	Harvest amount: Total	Unit	Mean per household	95% confidence limit (±) harvest
Marine invertebrates	**78.0**	**62.0**	**62.0**	**30.0**	**26.0**	**519.1**	**6.7**	**2.7**	**519.1**	**lb**	**6.7**	**21.4**
Razor clams	2.0	2.0	2.0	2.0	0.0	23.1	0.3	0.1	7.7	gal	0.1	119.0
Unknown clams	48.0	38.0	38.0	16.0	20.0	215.2	2.8	1.1	71.7	gal	0.9	27.9
Unknown cockles	8.0	8.0	8.0	0.0	0.0	38.1	0.5	0.2	12.7	gal	0.2	70.1
Blue king crab	4.0	4.0	4.0	0.0	2.0	21.3	0.3	0.1	9.2	ind	0.1	100.7
Red king crab	2.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Unknown mussels	74.0	62.0	62.0	20.0	22.0	220.7	2.9	1.1	147.1	gal	1.9	25.2
Sea anemone	4.0	2.0	2.0	2.0	0.0	0.8	0.0	0.0	0.4	gal	0.0	119.0
Shrimps	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	gal	0.0	0.0
Unknown marine invertebrates	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	gal	0.0	0.0

Source ADF&G Division of Subsistence household surveys, 2018.

Note Resources where the percentage using is greater than the combined received and harvest indicate use from resources obtained during a previous year.

Table 5-6.–Estimated harvest of nonsalmon fish for consumption by dogs, Mekoryuk, 2017.

Resource	Amount		Pounds	
Nonsalmon fish				
Unknown chars	4.6	ind	15.2	lb
Total	**4.6**	ind	**15.2**	**lb**

Source ADF&G Division of Subsistence household surveys, 2018.

Several other species made up the remainder of the nonsalmon fish harvest: saffron cod (709 lb), smelts (221 lb), capelin (200 lb), flounders (93 lb), rainbow trout (43 lb), and sculpins (39 lb; Table 5-6). The only whitefish reliably found on Nunivak Island is least cisco; 6% of households fished for least cisco and harvested 37 lb.

In 2017, fishers used hooks, whether casting with a rod, handlining, or jigging, to catch the great bulk of the nonsalmon fish (90%; Figure 5-6; tables 5-7 and 5-8). Hooks in open water caught all of the halibut and Pacific cod and most of the char, the three largest harvests by weight. Hooks jigged through ice caught the saffron cod and smelts, primarily in January through March.[19] Few households reported fishing for these fish in November and December of 2017 because ice conditions were poor until January of 2018. Set nets in open water caught a total of 6.5% of the harvest weight, including about 80% of the herring, 52% of the sculpin, 35% of the least cisco, and 7% of the char. Mekoryuk fishers also used cast nets for herring and capelin, spears for flounder, and open water jigging for tomcod during times when there would normally have been ice. That some herring was caught under ice is likely a survey documentation mistake.[20]

In the mid-20th century, a variety of specifically designed hooks, nets, traps, and spears were used for catching fish (VanStone 1989:13–16).

> Large composite hooks were used for cod, halibut, and wolf fish[21] [sic]. Similar small composite hooks were used for trout, tomcods, etc. However, for all small fish up to and including salmon, the people preferred nets in summer, spears in winter. (Lantis 1946)

By 1940, some fishers were using hooks in winter, but "anciently Nuniwagamiut [sic] did not angle for fish through the ice, using a stick to jiggle the line up and down—they fished through the ice only with

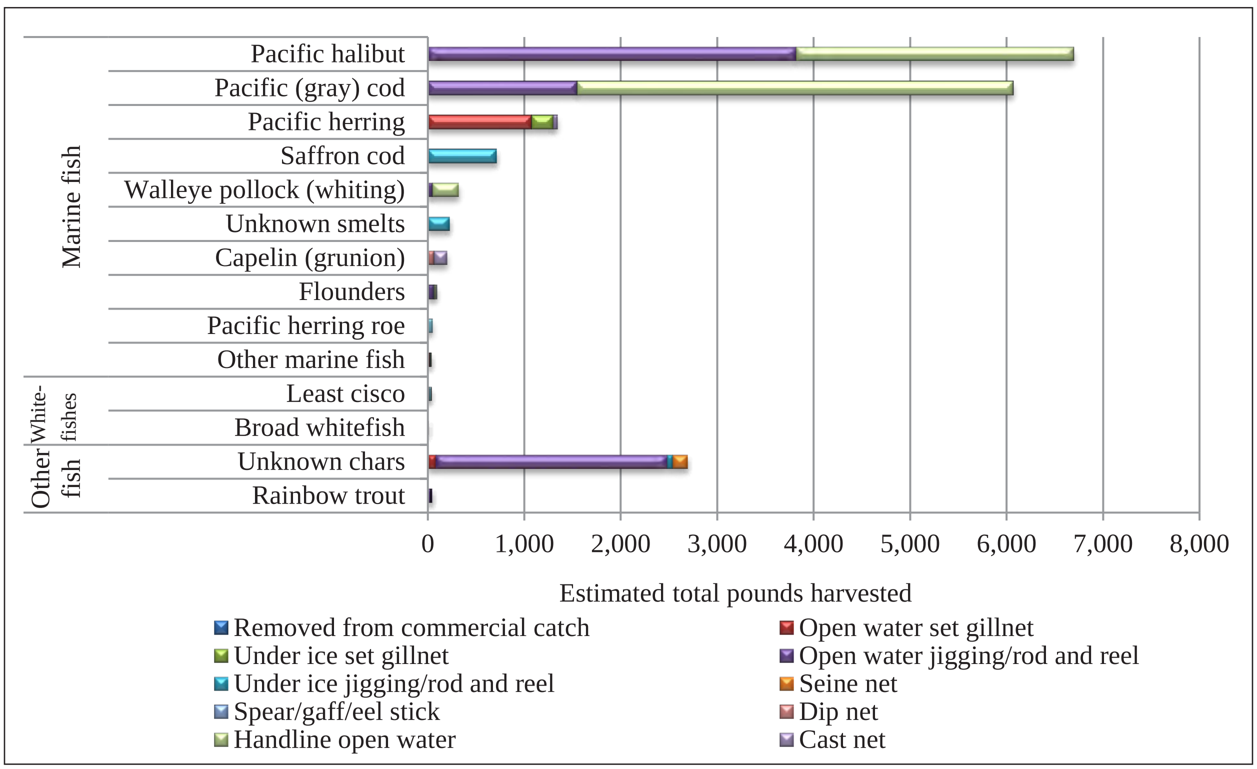


Figure 5-6.–Estimated harvest of nonsalmon fish by gear type, Mekoryuk, 2017.

19. Survey notes, 2018.

20. Mekoryuk Tribal Council, data review meeting, January 10, 2019.

21. Bering wolffish *Anarhichas orientalis* (Byersdorfer 2004).

Table 5-7.–Estimated harvest of nonsalmon fish by gear type, Mekoryuk, 2017.

		Removed from commercial catch		Subsistence methods: Open water set gillnet		Under ice set gillnet		Open water jigging/rod and reel		Under ice jigging/rod and reel		Seine net		Spear/gaff/eel stick		Dip net	
Resource	Units	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds
Nonsalmon fish			**0.0**		**1,204.7**	**37.0**	**221.8**		**7,897.2**		**1,007.0**		**152.5**		**6.8**		**61.6**
Pacific herring	gal	0.0	0.0	179.0	1,074.2	37.0	221.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pacific herring roe	gal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Capelin (grunion)	gal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.3	61.6
Unknown smelts	gal	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.1	36.6	219.5	0.0	0.0	0.0	0.0	0.0	0.0
Pacific (gray) cod	ind	0.0	0.0	0.0	0.0	0.0	0.0	482.8	1,544.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Saffron cod	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	118.2	709.0	0.0	0.0	0.0	0.0	0.0	0.0
Walleye pollock (whiting)	ind	0.0	0.0	0.0	0.0	0.0	0.0	35.0	49.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eels	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flounders	ind	0.0	0.0	4.6	5.1	0.0	0.0	46.2	50.8	6.2	6.8	0.0	0.0	6.2	6.8	0.0	0.0
Pacific halibut	lb	0.0	0.0	0.0	0.0	0.0	0.0	3,816.4	3,816.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sculpins	ind	0.0	0.0	20.0	20.0	0.0	0.0	0.0	0.0	10.8	10.8	0.0	0.0	0.0	0.0	0.0	0.0
Alaska blackfish	gal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Burbot	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unknown chars	ind	0.0	0.0	26.2	86.4	0.0	0.0	724.8	2,391.9	18.5	61.0	46.2	152.5	0.0	0.0	0.0	0.0
Arctic grayling	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Northern pike	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sheefish	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rainbow trout	ind	0.0	0.0	0.0	0.0	0.0	0.0	30.8	43.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Broad whitefish	ind	0.0	0.0	1.5	6.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bering cisco	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Least cisco	ind	0.0	0.0	18.5	12.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Humpback whitefish	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unknown whitefishes	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unknown nonsalmon fish	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

-continued-

Table 5-7.–Continued

		Subsistence methods: Handline open water		Cast net		Other method		Subsistence gear, any method		Any method	
Resource	Units	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds
Nonsalmon fish			**7,690.3**		**184.8**		**87.8**		**18,514.5**		**18,514.5**
Pacific herring	gal	0.0	0.0	7.7	46.2	0.0	0.0	223.7	1,342.1	223.7	1,342.1
Pacific herring roe	gal	0.0	0.0	0.0	0.0	8.5	50.8	8.5	50.8	8.5	50.8
Capelin (grunion)	gal	0.0	0.0	23.1	138.6	0.0	0.0	33.4	200.2	33.4	200.2
Unknown smelts	gal	0.0	0.0	0.0	0.0	0.0	0.0	36.8	220.6	36.8	220.6
Pacific (gray) cod	ind	1,413.0	4,521.4	0.0	0.0	1.5	4.9	1,897.3	6,071.3	1,897.3	6,071.3
Saffron cod	ind	0.0	0.0	0.0	0.0	0.0	0.0	118.2	709.0	118.2	709.0
Walleye pollock (whiting)	ind	191.2	267.7	0.0	0.0	0.0	0.0	226.2	316.6	226.2	316.6
Eels	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Flounders	ind	15.4	16.9	0.0	0.0	6.2	6.8	84.7	93.2	84.7	93.2
Pacific halibut	lb	2,876.6	2,876.6	0.0	0.0	1.5	1.5	6,694.5	6,694.5	6,694.5	6,694.5
Sculpins	ind	7.7	7.7	0.0	0.0	0.0	0.0	38.5	38.5	38.5	38.5
Alaska blackfish	gal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Burbot	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unknown chars	ind	0.0	0.0	0.0	0.0	0.0	0.0	815.7	2,691.8	815.7	2,691.8
Arctic grayling	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Northern pike	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sheefish	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rainbow trout	ind	0.0	0.0	0.0	0.0	0.0	0.0	30.8	43.1	30.8	43.1
Broad whitefish	ind	0.0	0.0	0.0	0.0	0.0	0.0	1.5	6.2	1.5	6.2
Bering cisco	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Least cisco	ind	0.0	0.0	0.0	0.0	33.9	23.7	52.4	36.7	52.4	36.7
Humpback whitefish	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unknown whitefishes	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unknown nonsalmon fish	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source ADF&G Division of Subsistence household surveys, 2018.

a. The harvested number of each resource is measured by the unit in which the resource harvest information was collected; the unit of measurement is p

Table 5-8.–Estimated percentages of nonsalmon fish harvest weight by gear type, Mekoryuk, 2017.

Resource	Removed from commercial catch	Subsistence methods: Open water set gillnet	Under ice set gillnet	Open water jigging/rod and reel	Under ice jigging/rod and reel	Seine net	Spear/gaff/eel stick	Dip net	Handline open water	Cast net	Other method	Subsistence gear, any method	Any method
Nonsalmon fish	**0.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
	0.0%	**2.4%**	**0.4%**	**50.1%**	**1.9%**	**0.5%**	**0.1%**	**0.1%**	**43.9%**	**0.3%**	**0.5%**	**100.0%**	**100.0%**
	0.0%	**2.4%**	**0.4%**	**50.1%**	**1.9%**	**0.5%**	**0.1%**	**0.1%**	**43.9%**	**0.3%**	**0.5%**	**100.0%**	**100.0%**
Pacific herring	0.0%	71.6%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	25.0%	0.0%	2.2%	2.2%
	0.0%	80.0%	16.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.4%	0.0%	100.0%	100.0%
	0.0%	1.7%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	2.2%	2.2%
Pacific herring roe	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	16.4%	0.1%	0.1%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	100.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%
Capelin (grunion)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	75.0%	0.0%	0.3%	0.3%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	30.8%	0.0%	69.2%	0.0%	100.0%	100.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.2%	0.0%	0.3%	0.3%
Unknown smelts	0.0%	0.0%	0.0%	0.0%	19.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.4%
	0.0%	0.0%	0.0%	0.5%	99.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.4%
Pacific (gray) cod	0.0%	0.0%	0.0%	9.4%	0.0%	0.0%	0.0%	0.0%	31.4%	0.0%	3.0%	18.5%	18.5%
	0.0%	0.0%	0.0%	25.4%	0.0%	0.0%	0.0%	0.0%	74.5%	0.0%	0.1%	100.0%	100.0%
	0.0%	0.0%	0.0%	4.7%	0.0%	0.0%	0.0%	0.0%	13.8%	0.0%	0.0%	18.5%	18.5%
Saffron cod	0.0%	0.0%	0.0%	0.0%	62.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	1.2%
	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	0.0%	0.0%	0.0%	0.0%	1.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.2%	1.2%
Walleye pollock (whiting)	0.0%	0.0%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	4.2%	0.0%	0.0%	2.2%	2.2%
	0.0%	0.0%	0.0%	15.5%	0.0%	0.0%	0.0%	0.0%	84.5%	0.0%	0.0%	100.0%	100.0%
	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	1.9%	0.0%	0.0%	2.2%	2.2%
Eels	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Flounders	0.0%	1.8%	0.0%	0.9%	3.2%	0.0%	100.0%	0.0%	0.3%	0.0%	11.9%	0.8%	0.8%
	0.0%	5.5%	0.0%	54.5%	7.3%	0.0%	7.3%	0.0%	18.2%	0.0%	7.3%	100.0%	100.0%
	0.0%	0.0%	0.0%	0.5%	0.1%	0.0%	0.1%	0.0%	0.2%	0.0%	0.1%	0.8%	0.8%
Pacific halibut	0.0%	0.0%	0.0%	74.3%	0.0%	0.0%	0.0%	0.0%	63.9%	0.0%	3.0%	65.2%	65.2%
	0.0%	0.0%	0.0%	57.0%	0.0%	0.0%	0.0%	0.0%	43.0%	0.0%	0.0%	100.0%	100.0%
	0.0%	0.0%	0.0%	37.2%	0.0%	0.0%	0.0%	0.0%	28.0%	0.0%	0.0%	65.2%	65.2%
Sculpins	0.0%	8.0%	0.0%	0.0%	5.7%	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.4%	0.4%
	0.0%	52.0%	0.0%	0.0%	28.0%	0.0%	0.0%	0.0%	20.0%	0.0%	0.0%	100.0%	100.0%
	0.0%	0.2%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.4%	0.4%
Alaska blackfish	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Burbot	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Unknown chars	0.0%	10.5%	0.0%	14.1%	9.7%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	7.9%	7.9%
	0.0%	3.2%	0.0%	88.9%	2.3%	5.7%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	0.0%	0.3%	0.0%	7.1%	0.2%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	7.9%	7.9%

-continued-

Table 5-8.–Continued.

		Subsistence methods											
Percentage base	Removed from commercial catch	Open water set gillnet	Under ice set gillnet	Open water jigging/rod and reel	Under ice jigging/rod and reel	Seine net	Spear/gaff/eel stick	Dip net	Handline open water	Cast net	Other method	Subsistence gear, any method	Any method
Arctic grayling	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Northern pike	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Sheefish	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Rainbow trout	0.0%	0.0%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.3%
	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.3%
Broad whitefish	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Bering cisco	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Least cisco	0.0%	7.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	65.7%	0.5%	0.5%
	0.0%	35.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	64.7%	100.0%	100.0%
	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.5%	0.5%
Humpback whitefish	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Unknown whitefishes	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Unknown nonsalmon fish	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

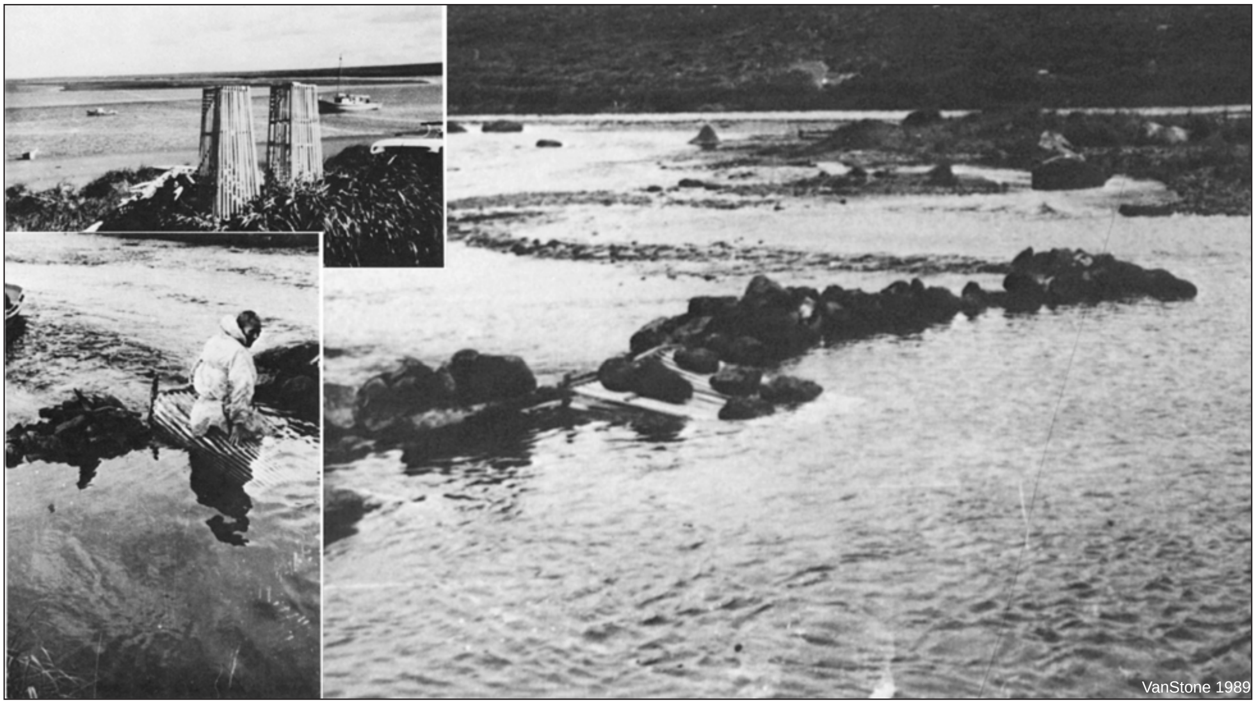


Plate 5-5.–Large wooden slat fish traps used in rock dams for catching salmon and sea-run char in the mid-20th century.

spears” (Lantis 1946:172). Spears allowed fishers the ability to release fish onto the ice without the use of bare hands (VanStone 1989:13). Although using spears requires greater dexterity and attention, many fishers still preferred them in 1940. Lantis added, “When angling for larger fish in the open sea, such as wolf fish [sic] and sculpin, they did use a bent bone to jiggle the line. It is not known how recent was the custom” (Lantis 1946:172). Larger hooks were employed mostly by adult men offshore, and smaller hooks from rocky shores, by women and children; older boys might use kayaks in the bays (Lantis 1946:245), and the men usually stayed within sight of the island (Lantis 1946:164). Additionally, “[t]here were small fish arrows and large fish harpoons, but neither class of weapon was used much by adults” (Lantis 1946:172). Nuniwarmiut also used traps, both for fish and for fox (Lantis 1946:173; Plate 5-5). Nets for fish were either for seining or for dipping. Also by 1940, new materials were beginning to replace sealskin fishlines and sinew bindings in the construction of equipment. For example, some net makers used needle and thread to make stickleback nets and nylon twine to make seines (VanStone 1989).

Sharing of Nonsalmon Resources

Household Specialization in Resource Harvesting

Previous studies (Wolfe 1987; Wolfe et al. 2010) have shown that in most rural Alaska communities, a relatively small portion of households produces most of the community’s fish and wildlife harvests, which they share with other households. A recent study of 3,265 households in 66 rural Alaska communities found that about 33% of the households accounted for 76% of subsistence harvests (Wolfe et al. 2010). Wolfe et al. (2010) observed that factors frequently associated with higher levels of subsistence harvests included larger households with a pool of adult male labor, higher wage income, involvement in commercial fishing, and community location. Recent Division of Subsistence studies in 16 Yukon-Kuskokwim Delta communities also recorded that a minority percentage of households in each community commonly produced a majority percentage of the wild food harvest. This was true for a variety of resource categories, including nonsalmon fish (Brown et al. 2013; 2015; Ikuta et al. 2014; 2016; Runfola et al. 2017; 2018).

In Mekoryuk in 2017, 70% of nonsalmon fish and marine invertebrate harvests, as estimated in pounds usable weight, were harvested by 22% of the community's households (Figure 5-7). The highest harvesting household brought in about 12% of the total harvest by weight. Further analysis of the study findings, beyond the scope of this report, might identify characteristics of the highly productive households in Mekoryuk and the other study communities.

Comparing Harvests and Uses in 2017 with Previous Years

Harvest Assessments

During the surveys, researchers asked respondents to assess their use of whitefishes and sheefish, other nonsalmon fish, and marine invertebrates in two ways. First, they asked whether the household had used more, less, or about the same amount of the resources during 2017 as compared to the last few years; if there was a change in use, researchers asked why. Second, researchers asked respondents if they got enough of the resource in 2017; if they had not gotten enough, they were asked why, how severe the impact had been, and if they had done anything differently to compensate for not getting enough.

Least cisco is the only whitefish present on Nunivak Island, and most households reported not using whitefishes (Figure 5-8; Table D5-6). However, most of those who did use it reported using the same or more in 2017.

Over half of responding households reported using either the same (47%) or more (10%) other nonsalmon fish, and 41% reported using less. Among the 20 households that reported reasons for using less other nonsalmon fish, almost half (45%) reported family or personal reasons, 30% reported that work schedules had not allowed enough time for fishing, and 25% said the weather or other environmental conditions had been a problem (Table D5-7). Other reasons included having to work when conditions were good, a lack

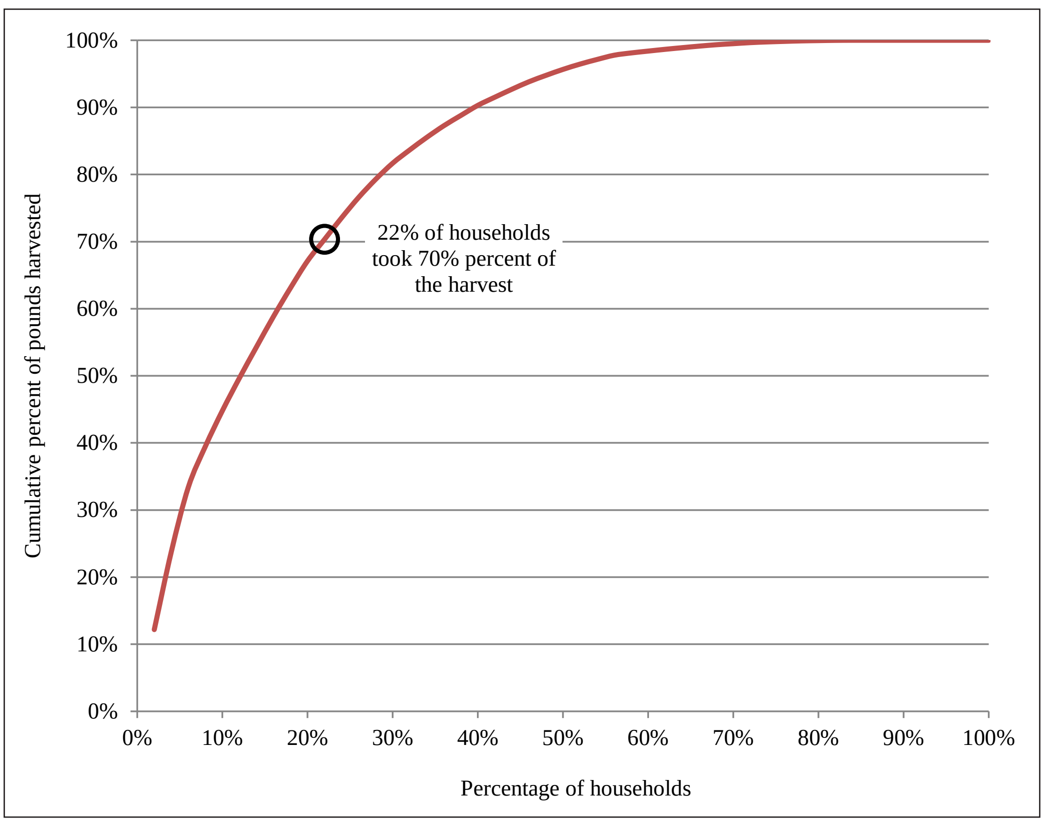


Figure 5-7.–Household specialization, Mekoryuk, 2017.

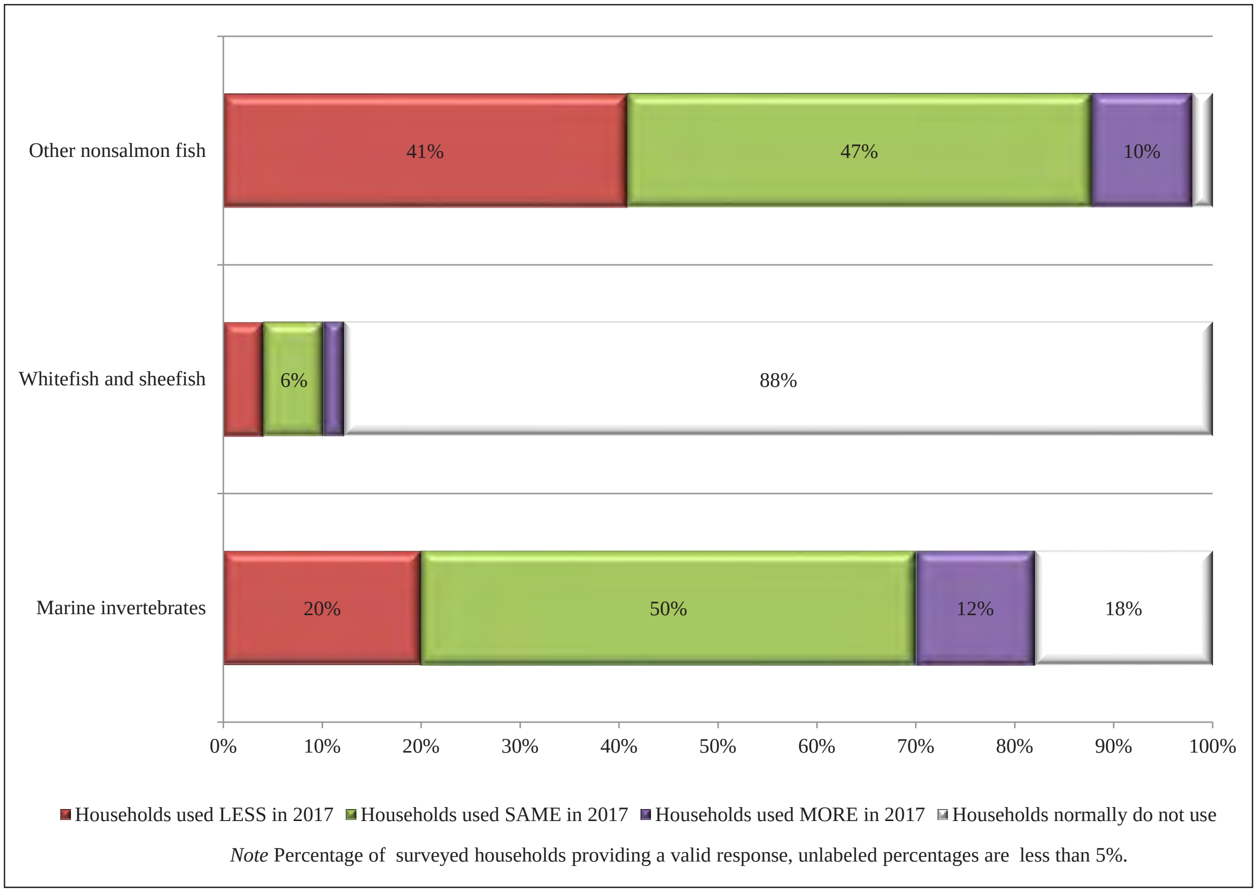


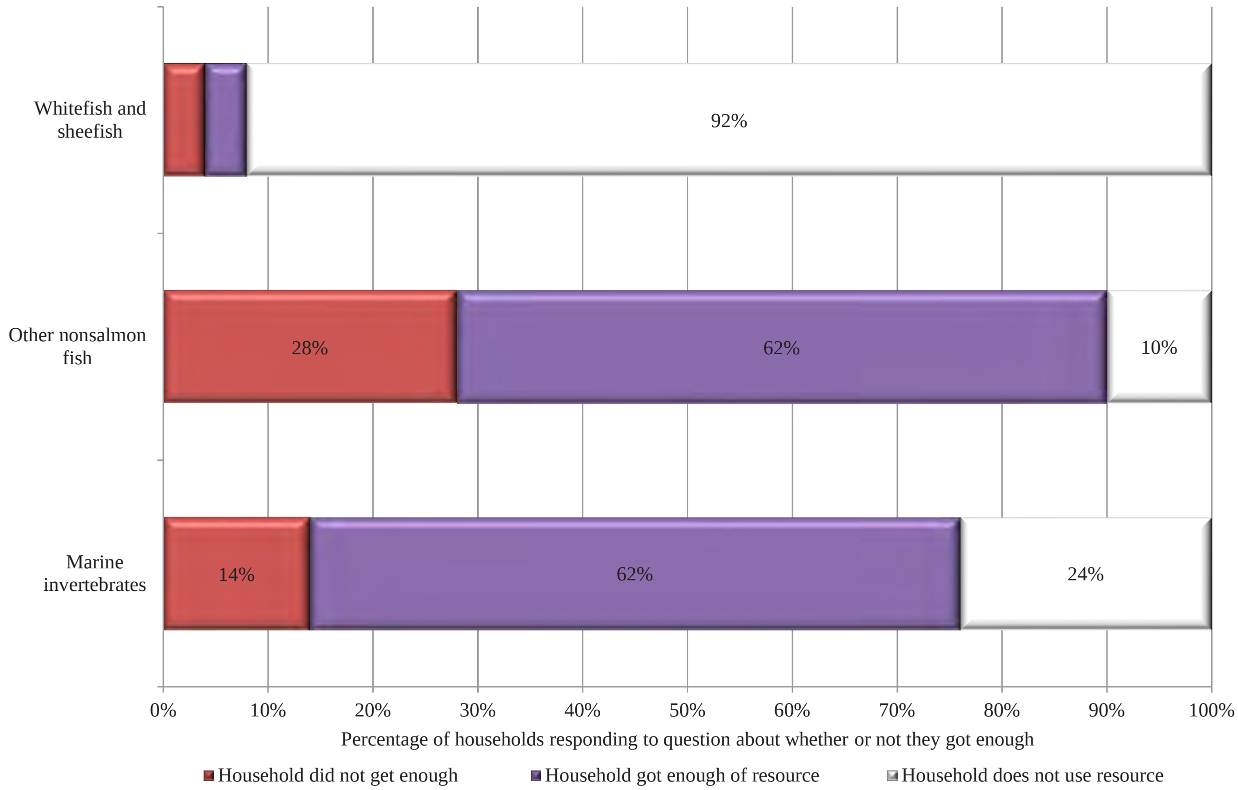
Figure 5-8.–Changes in household uses of nonsalmon fish and marine invertebrates compared to recent years, Mekoryuk, 2017.

of equipment, a lack of fish, a lack of need, or a lack of effort. Some households named more than one reason for a shortfall. The households that reported reasons for using more said that they had put in more effort, or had more success, enjoyed favorable weather, or received more (Table D5-8). More than twice as many respondents reported that they had gotten enough nonsalmon fish than reported not getting enough (Figure 5-9); those saying that they had not gotten enough most often named personal and family reasons or unfavorable weather and environmental conditions; reasons named less frequently included lack of time, lack of resources, and lack of equipment (Table D5-9). "Other" nonsalmon fish was the only group of resources for which shortfalls were described as having a major impact on the household from not having gotten enough (Table 5-9). Respondents used other subsistence foods and store-bought foods to make up for the nonsalmon fish shortfalls (Table D5-10).

Half of responding households said they used about the same amount of shellfish, and 20% reported using less (Figure 5-8). Those households named various reasons including family or personal reasons, lack of effort, and work schedules (Table D5-7). Some residents noted that the bay has become shallower, wider, and too muddy for good access; others said the resources are less available or less healthy.[22]

Appendix Table D5-11 describes nonsalmon and marine invertebrate resources that residents used in the past but do not currently use.

22. Survey notes, 2018.



Note Unlabeled percentages are less than 5%.

Figure 5-9.–Percentages of households reporting whether or not they got enough nonsalmon fish and marine invertebrates, Mekoryuk, 2017.

Harvest Data

Substantial documentation of Nuniwarmiut participation in multiple fisheries indicates that the social and economic values associated with salmon and nonsalmon fish and fishing are high (Hout 1966; Lantis 1946; VanStone 1989). However, few numeric data exist to compare Mekoryuk's historic use of fish with the 2017 nonsalmon fish survey results; thus, both qualitative and quantitative sources are identified and discussed here.

In 1966, U.S. Fish and Wildlife Service (USFWS) conducted a survey of wildlife use on Nunivak Island and found that salmon was "the most heavily utilized natural resource" (Hout 1966:6). Chum salmon was the only species carefully enumerated, and the harvest was considered low because many families stayed in town for summer construction work on a new school that year; coho salmon was said to be more abundant but less used because it arrives late in the season when weather inhibits drying (Hout 1966:1). Halibut fishing was concurrent and secondary to the focus on salmon that year; the report suggests that the halibut harvest "did not exceed 200 fish" of approximately 25 lb each, some of which were sold to individuals or restaurants in Bethel (Hout 1966:13). The report lists other fish that were utilized at the time: sockeye and pink salmon, halibut, Dolly Varden, blackfish, tomcod[23], flounders, herring, smelts, clams, cockles, and mussels. Of these, blackfish was the only resource not reported as harvested in 2017. The report also acknowledged use of king crab and other marine invertebrates (Hout 1966:17).

23. Hout (1966) identifies "tom cod" as *Micogladus proximus* (Pacific tomcod); Pacific tomcod was caught in Hout's experimental nets, but it is likely that the commonly harvested fish were saffron cod *Eleginus gracilis*. Misidentification of saffron cod, which is locally called tomcod across Alaska, has often caused confusion.

Table 5-9.–Reported impact to households that did not get enough nonsalmon fish or marine invertebrates, Mekoryuk, 2017.

		Households not getting enough _______ .				Impact to those not getting enough ______ .									
	Sample	Valid responses[a]		Did not get enough		No response		Not noticeable		Minor		Major		Severe	
Resource category	households	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	50	4	8.0%	2	50.0%	0	0.0%	0	0.0%	2	100.0%	0	0.0%	0	0.0%
Other nonsalmon fish	50	45	90.0%	14	31.1%	2	14.3%	2	14.3%	7	50.0%	3	21.4%	0	0.0%
Marine invertebrates	50	38	76.0%	7	18.4%	5	71.4%	0	0.0%	2	28.6%	0	0.0%	0	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Includes households failing to respond to the question and those households that never used the resource.

Various researchers estimated Mekoryuk's subsistence herring harvest in the 1970s and 1980s (Alaska Department of Fish and Game 1977:10; Regnart et al. 1978), but the methods were variable and the data incomplete (Pete 1984:17). Additionally, respondents in the 1980s described the 1970s as "less productive" than prior years, such that "harvest estimates for this time period may underestimate subsistence need" of herring and herring roe in the region (Pete 1984:18). Following the development of commercial fishing for herring and herring sac roe in the region (ADF&G 1987), ADF&G conducted household surveys with all Mekoryuk herring fishers in 1990 to document the harvest and use of herring that year (Pete 1991a). The research found that 59% of Mekoryuk households harvested approximately 8,925 lb of herring, which was used by 100% of households.

In the mid-2000s, USFWS conducted a fish study on Nunivak Island in close collaboration with local fishers (Drozda 2010). The research was focused primarily on the documentation of the traditional and contemporary Pacific cod fishery, which had been absent for over 30 years. The project surveyed all Mekoryuk fishing households and documented the harvest of five nonsalmon species during a single year (August 2005–July 2006): 1,405 saffron cod, 1,260 herring, 278 halibut, 260 Pacific cod, and 6 flounders (Drozda 2010:27,135–137). Because of differing methods, 2005–2006 data are not directly comparable to 2017 data.

Current and Historical Harvest Areas

Surveyors asked respondents to describe their 2017 fishing locations on maps; some households declined this portion of the survey, and surveyors did not contact all households. Therefore, the areas identified in the fishing maps are partial representations of areas used for resource harvests in 2017. Respondents harvested most nonsalmon resources from the north side of Nunivak Island, and several households traveled to the south shore for particular species (Figure 5-10). Most shellfish were harvested near Mekoryuk (Figure 5-11); some respondents mentioned that Shoal Bay is shallower and more difficult to navigate than it was historically (051217MYU1; 051417MYU4). Clams were the only resource that was collected across Etolin Strait, in Kangirlvar Bay.

Some fishers used large areas up to about 25 miles offshore to fish for halibut and Pacific cod, while others fished quite near the coast, especially at Cape Mendenhall and Cape Etolin (Figure 5-12), traditional sites for fishing Pacific cod (Drozda 2010). Historically, fishers caught small halibut along with Pacific cod along the island's coast (Lantis 1946), but bigger boats increased access to larger fish farther from shore in the 1970s and 1980s[24] (051217MYU1). Walleye pollock are sometimes caught on these trips, especially farther offshore (051217MYU1).

A few Mekoryuk households still pursue the herring run, including at least one household that fished on the south side of the island in 2017 (Figure 5-13). Respondents in the early 1980s said that herring fishing around the southeast corner of the island was more reliable than on the north side, in part because ice tended to linger longer on the north shore (Pete 1984:2–12). Thus, fishers commonly went to the southeast side of the island to fish for herring, often targeting Pacific cod, halibut, and walrus at the same time. Waters on the north side of the island were ice-free during the herring run in 2017, making access to these fish and their roe on kelp available closer to home, including at Daprakmiut (*Taprarmiut*).

Capelin, flounders, and sculpins were all more important food sources historically (Plate 5-3), but some households still fish for them or at least keep incidental catches (Figure 5-14). During the mapping component of the survey, respondents reported catching all three of these fish within about ten miles from shore, including some flounder and sculpin from the mouth of the Mekoryuk River. A couple described how elders ask children to go to particular places to increase the ratio of flounders being caught by ice-fishing when they have a craving (051217MYU1).

Fishers catch saffron cod and incidental smelt directly in front of Mekoryuk and as far as three miles up the Mekoryuk River (Figure 5-15). Those who fish further up river have a better chance of also catching char and rainbow trout, so the harvest areas for saffron cod and smelts overlap with those for char and rainbow

24. A. Godduhn field notes, January 13, 2019.

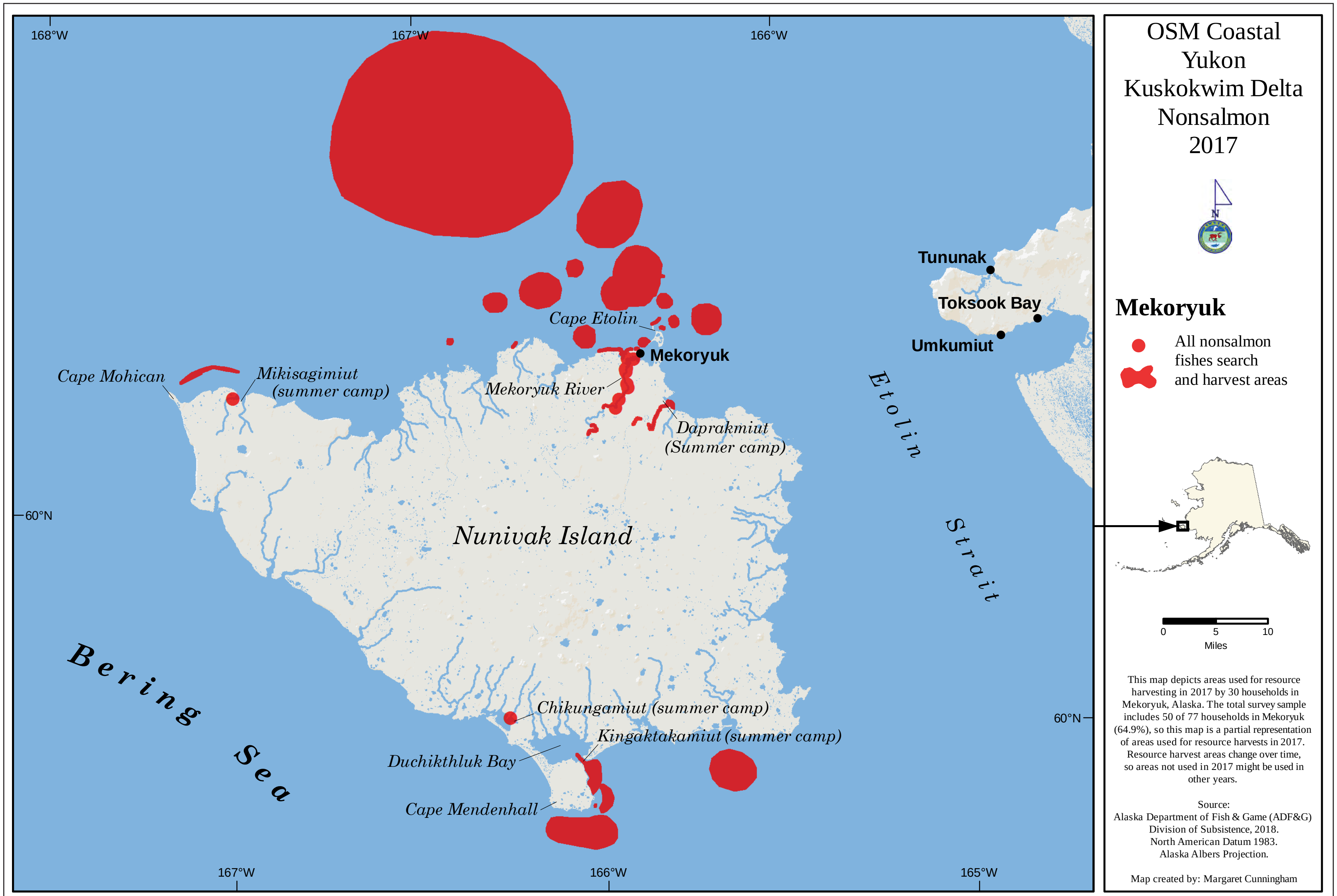


Figure 5-10.–Nonsalmon fishing areas, Mekoryuk, 2017.

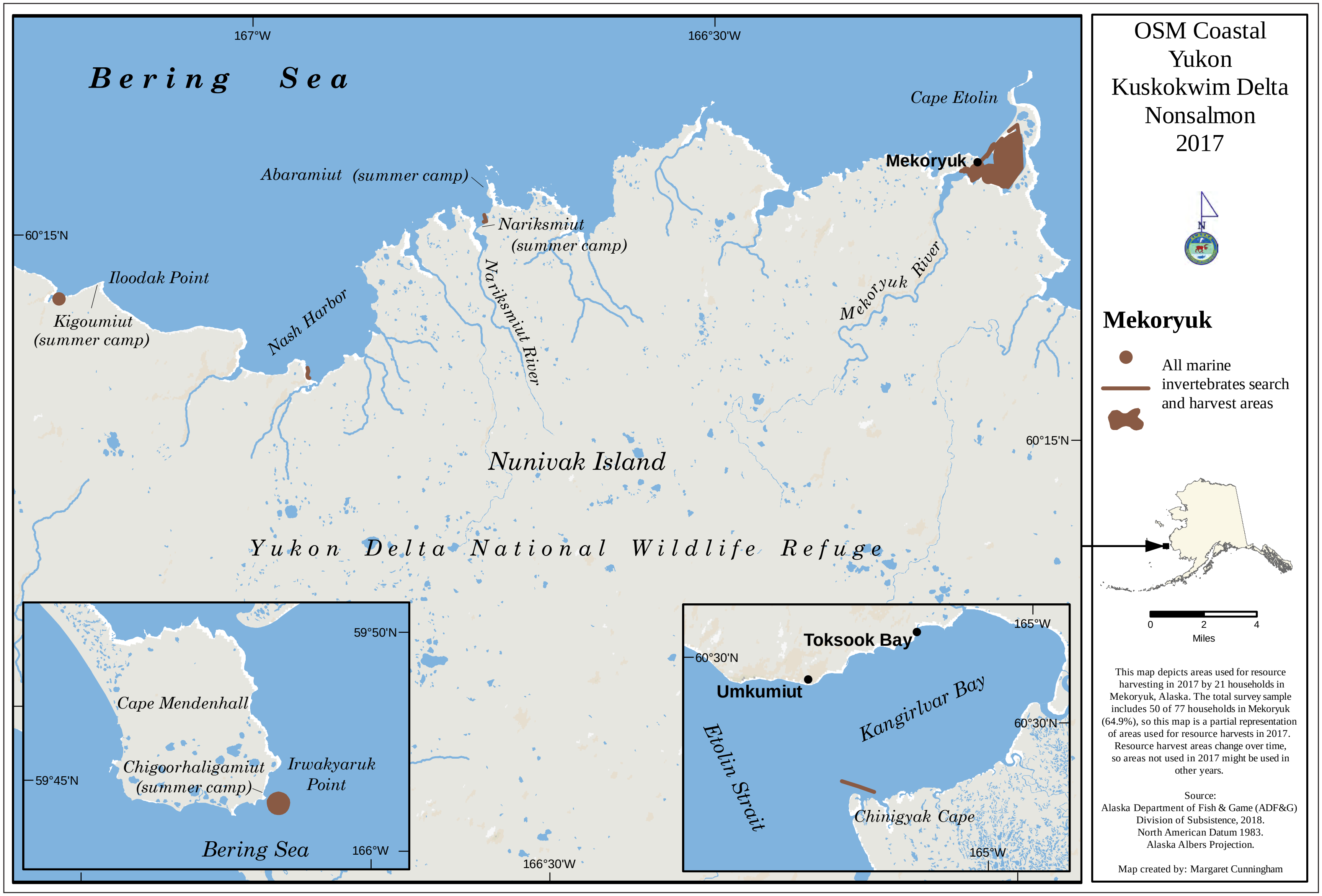


Figure 5-11.–Marine invertebrate collection areas, Mekoryuk, 2017.

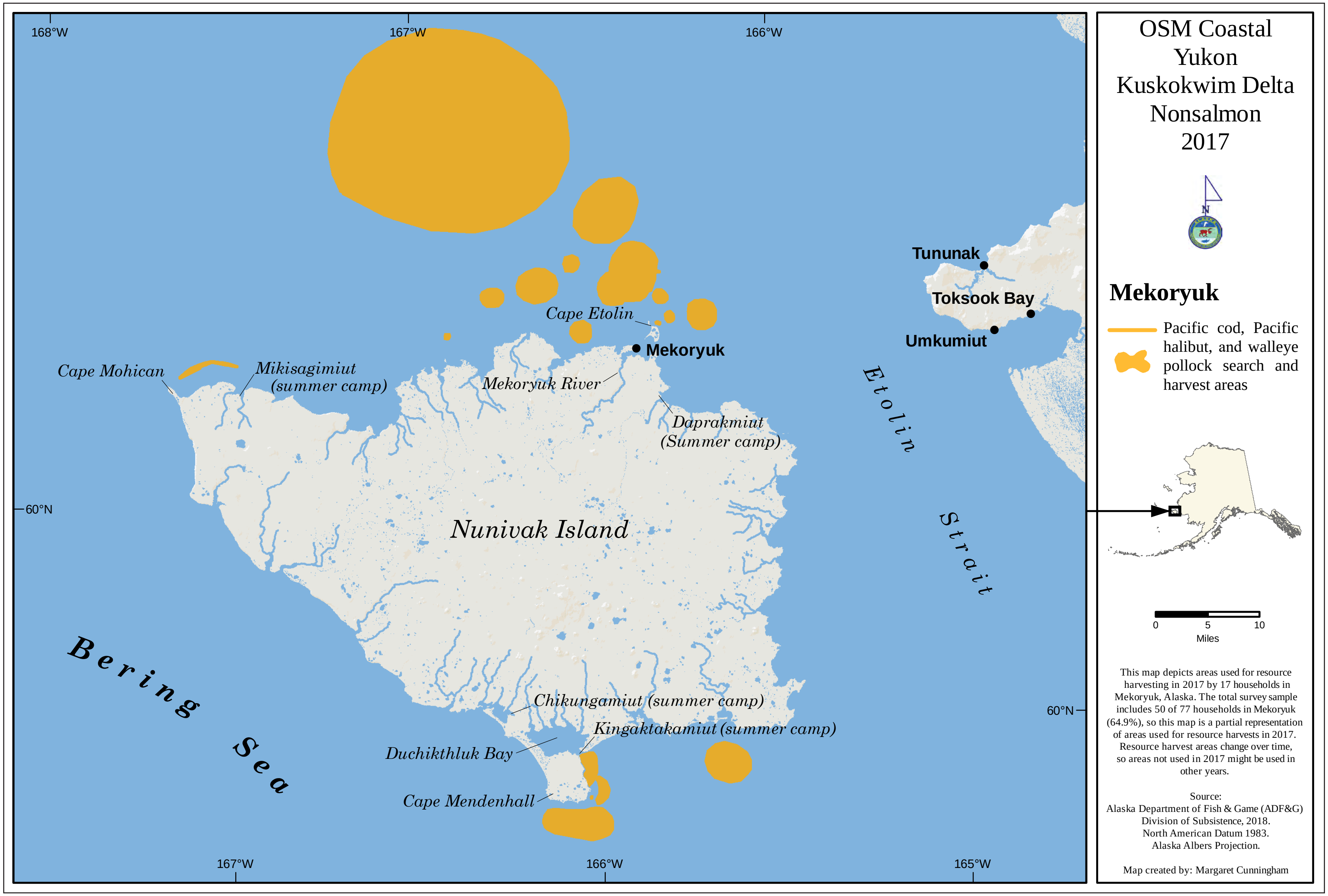


Figure 5-12.–Pacific cod, Pacific halibut, and walleye pollock fishing areas, Mekoryuk, 2017.

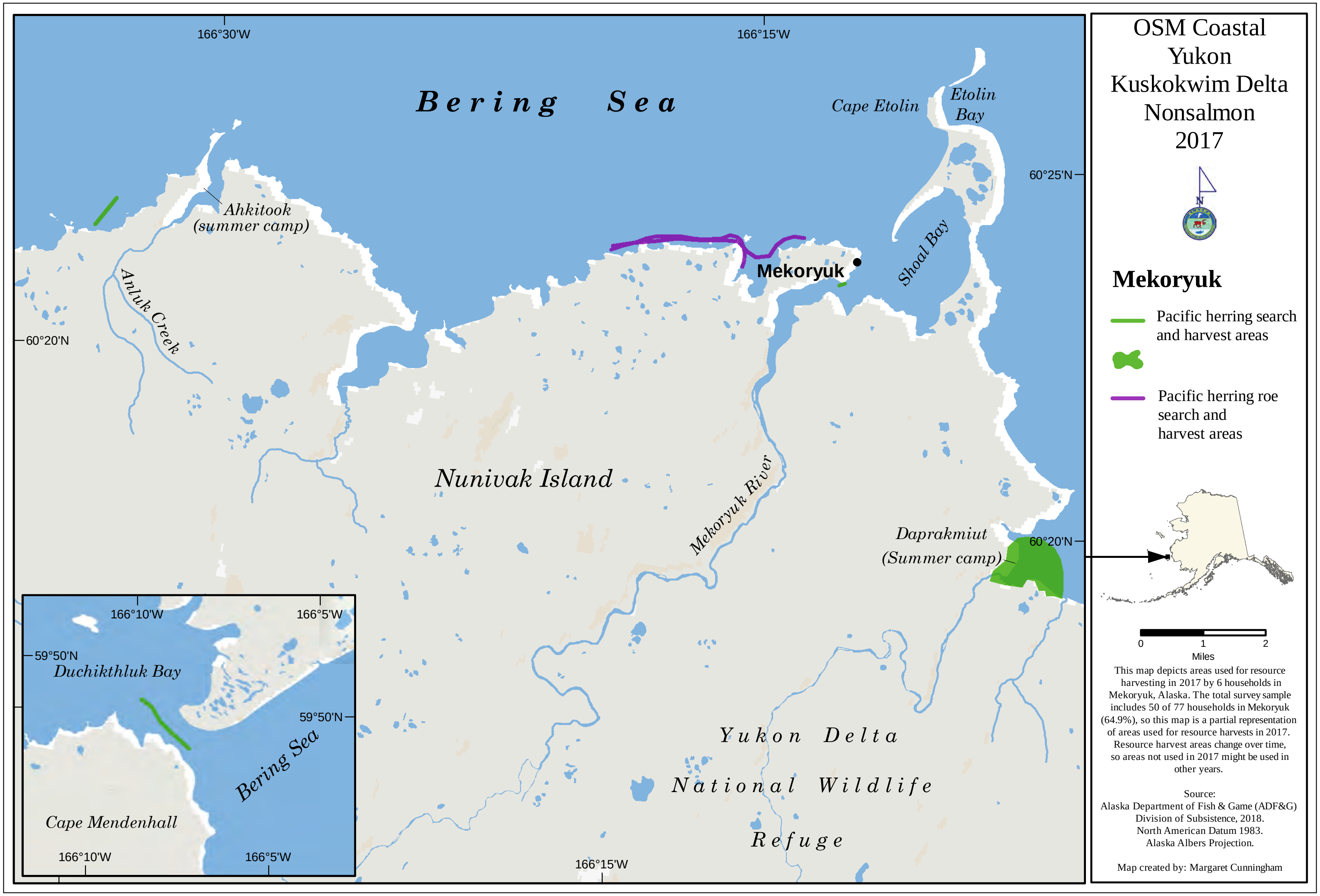


Figure 5-13.–Pacific herring fishing areas, Mekoryuk, 2017.

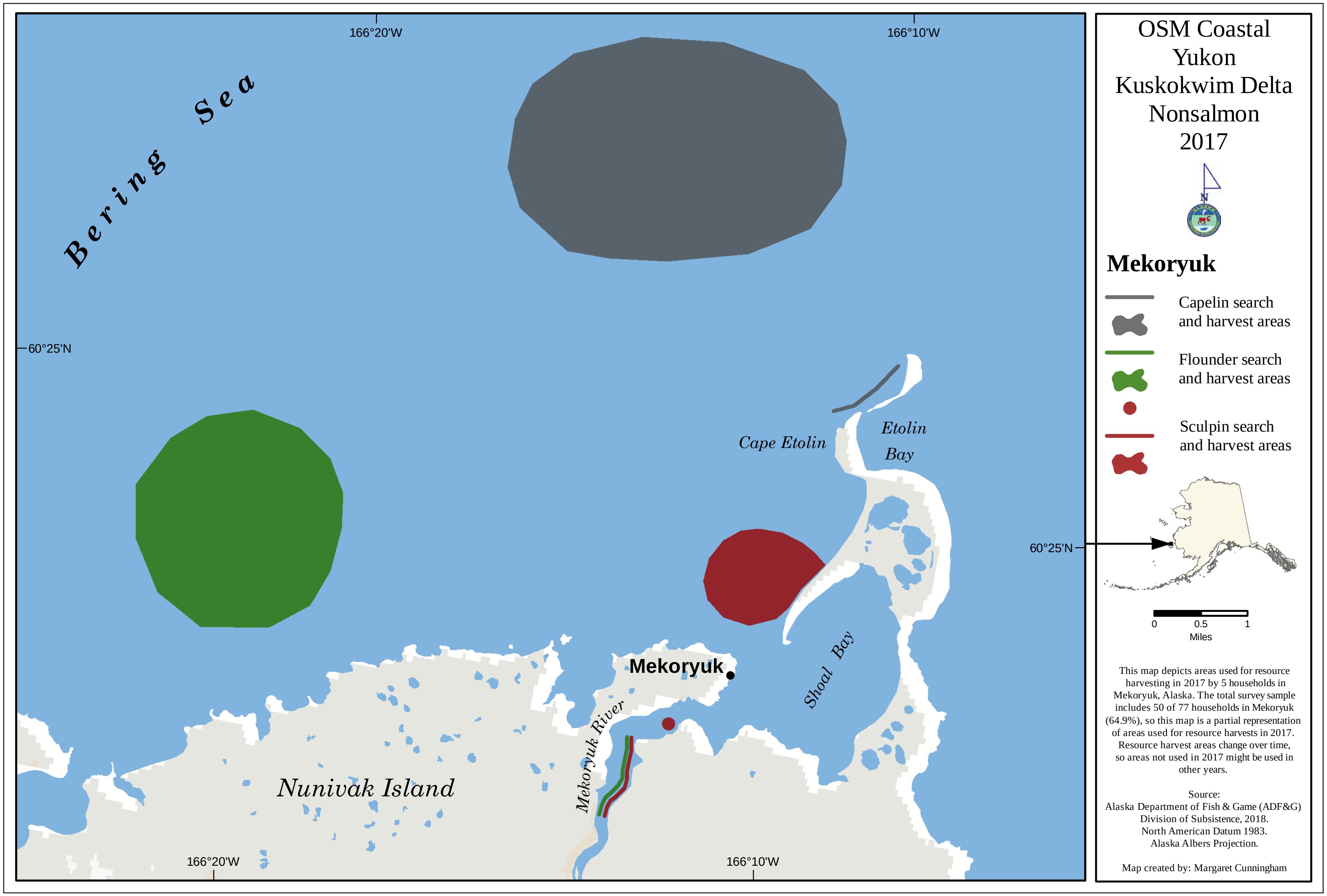


Figure 5-14.–Capelin, flounders, and sculpins fishing areas, Mekoryuk, 2017.

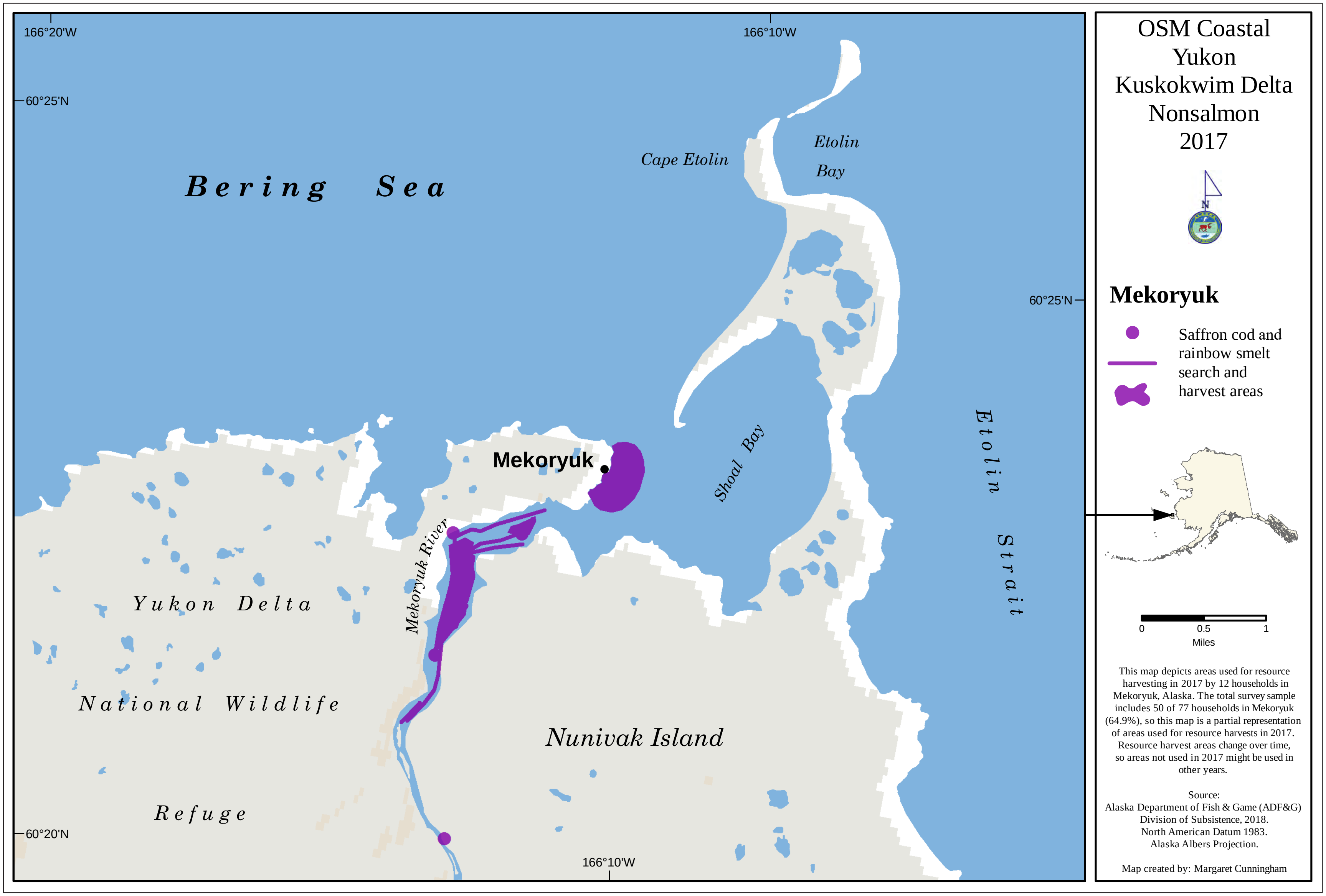


Figure 5-15.–Saffron cod and rainbow smelt fishing areas, Mekoryuk, 2017.

trout (figures 5-15 and 5-16); char are often caught incidentally to salmon fishing in Nunivak Island rivers (051317MYU2). Char are also caught on the oceanside of the Mekoryuk peninsula (Figure 5-16). One species of whitefish, least cisco, is reliably present on Nunivak Island. This fish runs to a small tributary of the Mekoryuk River, where it was targeted in 2017 (Figure 5-16), and can be found in a few other places around the island[25]. Although a stray broad whitefish was caught near Daprakmiut (*Taprarmiut*), this area should not be considered a search and harvest area for whitefishes.[26]

Three researchers have documented fishing around Nunivak Island (Drozda 2010; Hout 1966; Lantis 1946). Lantis (1946) used local knowledge to describe parts of the island she was unable to visit, identified 30 seasonal villages, and included notes about geographic and seasonal variation in fish abundance. Resources on the south coast around Cape Mendenhall (*Tacirrlag*), where multiple settlements had been abandoned, were described as depleted in 1940, though resources had been abundant when many people had lived there in the 1890s (Lantis 1946:163). According to local elders in 1940, Duchikthluk Bay had been deep and held flounders and tomcods in summer and tomcods in winter. They reported having taken beluga whale and crab from the bay and described herring and salmon as more abundant on the south and east sides of the island (Lantis 1946:164). Both Hout (1966) and Drozda (2010) conducted experimental fishing in streams around the island; they documented the number of each species caught and included notes about harvest and use largely based on respondent comments. Hout (1966) described each surveyed stream; respondents to that project identified over 30 fishing sites surrounding the island, although chum salmon was the only fishery to be quantified (Hout 1966). Drozda (2010) collected nearly 300 particular fishing site place names during a circumnavigation of the island with multiple elders. The study focused on Pacific cod, sockeye salmon, and Arctic grayling, but all fish caught by experimental fishing are reported with descriptions of the surveyed streams.

Observations of Nonsalmon Fisheries

Survey respondents were asked to describe changes that they have observed with respect to the harvest and use of nonsalmon fish and marine invertebrates. Respondents were first asked about local environmental conditions and whether any changes had affected their fishing. Respondents were then asked about changes to nonsalmon fish and invertebrate populations; again, if changes had been seen, they were asked how the changes have affected their harvest and use of those resources. Respondents were then asked to describe any other changes that had affected their fishing. In Mekoryuk, about 70% of surveyed households responded to these questions, so approximately 35% of Mekoryuk households are represented in the following summary of comments.

Most comments related to environmental conditions described warmer weather and a shift in the timing of seasons, especially that freeze-up is later than it used to be (Table 5-10). Many respondents referenced weak or poor ice that no longer supports ice fishing in November and December; a few households said similar things about ice conditions around the northwest corner of the island in the spring, where fishers target blue king crab when the ice is strong. Respondents described “rougher” summers that include more wind and “fall-like” weather, as well as an increase in the number and severity of storms, especially in the fall. Taken together, the comments describe how warm fall storms result in more rain and less snow with concurrent wind that breaks up and moves any ice that might have started to form. Several respondents mentioned rapid unseasonal swings in the weather, and a few described observations of change to the landscape, such as deposition at Shoal Bay, bank erosion (Plate 5-6), and melting permafrost that makes the land “more rugged.” A few respondents noted that the water is warmer; two described algae blooms in the river, and one was concerned about less seaweed along the beaches. Respondents also mentioned that flies have been worse in the last few years, and that more killer whales and seals have been chasing herring. Two respondents expressed concern about pollution, and one elder stated that the tides are higher than normal. Respondents talked about problems accessing resources including large tomcod full of eggs that were gone by the time the ice was safe enough for fishing, as well as halibut and Pacific cod, which require good

25. A. Godduhn field notes, January 14, 2019.
26. Review meeting with Mekoryuk Tribal Council, January 10, 2019.

Figure 5-16.–Chars and rainbow trout fishing areas, Mekoryuk, 2017.

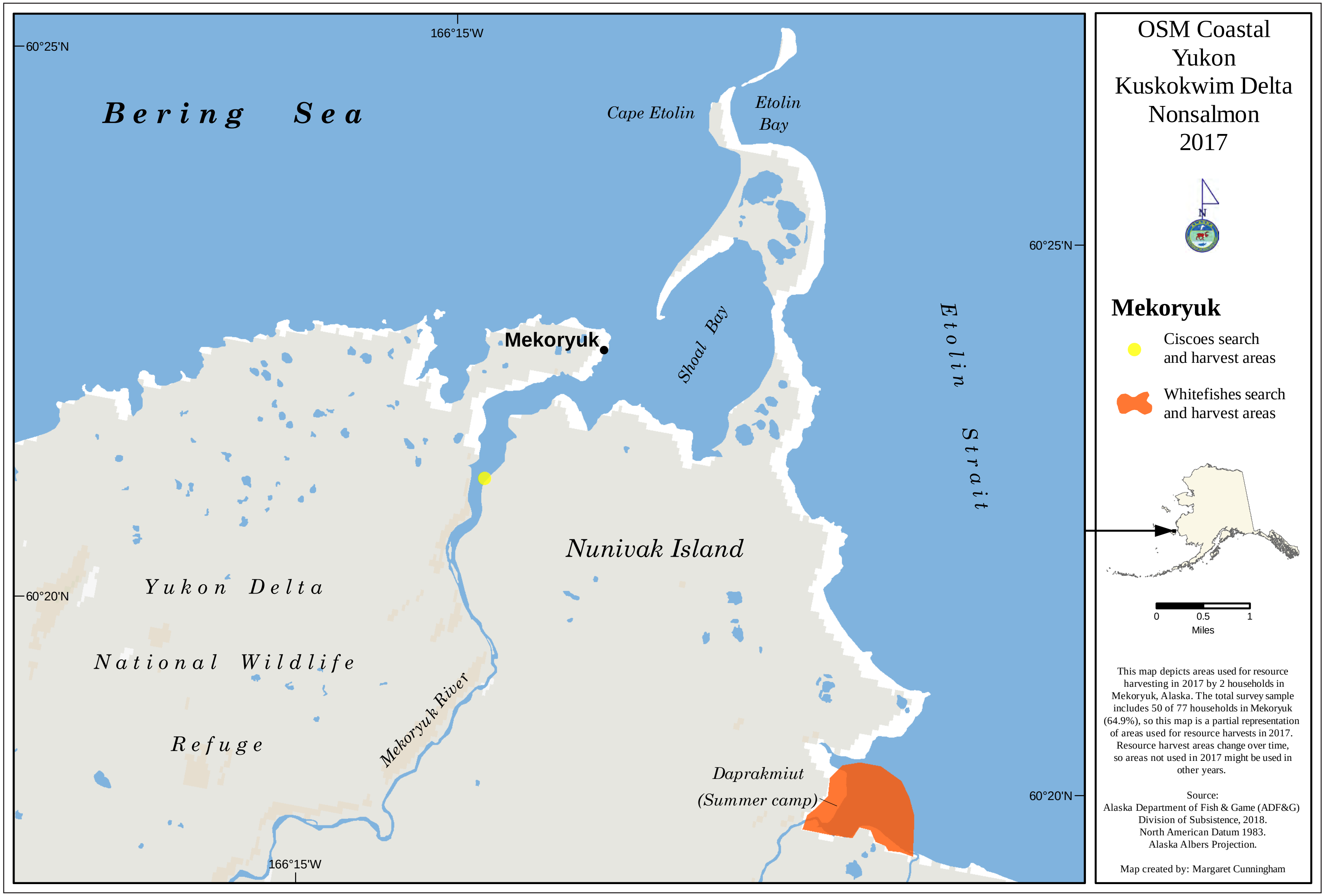


Figure 5-17.–Ciscoes and whitefishes fishing areas, Mekoryuk, 2017.

Table 5-10.–Observations and observed effects of changes in environmental conditions, Mekoryuk, 2017.

Observations	Effects
Weird seasons.	Usually by now people have hundreds of tomcod.
Where we picked clams sand is building up; cannot get boat in where in past we could. Seeing more rough weather during June to July, which is main fishing camp (salmon) time. Halibut and cod fishing too.	Access when low tide too hard to go in there so get less clams. Less fishing opportunity because we can't go out.
October water too warm, Ice forming late. Noticed these changes all his life. Even daddy in 70s said weather changing.	Dolly Varden, tomcod. Sometimes cannot get to area for resources. Ice melt before herring came, timing of herring is off and can miss entirely if not paying attention to the timing.
All come in their own time. If we have physical and financial ability to be on right time with nature, we are blessed. Providers [spouse and son] go commercial fishing (have to go far and long) and hire others to help her. Ice late, shoud be ice end of October. Now just freezing in January. Tomcod larger fish in November. Now, in January, less and only small tomcod.	No ice when fish here so no access, missed large tomcod run.
Ice slow to come. Usual end of October, now ice just hard [late Jan 2017]	Unable to get tomcod. Especially fall fish are full of eggs; missed them.
The weather, warmer weather. Everything takes longer to freeze.	
In everything we do it pertains to the weather. Weather is changing like its people and its not getting any better. Costs getting so high too. State making too much red tape, setting limits and quotas.	All subsistence is getting harder due to weather.
Warm winter. Kept crab fishers from going out in March. Too much ice moving around. No good summer weather, rough in the ocean.	Going out less and reduced harvest or miss timing altogether and no harvest like March—blue king crab.
Later winters and more windy, which effects even summertime—need less winds to travel by boat.	Hard to get wood, reindeeer, goose hunting—fall is very rough now.
We have warm winter. Snow fall is less. Ice coming in late. National Geographic says our climate is warming from gas coming out of our engines, sun hits that and planet warming. Show up melt Greenland and South Pole first. The ocean will rise and after that our planet will get hotter and hotter. Seeing high winds. Undependable ice to travel on, storms last longer. Summer boating more difficult now, more rough weather.	Safety. Too dangerous to travel by boat.
Tides are higher than normal. Ice is different now. Long time to freeze warmer water. Used to freeze in October.	Can't get out for tomcod.
Rough summer weather, warm fall.	Harder to get out.
Ocean trash, more deformed trout, Pacific cod, halibut, chum, kings. Summer weather is rougher.	Going to fish regardless but weather more challanging and deformities spooky.
Warm and late freeze. Lot of rain, freeze, rain, freeze.	No tomcods.
Ice late—stormy in summer cannot go out for halibut and Pacific cod.	Can't get the fish.
Fall time high water, too much rain. Ice didn't form to access when would normally be catching fish under ice. No access to large tomcod, lack of ice. Water too high to go by boat. Ice by January but then big tomcods gone, only little tomcod available in January.	Missed tomcod season, substuted salmon, use more dried salmon, chum salmon used.
Mentioned Shoal Bay has changed for shellfish. Summer and fall weather is rougher.	Hard to boat or fish.
Last summer [2016] ocean side, hardly any more seaweed, maybe too warm. Lots of long green algae all the way down the river, no rain.	Concerned but just don't know.
River warmer than in the past—warm to touch. Noticed algae, permafrost melting everywhere, side of river thawing. Land more rugged than it used to be. Noticed 2 foot drop in land—uneven thaw. Mentioned arsenic, mercury, and other pollution.	Got to travel more slowly.
Ice formed so late. Just froze up in January when used to 2 months earlier. By the time ice was safe couldn't get the tomcods that were larger and full of eggs. Tomcods here now in January are too small. No one wants these.	Cannot harvest what is wanted and the early tomcods are more nutritious having eggs and most desired.

-continued-

Table 5-10.–Continued.

Observations	Effects
Ice getting here later.	But not affecting harvest or use; I am still doing just fine.
Winter much shorter, December to April instead of October to May.	Not much effect.
Warm, ice doesn't set.	Can't go for tomcod.
Wet weather, too high water, not good.	Limited outings/travel.
Too much flies, lots more than used to be. Fish, reindeer guts at dump, hot weather where we go fish camp—channel changes can mean no fish. Last fall freeze, rain.	Changing currents and shallower makes it harder to move around and find fish. No ice and no tomcod or blackfish.
Storms and rough water have increased in frequency and duration. Spring is good. Summer is ok. Fall very rough, winter storms.	
Weather always—the weather melt, freeze, melt, freeze, rain. Summer always rough, calm weather doesn't last. Used to freeze solid, lots of snow by thanksgiving, now falls are rain.	Tomcod are missing this year.
Last few years I would say the weather is the boss. It's getting weird, less predictable. Now it's always seems like fall weather, windy and cold.	Can't go when storm rough. Used to be able, more calm and sunshiney.
Winters have changed. A lot less snow, Sept warm. November ice should be firm. Just got strong now, the ice.	Need firm ice for herring, ice fishing, and to get crab [blue king]. Reindeer herding difficult in winters without enough snow for snow machines.
Weather has been warm. River hasn't frozen proerly for several years and this year not till January when used to be end of October.	
All I know is the ice late by 2 months. Makes access to ice fishing not safe. Ice also not safe in March for crabs. We get them through ice in March.	Cannot harvest when ice unsafe, then we miss the time. Can miss entire resource [crab]
Never seen many killer whales and seals following the herring when they spawn. The herring didn't come to where we usually fish for them, so none to harvest, only saw a few spawned out. Need spawned out ones because they dry the best. Wet weather, late ice freeze up.	Prevents access for jigging when large tomcod are here.
Started freezing up then rained. She noticed her spinach growing, then refroze.	Kinda too cold to go out.
Too many flies to dry Dolly Vardens as dried fish. Flies appear in huge amounts when used to be good time to dry.	
Snow stopped about 4 years ago. Used to be lots in spring. Now it's gone before May. More mold in houses—freeze, damp, freeze, damp.	

Source ADF&G Division of Subsistence household surveys, 2018.

Plate 5-6.–The bank on the river side of Mekoryuk has eroded substantially, especially between 1963 and 1983 (U.S. Army Corps of Engineers 2008), but is underlain by volcanic rock.

weather for ocean travel. Several people who described changes did not describe related effects or said that they had not really been affected, and one person said that they are concerned but “just don’t know.”

Most respondents describing changes to fish had noticed changes in the abundance or size of fish, primarily fewer and smaller fish such as herring, saffron cod, or halibut (Table 5-11). However, one respondent said that “summer fish” including halibut, Pacific cod, and walleye pollock arrived later than expected in 2017 but got fat earlier than usual. Respondents noted concerns about fish health including parasites and lumps on “trouts” and sculpins, and they described increased predation by seals. One respondent noted that starfish had “disappeared” and that he had not seen crab since 2010. Two respondents commented about salmon, which are heavily harvested and exhibiting change, and one described the lack of ice for hunting seal and walrus.

A description of the full magnitude of change that elders have experienced is beyond the scope of this report. However, respondents mentioned “other changes,” including technology such as freezers and the ability to store foods, employment and education, expenses, and personal health (Table 5-12). Additionally, respondents identified both commercial fishing and the recent lack of commercial fishing as problematic.

Local Comments and Concerns

At the end of the survey, researchers asked respondents if they had any questions, comments, or concerns and paraphrased their responses (Table 5-13). Most respondents had already expressed their concerns, as described above, and did not respond to this question, so only 14 households are represented in the table. The following summary of local observations related to nonsalmon fish also includes some of the issues that were described during ethnographic interviews.

Table 5-11.–Observations and observed effects of changes in nonsalmon fish and marine invertebrates, Mekoryuk, 2017.

Observations	Effects
People say they are smaller.	
Salmon were late, Dollies were good.	
Red dots on regular trout that go back to ocean. He distinguishes this fish from Dolly Varden and char, says not rainbow trout. White dots on silver salmon when cut open: pus. It had disease spots on body and the color was red.	
Some trout had worms.	Gave those to dog.
Low halibut.	Just have to be patient.
Last fall and last 2 years, 4–5 salmon have white pus right inside the meat.	
Smaller and fewer. Seals now get then before we can get them.	
Last year the halibut were late—by summer they seem to be fatter than expected. Pacific cod and pollock too. Sometimes trout is milky. Summer fish have gotten bigger, more fat in spring. Maybe warmer water increased their food. Fewer pinks, chums. More small seals, spotted, around harbor and docks. More open water.	
Trouts with lumps and pus.	Let those go.
Towed seine at night, brother set net caught a few shells. No tomcod when and where expected, next bay too, nothing at all.	Way less tomcod.
Halibut are smaller, maybe farther out. Would go out for commercial and getting bigger ones [if opportunity]	
Sculpin have more worms in them. Trouth have more fish lice, they are getting some kinds of sores. More parasites in meat.	When he notices abnormalities he lets them go. Less take home catch if affected too much.
More pollution—sores on body / head.	Concerned but need it. Let the weird ones go.
Less fish. No herring, been low since late 1980s. Depleted from commercial fishing.	Travel farther; keep ears open.
More have parasites.	No
2016 cod head in all was pus or something. Few salmon with white dots and pus inside.	
Very few tomcod this year, and small.	I don't have as much.
Now catching king salmon because maybe warmer water temp changing last few years. Used to be lots of herring, not anymore. Has to do with ice, not exactly sure.	
No ice for seal and walrus. No hunting, no ice.	
One trout had big lump like cyst/tumor.	Threw it out.
Less tomcod and no herring in the spring. Tomcods smaller, too many seals. Dead tomcod in the bay. Noticed some kind of fish eggs on beach, bigger than herring eggs, made beach smelly.	
Starfish disappeared after second year [of residence; 6 years prior]. Haven't seen crab since 2010.	

Source ADF&G Division of Subsistence household surveys, 2018.

Table 5-12.–Additional observations, Mekoryuk, 2017.

Observations
Always too busy
Less need to dry and smoke. No more seal poke; freezers.
Too much work/classes
Too much commercial fishing for halibut.
Cost/gas.
Health.
Used to do a lot of commercial fishing (herring/halibut) but it stopped; hurt community. Now more subsistence but it's a struggle.
Hay fever last year, first time since Michigan.

Source ADF&G Division of Subsistence household surveys, 2018.

Table 5-13.–Respondent comments, Mekoryuk, 2017.

Chum—more males than females. Really big males but hardly any females. Seals in the bay probably eating all the fish
Caught way more salmon (reds, kings, silvers, chum) to make up for the lack of available halibut. All 5 species used in 2017.
Was told when young that he would be a fisher. Trout—March and April. Spring water makes trouble walking on edge.
Should open Pacific cod for commercial. Abundance in spring. CVRF from outside—not making communities a priority. [Director] gives board members lots of bonuses—so he controls them instead of other way around. [Tell them to] get on the ball—halibut, herring, and pollock. Village needs the money. Commercial fishing never a problem. Sometimes they are late but always plenty. All 3 fish could be commercial, and Pacific cod.
All fish received but flounder and invertebrates.
Wish the weather was warmer. Pacific cod had growth like tumor, didn't harvest. Less tomcod [saffron cod] and smaller.
Noticible climate change
Appreciates our presence
Lack of commercial fishing is a big issue/problem for community—need the money. Coastal erosion and wind erosion are serious.
Are the surveys important for decision to open commercial fishing? Will Pebble Mine mishap affect our fisheries?
CVRF shouldn't shut down. Didn't change halibut fishing but now lots of debt.
Be nice to see tagging study of halibut and [Pacific] cod to see where they go and maybe what they eat. Worried for Fukushima contaminants; otherwise content. Never used to see that.
Will you put more char in our river?
Last summer chums—big, no females. Lots last summer. More Pacific cod at Nash Harbor and south side. Used to use willow or drift wood to smoke fish; willow is better.

Source ADF&G Division of Subsistence household surveys, 2018.

Concerns often echoed those made when describing changes over time. For example, residents described the economic vacuum left by the lack of commercial fish buyers in the last few years and the resulting hardship for many families. They also said that dramatic changes to the climate have increased uncertainty. For example, in January 2018, eroding river banks were visible just outside of town (Plate 5-7). Finally, they talked about pollution, especially the nuclear power plant disaster at Fukushima, Japan in 2011, and their perception that the event is associated with a decline in the health of fish.

Acknowledgments

ADF&G Division of Subsistence wishes to thank the Native Village of Mekoryuk Tribal Council and residents of Mekoryuk for participating in this project and for extending genuine kindness at every opportunity. Local research assistants George Christmas, Debbie David, Russel Float, William Kiokan, and Linda Weston each did a great job of describing the surveys to potential respondents; they also provided much helpful insight to ADF&G staff about how fishing works in Mekoryuk. Additionally, nine individuals including Alice Smith, Purdy Olrun, Mark Olrun, and Tom Noatak participated in eight extended interviews; five key respondents chose to remain anonymous. Field staff extend special thanks to Muriel and Howard Amos for helpful background and translation services and to William Kiokan for above-and-beyond assistance in completion of the survey effort.

Quyana Mikuryarmiut!

Plate 5-7.–Weak edges on the Mekoryuk River, January 2018.

Plate 6-1.–Quinhagak and the complex mouth of the Kanektok River.

6. QUINHAGAK

Anna R. Godduhn

In January of 2018, three Division of Subsistence staff worked with six local research assistants to conduct nonsalmon subsistence harvest surveys with households in Quinhagak (Figure 1-1). Researchers surveyed 93 of 160 (58%) randomly selected households about their harvest and use of nonsalmon fish and marine invertebrates (Table 1-7), and the average survey length was 23 minutes (Table 1-8). The total nonsalmon fish and marine invertebrate harvest for the community of Quinhagak translated to about 81 lb per capita in 2017 (Table D6-1).

In addition to the household surveys, ADF&G researchers conducted 10 key respondent interviews with 11 knowledgeable Quinhagak subsistence fishers. Key respondents shared their observations, experiences, comments, and concerns, and they provided researchers with invaluable information regarding subsistence activities associated with nonsalmon fish, including seasonal harvest patterns and related changes over time. This information helped to contextualize the quantitative harvest and use data collected in the surveys.

Community Background[1]

Quinhagak (*Kuinerraq*[2]) is a relatively large Yup'ik community situated at the mouth of the Kanektok River (*Qanirtuuq*) on the east shore of Kuskokwim Bay, about 71 miles south of Bethel[3] (Plate 6-1). Quinhagak

1. This section was adapted from Ikuta et al. (2016).
2. This and other Yup'ik placename spellings in this chapter, unless otherwise noted, come from the Yup'ik Environmental Knowledge Project Atlas: Exchange for Local Observations and Knowledge of the Arctic (ELOKA). n.d. "Yup'ik Environmental Knowledge Project Atlas." Accessed March 19, 2019. http://eloka-arctic.org/communities/yupik
3. Alaska Department of Commerce, Community, and Economic Development (ADCCED) Division of Community and Regional Affairs, Juneau. n.d. "Alaska Community Database Online: Community Information." Accessed September 30, 2019 https://dcra-cdo-dcced.opendata.arcgis.com/ Hereinafter ADCCED n.d.

Plate 6-2.–Highly variable terrain makes knowledge of safe passages critical when conditions are poor.

has a marine climate that is changing (Fienup-Riordan and Rearden 2012). Like other coastal communities, Quinhagak is experiencing warmer autumns that make thawing shorelines and riverbanks more vulnerable to erosion. One community member remarked, "we don't get winter anymore."[4] Weak ice formation also makes travel more difficult, time consuming, and dangerous (Plate 6-2).

The Central Yup'ik name Kuinerraq is shortened from *Kuingnerraq*, which means "newly-formed river," and oral historical sources recall that the river mouth and the settlement were located a few miles north of the present location early in living memory; residents have relocated multiple times since then because of erosion (Rearden and Fienup-Riordan 2013:364,372–380; 021217KWN2). A key respondent identified the spit at the old mouth where he was born:

> Way down there, this village has been going up for, I don't know how many years, it's been moving up and up and up and now where the last place they were at, right down there [along the new river], now there's no more houses except a couple of them. (021217KWN2)

The Kanektok River has a gravel bottom and a steep descent from high mountains that eases to a more gradual slope as the river leaves the mountains;[5] local residents attempted to dissuade explorers from a direct ascent of this river but did guide the first mapping expedition in 1898 (Spurr 1900:55).

Yup'ik people have lived along the Kanektok and Arolik (*Agalik*, meaning ashes) rivers for millennia (Rearden and Fienup-Riordan 2013). Findings of an archaeological survey of southwestern Alaska in the early 1980s that included numerous prehistoric caribou fencing and hunting sites along the upper Kanektok River and around Kagati Lake[6] indicate thousands of years of human use (Ackerman 1985). Likewise, this section of Kuskokwim Bay coast holds evidence of long occupation (Fienup-Riordan and Rearden 2012).

After the erosion of artifacts from thawing shoreline about four miles south of Quinhagak accelerated in 2007, archaeological work at Nunalleq ("Old Village") began in 2009, and the remains of several sod houses and a large *qasgi* (men's house or community house) were excavated (Weiss 2015). Charred timbers and

4. A. Pleasant, Quinhagak resident, personal communication with author, November 4, 2018.
5. A. Pleasant, Quinhagak resident, personal communication with author, November 4, 2018.
6. Kagati Lake is the source of Kanektok River.

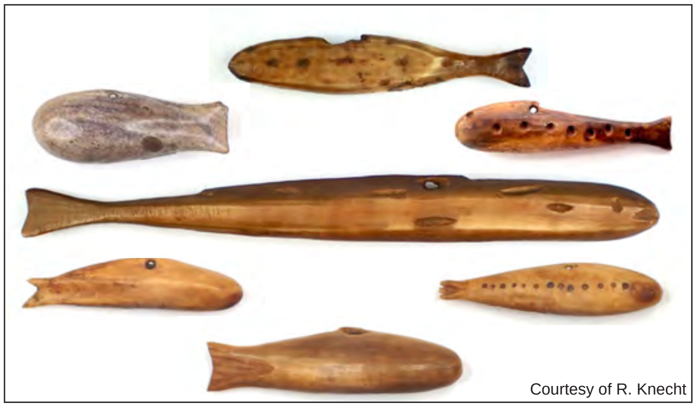


Plate 6-3.–Ancient fishing lures.

arrow heads from within the roofs of houses dating back 500 to 700 years bring tangible detail to local oral history that describes the burning of a village near the Arolik River (Fienup-Riordan et al. 2015).[7] The attack occurred during the Bow and Arrow Wars in the mid-17th century, prior to Euroamerican contact (Fienup-Riordan and Rearden 2016; Rearden and Fienup-Riordan 2013:394–398). The portion of the site excavated in 2011 and 2012 had already washed away by 2014 (Weiss 2015).

Quinhagak recently established the Nunalleq Culture & Archaeology Center, where local residents, especially elders and students, are working with academic researchers to process and ultimately store thousands of artifacts in Quinhagak.[8] Plate 6-3 shows a small sample of recovered stone, ivory, and fossil ivory fish lures that were jigged up and down, mostly through ice, to bring fish to the surface for spearing.[9] No hooks have been found at the site but sections of net have been recovered, including one that appears to be made of plant fiber. Other objects associated with nets are more durable: gauges to make them and shuttles to repair them were mostly made of wood, and drilled pieces of walrus rib or caribou antler were used to weight the nets (Plate 6-4). Oral history of unknown chronology describes that jigging holes were melted out by placing hot rocks on the ice, and also describes the use of bone and ivory hooks (Rearden and Fienup-Riordan 2013:392–394). Occupants of the site consumed fish, especially salmon, and caribou throughout the year; about a third of their diet was fish (Britton et al. 2013).The site supported multiple episodes of occupation, the last of which was continuous from about 1570 until the settlement burned (Ledger et al. 2018).

When the first Russian explorers came into Kuskokwim Bay in 1818, the people wore clothing made of beaver, fox, marten, wolf, and caribou skins; weapons, including knives, spears, bows, and arrows, were made primarily of wood with some iron and copper (Korsakovskiy and Vasilev 1988:46–47). "They make their seines and fish lines from the sinews of bearded seals and beluga. They make their pots out of clay and their dishes of wood" (Korsakovskiy and Vasilev 1988:72). Quinhagak was first mapped as "Koingak" in 1826 by Russian Admiral Gavril Sarichev and has been identified with a dozen spellings since then (Orth 1971rep.:788).

Plate 6-4.–Ancient tools to make, repair, and weight fishing lures.

In 1885, the first Moravian Sunday worship service in Alaska was held on the banks of the Shinette River (Warehouse Creek; Henkelman and Vitt 1985:64). The party was traveling to Bethel to establish a missionary station on the Kuskokwim River. In 1894, "the first [Moravian] Native home Missionary" Helper Kawagaleq left his home and began mission work in

7. University of Aberdeen Department of Archaeology. 2012. "Where archaeology and oral history meet." Accessed October 25, 2019. https://nunalleq.wordpress.com/2012/08/17

8. University of Aberdeen Department of Archaeology, n.d., "Nunalleq 2019" Accessed August 22, 2019. https://nunalleq.wordpress.com/

9. R Knecht, archaeologist, personal communication with author, March 20, 2019.

Quinhagak and, by 1904, the mission had constructed a new church building and a school. Consolidation and the influx of prospectors resulted in a bustling town during the Gold Rush at the turn of the 20th century, despite epidemics that ravaged southwest Alaska during this period (Fortuine 1989; Wolfe et al. 1984:113–115). Quinhagak thrived as a supply and transport hub for the entire Kuskokwim River because Warehouse Creek was as far as large ships could reliably travel until channels were mapped in 1910 (Frost 2013). Quinhagak's post office was established in 1905.[10]

Quinhagak participated in reindeer herding from 1906 to the mid-1940s, but the herd dispersed as local interest in herding waned; reindeer herding had effectively ended by 1950 (Rearden and Fienup-Riordan 2013). In the mid-1950s, some Quinhagak residents began small-scale commercial salmon fishing at the mouths of the Kanektok and Arolik rivers (Rearden and Fienup-Riordan 2013), but the efforts were plagued by processing and transportation problems (Regnart et al. 1968). Many residents went to Togiak to work at canneries during that period; after statehood in 1959, commercial fisheries were developed in the Kuskokwim River. Quinhagak fishers could then work closer to home, do work they preferred (fishing rather than processing), and earn more money (Wolfe et al. 1984:157). The Quinhagak district of the Kuskokwim Management Area is a small compared to the Kuskokwim River in terms of salmon production, but all five species of Pacific salmon run in the Kanektok and Arolik rivers, and commercial salmon fishing played a central role in the development of contemporary Quinhagak (Wolfe et al. 1984).

Commercial fishing opened for Pacific herring[11] in Bristol Bay in the 1970s, and Quinhagak fishers traveled to participate (Wolfe et al. 1984:93). The fishery expanded around Cape Newenham to Goodnews Bay in 1979, and Quinhagak participation increased (Wolfe et al. 1984:300). However, throughout the 1980s and 1990s, Quinhagak residents held at least three times as many commercial salmon permits as herring permits.[12] During the 1982 commercial salmon season, 71 of 98 total Quinhagak households held 91 commercial salmon fishing permits; five of these permits were held by women, and five permits were for Bristol Bay (Wolfe et al. 1984:259). One hundred fishermen earned $796,000 from commercial fishing in 1982, half of the total income earned in the community; more than 90% of the income was generated from the Kuskokwim River and Bay (Wolfe et al. 1984:205). A few residents went to Security Cove for the commercial herring sac roe fishery. Participation in the herring fishery fluctuated in the 1980s and fell in the 1990s.[13] Commercial fishing for Pacific halibut[14] and Pacific cod was developed in the eastern Bering Sea in the early 1980s; the commercial fishing grounds are located at a distance that requires capital investment in boats and gasoline, but some Quinhagak fishers made the investment and grew accustomed to the opportunity. Commercial fishing (especially of salmon) warranted the construction of a fish processing plant in 1992 (Knapp et al. 2001), but the plant has not operated since 2009 (Brodersen and Carroll 2011:44). Kuskokwim Bay fish were thereafter processed at a new plant in Platinum, but that plant has not operated since 2015.[15]

Additionally, multiple fishing guides, based mostly in Anchorage or Dillingham, popularized sport fishing adventures along the remote rivers of the Togiak National Wildlife Refuge (NWR), including the Kanektok and Arolik rivers. Concerns related to sport fishing date back to the 1980s (Wolfe 1988). Although people in Quinhagak are glad to share their fish, their view of "catch and release" as disrespectful and their observations of injured fish have resulted in tension (021417KWN4, 110218KWN9, 020618KWN8, 021317KWN3; Chythlook 2015; 2018; Kluwe and Krumpe 2003; Wolfe 1988).

10. ADCCED n.d.

11. Hereinafter, *herring*.

12. Commercial Fisheries Entry Commission, n.d. "Fishery Statistics – Participation & Earnings." Accessed August 9, 2019. https://www.cfec.state.ak.us/fishery_statistics/earnings.htm Hereinafter *CFEC n.d.*

13. CFEC n.d.

14. Hereinafter, *halibut*.

15. Demer, L. 2016. "When residents of an Alaska fishing village can't fish, normal life comes to an end." Anchorage Daily News. Accessed August 23, 2019. https://www.adn.com/alaska-news/rural-alaska/2016/07/24/when-residents-of-an-alaska-fishing-village-cant-fish-normal-life-comes-to-an-end/

Plate 6-5.–Two frozen chars on the Arolik River in February 2017.

The Native Village of Kwinhagak was recognized in 1948 (Wolfe et al. 1984:128), the local Qanirtuuq Corporation was incorporated in 1973[16], and the City of Quinhagak was incorporated in 1975[17]. Qanirtuuq Inc. operates many of the businesses in the community, including the hardware store and fuel sales. Two federal wildlife refuges were established nearby in 1980 under the Alaska National Interest Lands Conservation Act (ANILCA). The Togiak NWR surrounds Quinhagak's inholdings (mostly Native allotments and lands selected by the Qanirrtuq Corporation); the refuge extends south to Cape Newenham, west to Dillingham, and north to the Yukon Delta NWR. Much of the Kanektok River is within the Togiak Wilderness Area, and Native allotments are scattered along the lower Kanektok River.[18]

Historically the Kanektok River was easily navigable up to about 30 miles for most skiffs (Wolfe et al. 1984:90,132), but at least one respondent stated that the river is getting shallower and that outboard propellers are no longer useful upstream of about eight miles (021317KWN3, 021417KWN4). The community is not accessible by road. However, a state-owned gravel airstrip enables air transportation, passenger mail, and cargo service; and a harbor and dock receive the biannual barge deliveries of heavy goods and fuel. Infrastructure includes a post office, a clinic, a store, three energy generating wind turbines, the kindergarten through grade 12 Kuinerramiut Elitnaurviat School, a water treatment plant, a city dock, and a landfill. Water delivery and sewer and trash disposal are provided by the Native Village of Kwinhagak. Bethel, the regional hub, is a 45-minute flight from the community. In addition, float planes land on the Kanektok River, and boats, all-terrain vehicles, snowmachines, trucks, and cars are used for local transportation; few if any dog teams remain. Major winter trails are marked to Eek (39 miles) and Goodnews Bay (39 miles).

Seasonal Round[19]

Because of the variety of habitats near the community, Quinhagak has numerous marine and freshwater fish and marine invertebrates available for year-round harvest with seasonal variation in both availability and preferred harvest condition. The most avid participants fish throughout the year, but activity increases as the days grow longer and warmer in the spring. At that time, more fishers go out to jig through the ice for rainbow smelt[20] (*iqalluaq*)[21], chars (locally "trout"; Plate 6-5), rainbow trout (locally "rainbows," *talaariq*), and sometimes Bering cisco (*imarpinraq*). Some fishers also go to the Eek or Johnson rivers to jig for northern pike (*cuukvak*, sometimes *luqruuyaq*)[22] and burbot (*manignaq*); these trips sometimes involve

16. Qanirtuuq Incorporated, 2017. "Qanirtuuq, Incorporated: Home." Accessed August 23, 2019. https://www.qanirtuuq.com/
17. ADCCED n.d.
18. U.S. Fish and Wildlife Service. "Togiak National Wildlife Refuge, Alaska." Accessed August 23, 2019. https://www.fws.gov/refuge/Togiak/map.html
19. This section was adapted from Ikuta et al. (2016).
20. Hereinafter *smelt*.
21. Unless otherwise noted, this and other local Yup'ik fish names come from Wolfe (1984:316), and contemporary spelling corrections come from Jacobson (2012) as needed; terms were verified as locally prevalent in use by Dora Strunk, Yup'ik teacher at the Kuinerrarmiut Elitnaurviat School, November 5, 2018.
22. Hereinafter *pike*.

overnight visits to friends or family in Eek or Tuntutuliak but are most often accomplished during one long day (021217KWN2, 021317KWN3). Pike were not found in the Kanektok River historically (MacDonald and Lisac 1998), nor were they reported as harvested by Quinhagak residents in 1982. These predatory fish were first caught locally sometime between 2002 and 2012 (021317KWN3; 110218KWN9) and have become an increasingly substantial source of food.

Great numbers of chars come downriver in the spring following the thaw of ice, and fishers impatient for open water may go upriver by land to catch a portion (021417KWN6). Once ice clears from the river mouth, smelt arrive from the Kuskokwim Bay to run upriver as the first spawning run of the year; fishers use dip nets from boats or the river bank to catch these. One key respondent described smelt processing: she can tell the females apart, and she loves the eggs they hold throughout the winter. She described gutting the fish without slitting it all the way to leave the eggs in the fish for drying: "You want to dry that all together with the whole fish and they are dried and smoked and the roe is so good, you dip it in seal oil" (021517KWN7).

Some fishers fish for herring along the shallow coast, although the run is small compared to those at Goodnews Bay or Nelson Island. Summer fishing is largely focused on salmon and halibut. Halibut do not come in close to Quinhagak, but one key respondent explained that the presence of herring indicates that halibut will be in the bay (110318KWN10). Fishing for halibut often results in incidental catches of Pacific cod and, occasionally, walleye pollock. Likewise, salmon nets along the coast often catch chars, and occasionally sheefish (*ciiq*), flounders (*uraluq*), soles (*naternaq*), or sculpins (*kayutaq* or *nertuli*, sometimes called "devilfish"); any of these fish are brought home, especially if they have been injured or killed by the catching (021517KWN7).

In July, following the peak of the salmon runs, the return of sea-run char accelerates. "Commercial fishermen catch them and they are good eating" (021417KWN4). When they arrive, these fish are fat and ready to swim to spawning grounds in the Ahklun Mountains (021217KWN2; 021417KWN4; 021517KWN7). Subsistence fishers use nets or rod and reel[23] gear to catch them. Quinhagak residents favor chars, in part because they can be caught any time of year (although there is a lull in the mid-winter; 110218KWN9; 021417KWN4). The sea-run char tend to be larger and have a higher fat content than the river residents. Key respondents explained that some fishers prefer the spring run because the fish are easier to dry, and others prefer the higher fat content of these fish in the summer and fall (021317KWN3; 021217KWN2; 021517KWN7; 110218KWN9; 021417KWN6; 110318KWN10).

In the fall, saffron cod (*ceturrnaq*, locally called "tomcod") is abundant in coastal waters including the lowest sections of the rivers; some respondents said that these fish are more common than they used to be, but others said they have always occurred in smaller numbers than smelts. In the late summer and fall just before freeze-up, fishers travel to the Eek or Eenayarak river systems to target least cisco, humpback whitefish, and broad whitefish. Fishing also continues in the Kanektok River (Plate 6-6). As ice begins to set, a few households still set traps for Alaska blackfish (*can'giig*) in small creeks of the tundra lake systems; traditionally this activity occupied much of the winter for some households (Rearden and Fienup-Riordan 2013), although these fish are smaller and less abundant than farther north near Eek or across Kuskokwim Bay (Wolfe et al. 1984:93; 021217KWN2).

Several nonsalmon fish are present in the Kanektok River throughout the winter: char, round whitefish, Arctic grayling (*culugpauk* or "sushi fish"[24]), and rainbow trout (Wolfe et al. 1984:317). These fish as well as Bering cisco were harvested throughout the winter, and some of these were more important historically. Round whitefish (*cavirrutnaq*) was harvested from August through May. They are abundant at times but are often unknown to younger fishers who tend to target larger fish than their elders (021217KWN1, 021317KWN3). Two key respondents who struggled to remember the name of this fish likened it to Arctic grayling; one called it "the other grayling" and both identified it, like Arctic grayling, as best eaten raw.

23. Prior to 2000, when rod and reel gear became legal for subsistence fishing in the Kuskokwim Bay Area, subsistence fishers were required to hold a sport fish license to use a hook or line attached to rod or pole.

24. Quinhagak respondents identified grayling as an occasional catch best consumed raw, immediately following removal from the water (021417KWN7).

Plate 6-6.–Catches from a net set twice for about an hour each time in early November, 2018.

By the mid-1950s, residents had begun commercial salmon fishing at the mouths of the Kanektok and Arolik rivers. Commercial fishing shifted activities more toward the coast and provided a means to obtain cash for the purchase of subsistence hunting and fishing gear (Wolfe et al. 1984). In the early 1990s, Quinhagak people continued to travel between spring, summer, and winter camps depending on the availability of needed resources, and fishing occurred year-round (Rearden and Fienup-Riordan 2013). Throughout the winter and into spring, people jigged for chars and other nonsalmon fish species. In the spring, people tended to focus on seal hunting, and at the same time they jigged through the ice along the coast for saffron cod and smelt. The most intensive nonsalmon fishing, especially for char, occurred after the salmon runs in the late summer and fall.

Quinhagak residents no longer relocate their entire households between seasonal camps as they did in prehistoric times, or even to the degree that they did in the 1990s. Advances in equipment, particularly boats with large motors and snowmachines, have greatly increased the ability of residents to meet their needs on day trips, while modern obligations often preclude extended periods of absence from Quinhagak (La Vine et al. 2007; 021417KWN4; 021317KWN3). Commercial fishing has been variously focused on salmon, herring, and halibut over the decades, but because of a lack of processing facilities, those opportunities have been absent in recent years (Fall et al. 2018).

Population Estimates and Demographic Information

Surveys conducted in February 2018 for the 2017 study year recorded demographic and nonsalmon fish and marine invertebrate harvest and use information from a sample of all Quinhagak households that were residing in the community for at least six months of the study year. Surveyors attempted a 60% random sample of all households and achieved a sample of 58% (Table 1-7). Demographic data were expanded to estimate a total population for the community of 666 individuals residing in 160 households in 2017 (Table 6-1; Figure 6-1); about 96% of the population identified as Alaska Native.

The first documented count of Quinhagak's population was in 1880 of 83 individuals, which grew to 201 by 1900 (Wolfe et al. 1984:113–116). The population fluctuated in the early 1900s as epidemics reduced the regional population and consolidation reduced the number of settlements in the area. Quinhagak has grown steadily since 1950; decennial census population counts show gradual growth, from 194 residents in 1950 to 669 in 2010 (Figure 6-2).

In the 2010 decennial census, the U.S. Census Bureau identified 165 households in Quinhagak in a total population of 669 (Table 6-1; Figure 6-1). In 2018, the U.S. Census Bureau American Community Survey estimated a five-year (2013–2017) average number of 163 occupied households and a five-year average population of 763. These figures are statistically similar to this study's estimates.[25] The population profile shows slightly more males than females and small 25 to 55 year cohorts (Figure 6-3 and Table D6-2).

In 2017, household sizes varied from one to 14 members with an average of four, and the vast majority (97%) had at least one Alaska Native head of household (Table 6-2). The mean average age of residents was estimated as 29 years with a median of 24 years. The estimated average length of residency was about 24 years for the total population and 43 years for heads of households. Most heads of household were born in Quinhagak (77%) and other communities across the Yukon-Kuskokwim Delta region, especially Eek (6%; Table D6-3). Another 6% of household heads came from outside Alaska. A larger portion of the total population was born in Quinhagak (83%), and a smaller portion was from Eek (3%) or outside Alaska (2%; Table D6-4).

Summary of Harvest and Use Patterns

Harvest and Use of Nonsalmon Resources at the Household Level

Figure 6-4 shows the percentages of households that attempted to harvest, harvested, and used nonsalmon fish and marine invertebrates in 2017. Any resource harvested or received by a household is considered used by that household, whether it is consumed, preserved, given away, fed to dogs, used as bait, or lost to spoilage. All 80% of households that went fishing caught fish, although some did not catch everything they wanted, as detailed below. Because many households share their catch, 90% of surveyed households reported using nonsalmon fish. About 20% of respondents reported using marine invertebrates, but only half of that portion (10%) went to collect them. At least one household (1%) that attempted to harvest marine invertebrates did not find any.

Table 6-3 summarizes nonsalmon fish and marine invertebrate harvest and use characteristics for Quinhagak in 2017 at the household level. The average harvest was 335 pounds usable weight (lb) per household. This study found that community households harvested an average of four different kinds of nonsalmon fish or marine invertebrates and used an average of six kinds of nonsalmon resources. The maximum number of resources used by any household was 15. In addition, households gave away an average of two kinds of nonsalmon fish or invertebrate. Overall, at least 26 types of nonsalmon fish and marine invertebrates were used by Quinhagak households (Table D6-5).

25. Differences between population estimates and counts by the Division of Subsistence, U.S. Census Bureau decennial census, American Community Survey, and the Alaska Department of Labor and Workforce Development are likely due to differences in sample sizes and variations in methods of expansion from sampled to unsampled households. For example, the 2010 Census count is based upon the total number of individuals who considered Quinhagak to be their principal place of residence on April 15, 2010, whereas the Division of Subsistence population estimate is based upon a quantitative expansion of the number of individuals who resided in responding households in Quinhagak for at least six months during the study year. Different population estimates are considered to be significantly similar if one estimate falls within the range of error calculated for another estimate.

Table 6-1.–Population estimates, Quinhagak, 2010, 2013–2017, and 2017.

	Census (2010)	5-year American Community Survey (2013–2017)		This study (2017)	
		Estimate	Range[a]	Estimate	Range[b]
Total population					
Households	165	163.0	140 – 186	160.0	
Population	669	763.0	620 – 906	665.8	609 – 723
Alaska Native					
Population	650	671.0	607 – 735	645.9	585 – 707
Percentage	97.2%	87.9%	79.6% – 96.3%	97.0%	87.9% – 106.1%

Sources U.S. Census Bureau (2011) for 2010 estimate; U.S. Census Bureau for American Community Survey (ACS) 2017 estimate (5-year average); and ADF&G Division of Subsistence household surveys, 2018 for 2017 estimate.

Note Division of Subsistence household survey elegiblity requirements differ from those used by ACS.

a. ACS data range is the reported margin of error.

b. No range of households is estimated for division surveys.

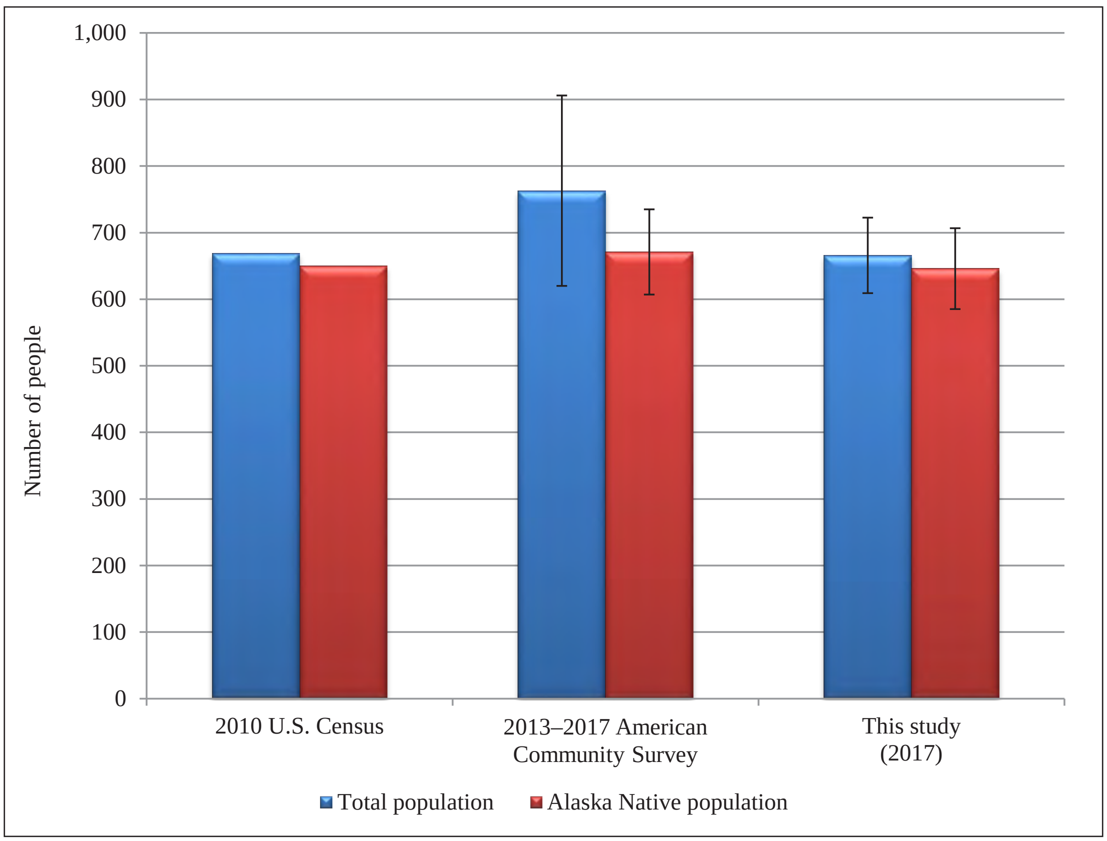


Figure 6-1.–Alaska Native and overall population estimates, Quinhagak, 2010, 2013–2017, and 2017.

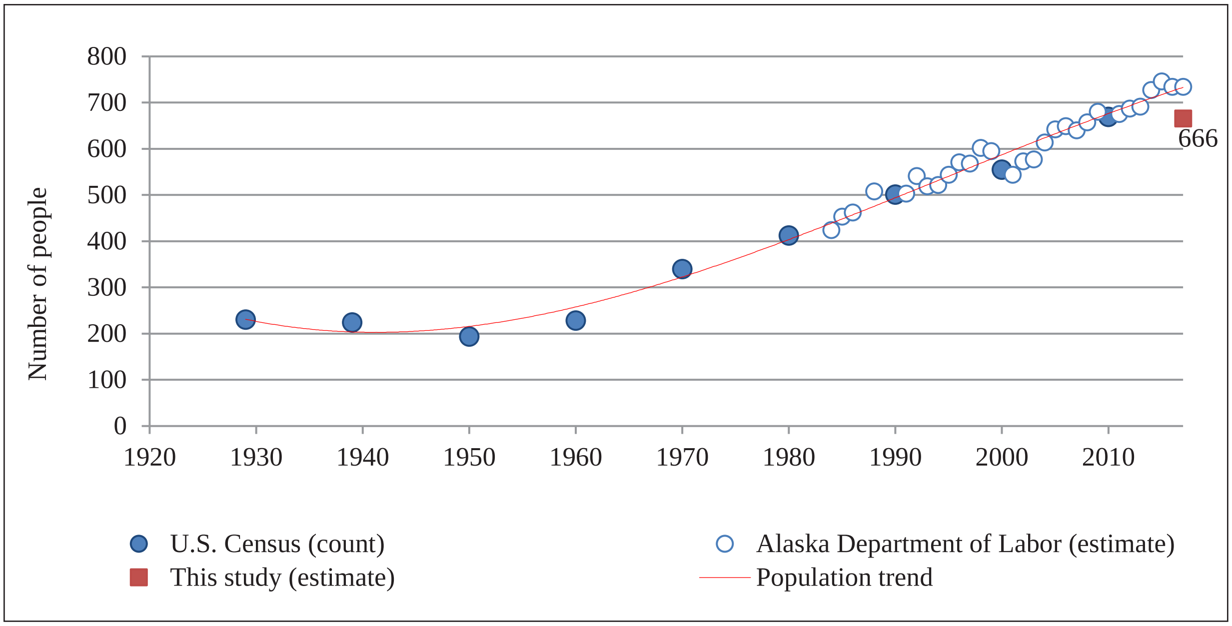


Figure 6-2.–Population estimates, Quinhagak, 1929–2017.

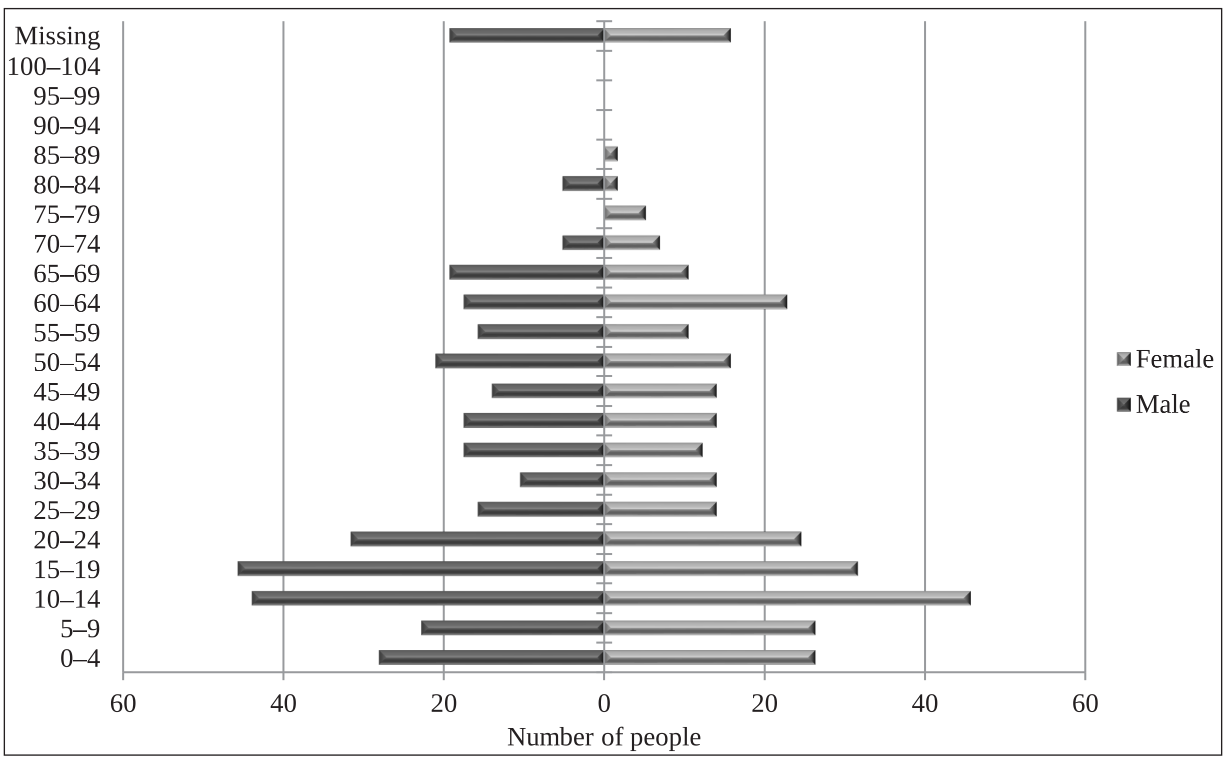


Figure 6-3.–Population profile, Quinhagak, 2017.

Table 6-2.–Sample and demographic characteristics, Quinhagak, 2017.

Characteristics	Community Quinhagak
Sampled households	93
Eligible households	160
Percentage sampled	58.1%
Sampled population	387
Estimated community population	665.8
Household size	
Mean	4.2
Minimum	1.0
Maximum	14.0
Age	
Mean	29.0
Minimum[a]	0
Maximum	89
Median	24.0
Length of residency	
Total population	
Mean	24.0
Minimum[a]	0
Maximum	89
Heads of household	
Mean	43.1
Minimum[a]	1
Maximum	89
Alaska Native	
Estimated households[b]	
Number	153.0
Percentage	95.7%
Estimated population	
Number	645.9
Percentage	97.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. A minimum age of 0 (zero) is used for infants who are less than 1 year of age.

b. The estimated number of households in which at least 1 head of household is Alaska Native.

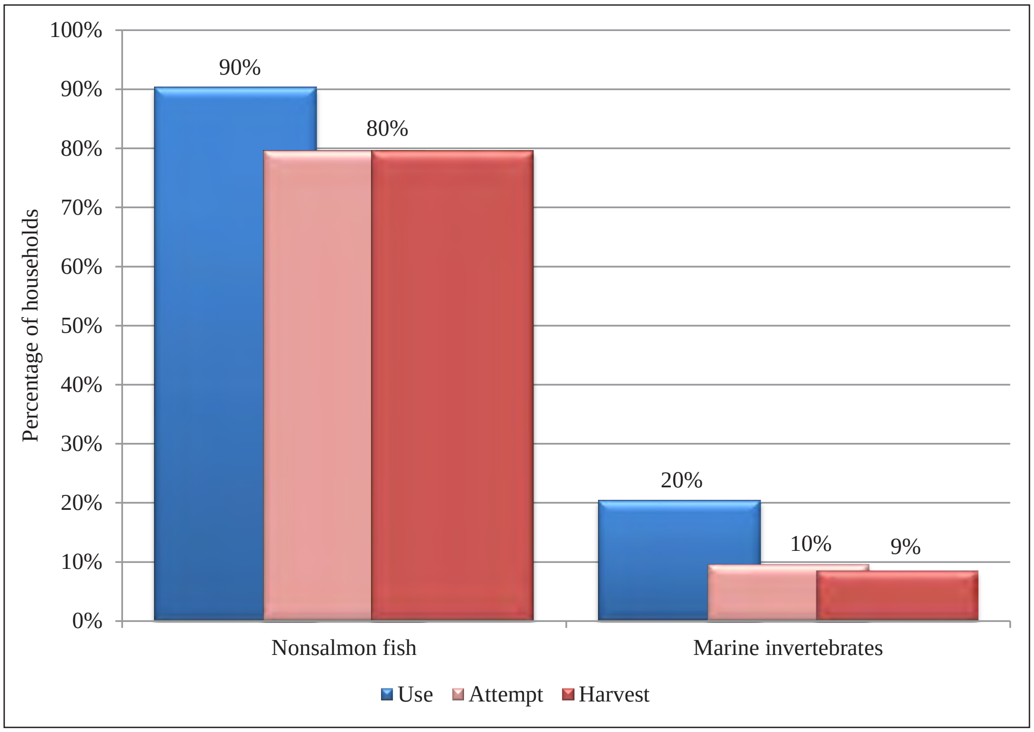


Figure 6-4.–Percentages of households using, attempting to harvest, and harvesting nonsalmon fish and marine invertebrates, Quinhagak, 2017.

Harvest Quantities and Composition of Nonsalmon Fish

In 2018, surveyors recorded the nonsalmon fish and marine invertebrate resources harvested and used by members of responding households in 2017, and the data were expanded to estimate harvests and uses for the whole community. Table 6-4 lists the nonsalmon fish used by the highest percentages of households, and Figure 6-5 shows the species with the highest harvests (by weight) during the study year. Generally, these graphics show the same set of resources, but there are exceptions and the relative positions vary.

Chars[26] are Quinhagak's most heavily harvested and widely used nonsalmon fish, by 81% of Quinhagak households in 2017 (Table 6-4; Figure 6-5). The second most harvested fish by weight, pike, was not as widely used: 39% of households used pike in 2017. However, rainbow smelt and Bering cisco, the third and fourth most harvested resources by weight, were the second and third most widely used nonsalmon fish resources (73% and 67% of households, respectively). Some resources that were harvested in very small amounts are featured in the most widely used list: Arctic grayling, herring roe, and Alaska blackfish are included as "all other resources" in Figure 6-5 and Figure D6-1.

Table 6-5 reports estimated subsistence nonsalmon fish and marine invertebrate harvests and uses by Quinhagak residents in 2017. The table is organized first by general category and then by species, and all edible resources are presented in pounds usable weight (lb; see Appendix C for conversion factors). The harvest column shows percentages of households in which any member of the surveyed household harvested a resource during the study year. The use column shows percentages of households that used a resource, including resources acquired from other harvesters or given away. Purchased foods are not included, but fish retained from commercial fishing are included, whether they were the target species or caught incidentally. Differences between harvest and use percentages reflect sharing among households, which results in a wider distribution of wild foods.

26. Reported as Dolly Varden, Arctic char, and lake trout.

Table 6-3.–Nonsalmon fish and marine invertebrate harvest and use characteristics, Quinhagak, 2017.

Characteristic	
Mean number of resources used per household	**5.5**
Minimum	0
Maximum	15
95% confidence limit (±)	8.7%
Median	5.0
Mean number of resources attempted to harvest per household	**3.7**
Minimum	0
Maximum	11
95% confidence limit (±)	10.2%
Median	4.0
Mean number of resources harvested per household	**3.7**
Minimum	0
Maximum	10
95% confidence limit (±)	10.1%
Median	4.0
Mean number of resources received per household	**2.4**
Minimum	0
Maximum	10
95% confidence limit (±)	13.7%
Median	2.0
Mean number of resources given away per household	**1.7**
Minimum	0
Maximum	11
95% confidence limit (±)	17.5%
Median	1.0
Household harvest (pounds)	
Minimum	0
Maximum	2,128
Mean	335.4
Median	179.0
Total harvest weight (lb)	53,663.8
Community per capita harvest (lb)	80.6
Percentage using any resource	90%
Percentage attempting to harvest any resource	81%
Percentage harvesting any resource	81%
Percentage receiving any resource	73%
Percentage giving away any resource	57%
Number of households in sample	93
Number of resources asked about and identified voluntarily by respondents	33

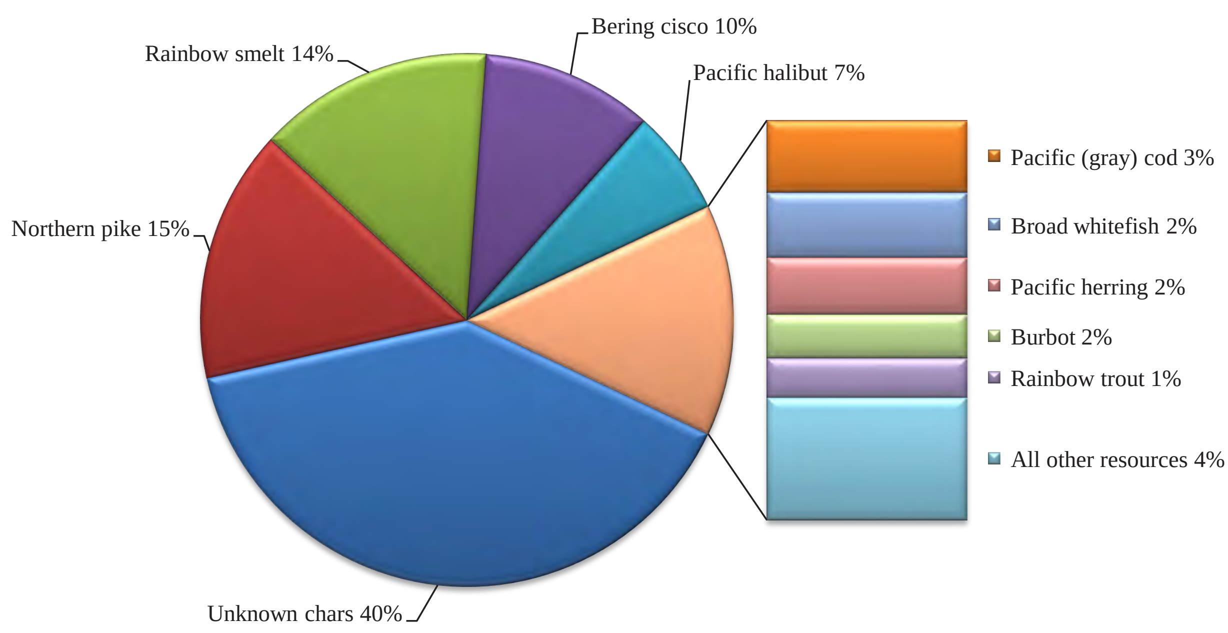
Source ADF&G Division of Subsistence household surveys, 2018.

Table 6-4.–Top ranked nonsalmon fish and marine invertebrate resources used by households, Quinhagak, 2017.

Rank[a]	Resource	Percentage of households using
1.	Unknown chars	80.6%
2.	Rainbow smelt	73.1%
3.	Bering cisco	66.7%
4.	Arctic grayling	38.7%
4.	Northern pike	38.7%
6.	Pacific halibut	36.6%
7.	Rainbow trout	33.3%
8.	Pacific herring roe	26.9%
9.	Pacific herring	23.7%
9.	Alaska blackfish	23.7%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Resources used by the same percentage of households share the lowest rank value instead of having sequential rank values.



Note The "all other resources" category represents all species that contributed less than 1% to the total harvest.

Figure 6-5.–Top nonsalmon fish and marine invertebrate resources harvested by percentage of total harvest weight, Quinhagak, 2017.

Table 6-5.–Estimated harvest and use of nonsalmon fish and marine invertebrates, Quinhagak, 2017.

	Percentage of households					Harvest weight (lb)			Harvest amount			
Resource	Using	Attempting harvest	Harvesting	Receiving	Giving away	Total	Mean per household	Per capita	Total	Unit	Mean per household	95% confidence limit (±) harvest
All surveyed resources	**90.3**	**80.6**	**80.6**	**73.1**	**57.0**	**53,663.8**	**335.4**	**80.6**	**53,663.8**	**lb**	**335.4**	**18.4**
Nonsalmon fish	**90.3**	**79.6**	**79.6**	**72.0**	**55.9**	**53,299.8**	**333.1**	**80.1**	**53,299.8**	**lb**	**333.1**	**18.6**
Pacific herring	23.7	9.7	9.7	15.1	5.4	1,075.3	6.7	1.6	179.2	gal	1.1	69.4
Pacific herring roe	26.9	2.2	1.1	24.7	3.2	5.2	0.0	0.0	0.9	gal	0.0	128.5
Rainbow smelt	73.1	62.4	62.4	20.4	23.7	7,676.5	48.0	11.5	1,279.4	gal	8.0	42.8
Pacific (gray) cod	15.1	10.8	10.8	5.4	7.5	1,362.9	8.5	2.0	425.9	ind	2.7	80.2
Saffron cod	10.8	6.5	6.5	4.3	3.2	109.7	0.7	0.2	18.3	gal	0.1	65.3
Walleye pollock (whiting)	4.3	2.2	2.2	2.2	1.1	31.3	0.2	0.0	22.4	ind	0.1	92.8
Flounders	8.6	7.5	7.5	1.1	0.0	98.4	0.6	0.1	89.5	ind	0.6	68.5
Pacific halibut	36.6	18.3	16.1	21.5	10.8	3,448.6	21.6	5.2	3,448.6	lb	21.6	42.9
Sculpins	2.2	2.2	2.2	0.0	0.0	13.8	0.1	0.0	13.8	ind	0.1	101.3
Sticklebacks (needlefish)	1.1	0.0	0.0	1.1	0.0	0.0	0.0	0.0	0.0	gal	0.0	0.0
Alaska blackfish	23.7	8.6	8.6	17.2	3.2	457.9	2.9	0.7	76.3	gal	0.5	64.9
Burbot	14.0	6.5	6.5	10.8	4.3	823.7	5.1	1.2	196.1	ind	1.2	75.8
Lake trout	1.1	1.1	1.1	0.0	0.0	23.2	0.1	0.0	8.6	ind	0.1	128.5
Unknown chars	80.6	71.0	71.0	29.0	36.6	21,191.4	132.4	31.8	6,421.6	ind	40.1	22.2
Arctic grayling	38.7	36.6	36.6	4.3	10.8	313.1	2.0	0.5	447.3	ind	2.8	26.3
Northern pike	38.7	21.5	21.5	20.4	9.7	8,233.3	51.5	12.4	2,494.9	ind	15.6	36.9
Sheefish	2.2	2.2	2.2	0.0	1.1	47.3	0.3	0.1	8.6	ind	0.1	92.2
Rainbow trout	33.3	31.2	30.1	6.5	7.5	738.8	4.6	1.1	527.7	ind	3.3	56.3
Unknown trouts	1.1	1.1	1.1	0.0	0.0	7.2	0.0	0.0	5.2	ind	0.0	128.5
Broad whitefish	12.9	6.5	6.5	6.5	5.4	1,218.1	7.6	1.8	304.5	ind	1.9	77.5
Bering cisco	66.7	48.4	48.4	31.2	32.3	5,584.6	34.9	8.4	3,989.0	ind	24.9	29.1
Least cisco	2.2	2.2	2.2	0.0	0.0	277.0	1.7	0.4	395.7	ind	2.5	112.8
Humpback whitefish	10.8	3.2	3.2	7.5	2.2	541.9	3.4	0.8	309.7	ind	1.9	108.4
Round whitefish	2.2	2.2	2.2	0.0	0.0	20.6	0.1	0.0	20.6	ind	0.1	109.0
Unknown whitefishes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Unknown nonsalmon fish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0

-continued-

Table 6-5.–Continued.

Resource	Percentage of households: Using	Attempting harvest	Harvesting	Receiving	Giving away	Harvest weight (lb): Total	Mean per household	Per capita	Harvest amount: Total	Unit	Mean per household	95% confidence limit (±) harvest
Marine invertebrates	**20.4**	**9.7**	**8.6**	**12.9**	**1.1**	**364.0**	**2.3**	**0.5**	**364.0**	**lb**	**2.3**	**81.5**
Razor clams	1.1	1.1	1.1	0.0	0.0	2.6	0.0	0.0	0.9	gal	0.0	128.5
Unknown clams	17.2	6.5	5.4	11.8	1.1	255.7	1.6	0.4	85.2	gal	0.5	105.0
Unknown cockles	2.2	1.1	1.1	1.1	0.0	103.2	0.6	0.2	34.4	gal	0.2	128.5
Red king crab	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Unknown mussels	1.1	1.1	1.1	0.0	0.0	2.6	0.0	0.0	1.7	gal	0.0	128.5
Shrimps	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	gal	0.0	0.0
Unknown marine invertebrates	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	gal	0.0	0.0

Source ADF&G Division of Subsistence household surveys, 2018.

Note Resources where the percentage using is greater than the combined received and harvest indicate use from resources obtained during a previous year.

In 2017, 71% of Quinhagak households fish caught about 6,422 chars, which weighed 21,191 lb, or 32 lb per capita (Table 6-5). Chars were the most widely sought nonsalmon resource (71% of households fished for them) and also the most commonly shared (37% of households gave away chars and 29% received them). One respondent described a system of sharing that includes a lot of people who go fishing once in a while, and share, such that "nobody has to go all the time."[27] Bering cisco and rainbow trout are harvested incidentally when fishing in the river: "we catch different kinds of fish, even rainbows, accidentally" (021217KWN2). Bering cisco was the second most widely shared nonsalmon fish in 2017, given away by 32% of households. Many people like rainbow trout: one woman described the fish as sweeter than the other trout (110218KWN9). However, some do not like to eat them because they eat mice (110218KWN9; 021317KWN3). One key respondent chuckled as he wondered how the same people eat pike, which "eat anything" (021217KWN2). Although no households reported intentionally fishing for their dogs, rainbow trout are the nonsalmon fish most often used as dog food (Table 6-6).

Smelt are a popular target and the results indicate that about 62% of households harvested 7,677 lb (1,279 gallons) of these small fish (Table 6-5). Fishers said that they sometimes catch saffron cod when they are fishing for smelt; the 2017 saffron cod harvest came to an estimated 110 lb. Fishers reported occasionally catching Arctic grayling incidentally; they described it as a "sushi fish" and said that they usually eat it fresh and raw on site (021417KWN6; 021317KWN3; 021217KWN2).

Of the six species of whitefish that occur along Alaska's Bering Sea coast, only round whitefish and Bering cisco are reliably found in the Kanektok River; round whitefish are very small and swim through most nets. Bering cisco is the most harvested whitefish in Quinhagak; fishers harvested 5,585 lb in 2017 (Table 6-5). Quinhagak residents also harvested other whitefishes, especially broad whitefish (1,218 lb), although in smaller amounts because of the distance to fishing locations.

About 18% of households went fishing on the ocean to target halibut, and 16% successfully harvested 3,449 lb of that fish. Pacific cod and walleye pollock are sometimes caught when fishing for halibut. About 15% of households used 1,363 lb of Pacific cod, and 4% of households used 31 lb of walleye pollock.

Quinhagak fishers used a few different gear types for nonsalmon fishing, especially hooks (Figure 6-6; Table 6-7). Survey data indicate that fishers caught 54% of the nonsalmon finfish weight by fishing with a hook through ice and 28% by fishing with a hook in open water (Table 6-8). More smelt was taken in open water than would have been if ice had set up normally in the fall of 2017; many fishers reported jigging for smelt from a boat or the river bank through open water instead of ice.

Marine invertebrates were neither widely nor heavily harvested by Quinhagak residents and one household did not find clams when they went to look. However, an estimated total of 364 lb were produced from about 85 gallons of clams, 34 gallons of cockles, and almost two gallons of mussels (Table 6-5; Figure D6-2). The communitywide average harvest per household was just over two pounds.

Table 6-6.–Estimated harvest of nonsalmon fish for consumption by dogs, Quinhagak, 2017.

Resource	Amount	Pounds
Nonsalmon fish		
Northern pike	1.7 ind	5.7 lb
Rainbow trout	27.5 ind	38.5 lb
Bering cisco	8.6 ind	12.0 lb
Total	**37.8 ind**	**56.3 lb**

Source ADF&G Division of Subsistence household surveys, 2018.

27. A. Godduhn field notes, November 3, 2018.

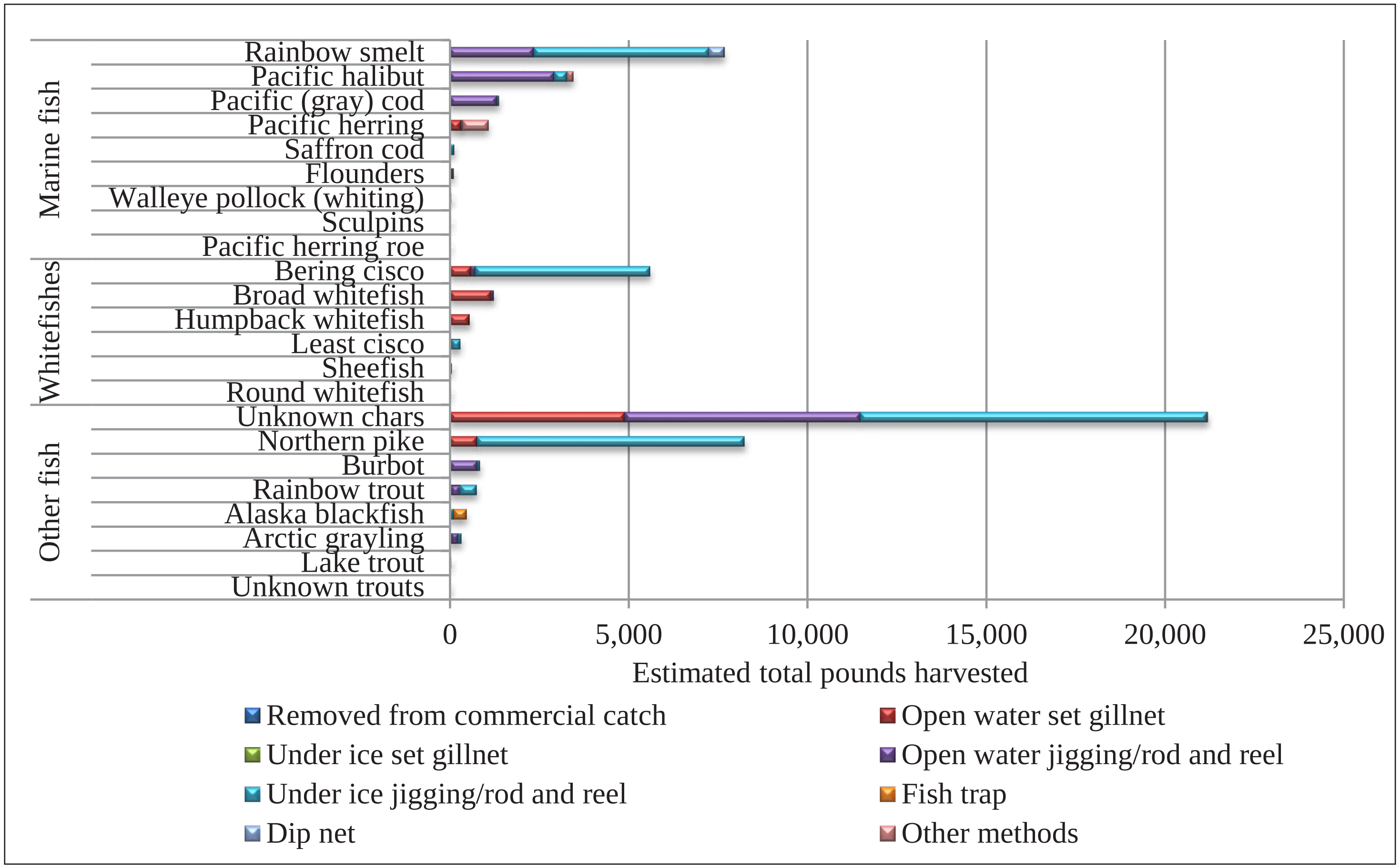


Figure 6-6.–Estimated harvest of nonsalmon fish by gear type, Quinhagak, 2017.

Table 6-7.–Estimated harvest of nonsalmon fish by gear type, Quinhagak, 2017.

				Subsistence methods																	
		Removed from commercial catch		Open water set gillnet		Under ice set gillnet		Open water jigging/rod and reel		Under ice jigging/rod and reel		Fish trap		Dip net		Other method		Subsistence gear, any method		Any method	
Resource	Units	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds	Number[a]	Pounds
Nonsalmon fish			**11.4**		**8,409.2**		**0.0**		**14,645.9**		**28,487.0**		**354.6**		**435.4**		**956.3**		**53,288.4**		**53,299.8**
Pacific herring	gal	0.0	0.0	51.9	311.4	0.0	0.0	0.0	0.0	6.9	41.3	0.0	0.0	0.0	0.0	120.4	722.6	179.2	1,075.3	179.2	1,075.3
Pacific herring roe	gal	0.0	0.0	0.9	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	5.2	0.9	5.2
Rainbow smelt	gal	0.0	0.0	0.0	0.0	0.0	0.0	389.4	2,336.3	816.0	4,896.1	0.0	0.0	72.3	433.5	1.7	10.4	1,279.4	7,676.5	1,279.4	7,676.5
Pacific (gray) cod	ind	0.0	0.0	0.0	0.0	0.0	0.0	408.7	1,307.8	17.2	55.1	0.0	0.0	0.0	0.0	0.0	0.0	425.9	1,362.9	425.9	1,362.9
Saffron cod	gal	0.0	0.0	0.0	0.0	0.0	0.0	0.6	3.6	17.7	106.1	0.0	0.0	0.0	0.0	0.0	0.0	18.3	109.7	18.3	109.7
Walleye pollock (whiting)	ind	0.0	0.0	0.0	0.0	0.0	0.0	22.4	31.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.4	31.3	22.4	31.3
Flounders	ind	0.0	0.0	56.8	62.5	0.0	0.0	22.4	24.6	0.0	0.0	0.0	0.0	1.7	1.9	8.6	9.5	89.5	98.4	89.5	98.4
Pacific halibut	lb	0.0	0.0	0.0	0.0	0.0	0.0	2,900.2	2,900.2	363.0	363.0	0.0	0.0	0.0	0.0	185.4	185.4	3,448.6	3,448.6	3,448.6	3,448.6
Sculpins	ind	0.0	0.0	10.3	10.3	0.0	0.0	3.4	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.8	13.8	13.8	13.8
Sticklebacks (needlefish)	gal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alaska blackfish	gal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	17.2	103.2	59.1	354.6	0.0	0.0	0.0	0.0	76.3	457.9	76.3	457.9
Burbot	ind	0.0	0.0	0.0	0.0	0.0	0.0	180.6	758.7	15.5	65.0	0.0	0.0	0.0	0.0	0.0	0.0	196.1	823.7	196.1	823.7
Lake trout	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.6	23.2	0.0	0.0	0.0	0.0	0.0	0.0	8.6	23.2	8.6	23.2
Unknown chars	ind	3.4	11.4	1,476.1	4,871.2	0.0	0.0	1,998.2	6,594.1	2,935.3	9,686.4	0.0	0.0	0.0	0.0	8.6	28.4	6,418.2	21,180.0	6,421.6	21,191.4
Arctic grayling	ind	0.0	0.0	53.3	37.3	0.0	0.0	270.1	189.1	123.9	86.7	0.0	0.0	0.0	0.0	0.0	0.0	447.3	313.1	447.3	313.1
Northern pike	ind	0.0	0.0	228.8	755.1	0.0	0.0	1.7	5.7	2,264.4	7,472.5	0.0	0.0	0.0	0.0	0.0	0.0	2,494.9	8,233.3	2,494.9	8,233.3
Sheefish	ind	0.0	0.0	8.6	47.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.6	47.3	8.6	47.3
Rainbow trout	ind	0.0	0.0	12.0	16.9	0.0	0.0	186.1	260.5	329.6	461.4	0.0	0.0	0.0	0.0	0.0	0.0	527.7	738.8	527.7	738.8
Unknown trouts	ind	0.0	0.0	0.0	0.0	0.0	0.0	5.2	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.2	7.2	5.2	7.2
Broad whitefish	ind	0.0	0.0	285.6	1,142.4	0.0	0.0	18.9	75.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	304.5	1,218.1	304.5	1,218.1
Bering cisco	ind	0.0	0.0	416.6	583.2	0.0	0.0	94.6	132.5	3,477.8	4,868.9	0.0	0.0	0.0	0.0	0.0	0.0	3,989.0	5,584.6	3,989.0	5,584.6
Least cisco	ind	0.0	0.0	51.6	36.1	0.0	0.0	0.0	0.0	344.1	240.9	0.0	0.0	0.0	0.0	0.0	0.0	395.7	277.0	395.7	277.0
Humpback whitefish	ind	0.0	0.0	301.1	526.9	0.0	0.0	8.6	15.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	309.7	541.9	309.7	541.9
Round whitefish	ind	0.0	0.0	3.4	3.4	0.0	0.0	0.0	0.0	17.2	17.2	0.0	0.0	0.0	0.0	0.0	0.0	20.6	20.6	20.6	20.6
Unknown whitefishes	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unknown nonsalmon fish	ind	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source ADF&G Division of Subsistence household surveys, 2018.

Table 6-8.–Estimated percentages of nonsalmon harvest weight by gear type, Quinhagak, 2017.

Resource	Percentage base	Removed from commercial catch	Subsistence methods: Open water set gillnet	Under ice set gillnet	Open water jigging/rod and reel	Under ice jigging/rod and reel	Fish trap	Dip net	Other method	Subsistence gear, any method	Any method
Nonsalmon fish	**Gear type**	**100.0%**	**100.0%**	**0.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
	Resource	**0.0%**	**15.8%**	**0.0%**	**27.5%**	**53.4%**	**0.7%**	**0.8%**	**1.8%**	**100.0%**	**100.0%**
	Total	**0.0%**	**15.8%**	**0.0%**	**27.5%**	**53.4%**	**0.7%**	**0.8%**	**1.8%**	**100.0%**	**100.0%**
Pacific herring	Gear type	0.0%	3.7%	0.0%	0.0%	0.1%	0.0%	0.0%	75.6%	2.0%	2.0%
	Resource	0.0%	29.0%	0.0%	0.0%	3.8%	0.0%	0.0%	67.2%	100.0%	100.0%
	Total	0.0%	0.6%	0.0%	0.0%	0.1%	0.0%	0.0%	1.4%	2.0%	2.0%
Pacific herring roe	Gear type	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Resource	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Rainbow smelt	Gear type	0.0%	0.0%	0.0%	16.0%	17.2%	0.0%	99.6%	1.1%	14.4%	14.4%
	Resource	0.0%	0.0%	0.0%	30.4%	63.8%	0.0%	5.6%	0.1%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	4.4%	9.2%	0.0%	0.8%	0.0%	14.4%	14.4%
Pacific (gray) cod	Gear type	0.0%	0.0%	0.0%	8.9%	0.2%	0.0%	0.0%	0.0%	2.6%	2.6%
	Resource	0.0%	0.0%	0.0%	96.0%	4.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	2.5%	0.1%	0.0%	0.0%	0.0%	2.6%	2.6%
Saffron cod	Gear type	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%	0.0%	0.2%	0.2%
	Resource	0.0%	0.0%	0.0%	3.3%	96.7%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.2%	0.2%
Walleye pollock (whiting)	Gear type	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
	Resource	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
Flounders	Gear type	0.0%	0.7%	0.0%	0.2%	0.0%	0.0%	0.4%	1.0%	0.2%	0.2%
	Resource	0.0%	63.5%	0.0%	25.0%	0.0%	0.0%	1.9%	9.6%	100.0%	100.0%
	Total	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.2%
Pacific halibut	Gear type	0.0%	0.0%	0.0%	19.8%	1.3%	0.0%	0.0%	19.4%	6.5%	6.5%
	Resource	0.0%	0.0%	0.0%	84.1%	10.5%	0.0%	0.0%	5.4%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	5.4%	0.7%	0.0%	0.0%	0.3%	6.5%	6.5%
Sculpins	Gear type	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Resource	0.0%	75.0%	0.0%	25.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Sticklebacks (needlefish)	Gear type	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Resource	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Alaska blackfish	Gear type	0.0%	0.0%	0.0%	0.0%	0.4%	100.0%	0.0%	0.0%	0.9%	0.9%
	Resource	0.0%	0.0%	0.0%	0.0%	22.5%	77.4%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.2%	0.7%	0.0%	0.0%	0.9%	0.9%
Burbot	Gear type	0.0%	0.0%	0.0%	5.2%	0.2%	0.0%	0.0%	0.0%	1.5%	1.5%
	Resource	0.0%	0.0%	0.0%	92.1%	7.9%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	1.4%	0.1%	0.0%	0.0%	0.0%	1.5%	1.5%

-continued-

Table 6-8.–Continued.

Resource	Percentage base	Removed from commercial catch	Subsistence methods: Open water set gillnet	Under ice set gillnet	Open water jigging/rod and reel	Under ice jigging/rod and reel	Fish trap	Dip net	Other method	Subsistence gear, any method	Any method
Lake trout	Gear type	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
	Resource	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Unknown chars	Gear type	100.0%	57.9%	0.0%	45.0%	34.0%	0.0%	0.0%	3.0%	39.7%	39.8%
	Resource	0.1%	23.0%	0.0%	31.1%	45.7%	0.0%	0.0%	0.1%	99.9%	100.0%
	Total	0.0%	9.1%	0.0%	12.4%	18.2%	0.0%	0.0%	0.1%	39.7%	39.8%
Arctic grayling	Gear type	0.0%	0.4%	0.0%	1.3%	0.3%	0.0%	0.0%	0.0%	0.6%	0.6%
	Resource	0.0%	11.9%	0.0%	60.4%	27.7%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.1%	0.0%	0.4%	0.2%	0.0%	0.0%	0.0%	0.6%	0.6%
Northern pike	Gear type	0.0%	9.0%	0.0%	0.0%	26.2%	0.0%	0.0%	0.0%	15.5%	15.4%
	Resource	0.0%	9.2%	0.0%	0.1%	90.8%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	1.4%	0.0%	0.0%	14.0%	0.0%	0.0%	0.0%	15.4%	15.4%
Sheefish	Gear type	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
	Resource	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%
Rainbow trout	Gear type	0.0%	0.2%	0.0%	1.8%	1.6%	0.0%	0.0%	0.0%	1.4%	1.4%
	Resource	0.0%	2.3%	0.0%	35.3%	62.5%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.5%	0.9%	0.0%	0.0%	0.0%	1.4%	1.4%
Unknown trouts	Gear type	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Resource	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Broad whitefish	Gear type	0.0%	13.6%	0.0%	0.5%	0.0%	0.0%	0.0%	0.0%	2.3%	2.3%
	Resource	0.0%	93.8%	0.0%	6.2%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	2.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	2.3%	2.3%
Bering cisco	Gear type	0.0%	6.9%	0.0%	0.9%	17.1%	0.0%	0.0%	0.0%	10.5%	10.5%
	Resource	0.0%	10.4%	0.0%	2.4%	87.2%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	1.1%	0.0%	0.2%	9.1%	0.0%	0.0%	0.0%	10.5%	10.5%
Least cisco	Gear type	0.0%	0.4%	0.0%	0.0%	0.8%	0.0%	0.0%	0.0%	0.5%	0.5%
	Resource	0.0%	13.0%	0.0%	0.0%	87.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.1%	0.0%	0.0%	0.5%	0.0%	0.0%	0.0%	0.5%	0.5%
Humpback whitefish	Gear type	0.0%	6.3%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	1.0%	1.0%
	Resource	0.0%	97.2%	0.0%	2.8%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	1.0%
Round whitefish	Gear type	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
	Resource	0.0%	16.7%	0.0%	0.0%	83.3%	0.0%	0.0%	0.0%	100.0%	100.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Unknown whitefishes	Gear type	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Resource	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Unknown nonsalmon fish	Gear type	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Resource	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

Sharing of Nonsalmon Resources

Household Specialization in Resource Harvesting

Previous studies (Wolfe 1987; Wolfe et al. 2010) have shown that in most rural Alaska communities, a relatively small portion of households produces most of the community's fish and wildlife harvests, which they share with other households. A recent study of 3,265 households in 66 rural Alaska communities found that about 33% of the households accounted for 76% of subsistence harvests (Wolfe et al. 2010). Wolfe et al. (2010) observed that factors frequently associated with higher levels of subsistence harvests included larger households with a pool of adult male labor, higher wage income, involvement in commercial fishing, and community location. Recent Division of Subsistence studies in 16 Yukon-Kuskokwim Delta communities also recorded that a minority percentage of households in each community commonly produced a majority percentage of the wild food harvest. This was true for a variety of resource categories, including nonsalmon fish (Brown et al. 2013; 2015; Ikuta et al. 2014; 2016; Runfola et al. 2017; 2018).

For Quinhagak in 2017, 70% of nonsalmon fish harvests, as estimated in pounds usable weight, were harvested by 25% of the community's households (Figure 6-7). Further analysis of the study findings, beyond the scope of this report, might identify characteristics of the highly productive households in Quinhagak and the other study communities.

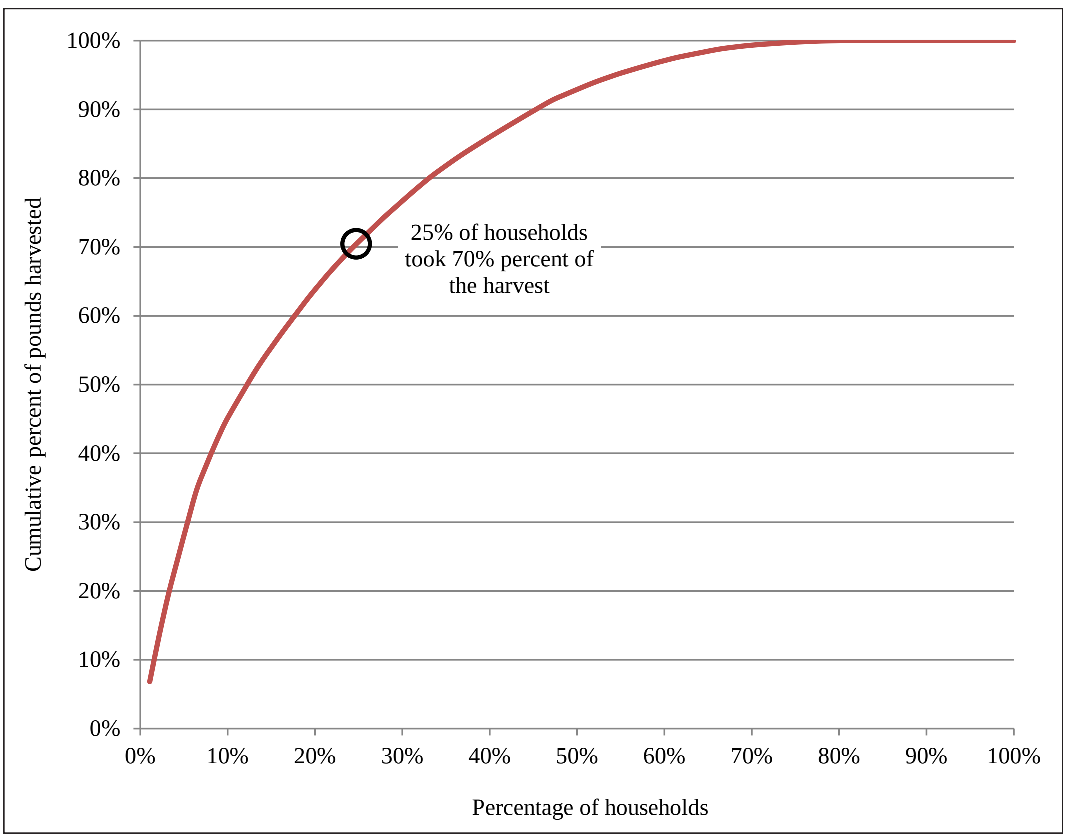


Figure 6-7.–Household specialization, Quinhagak, 2017.

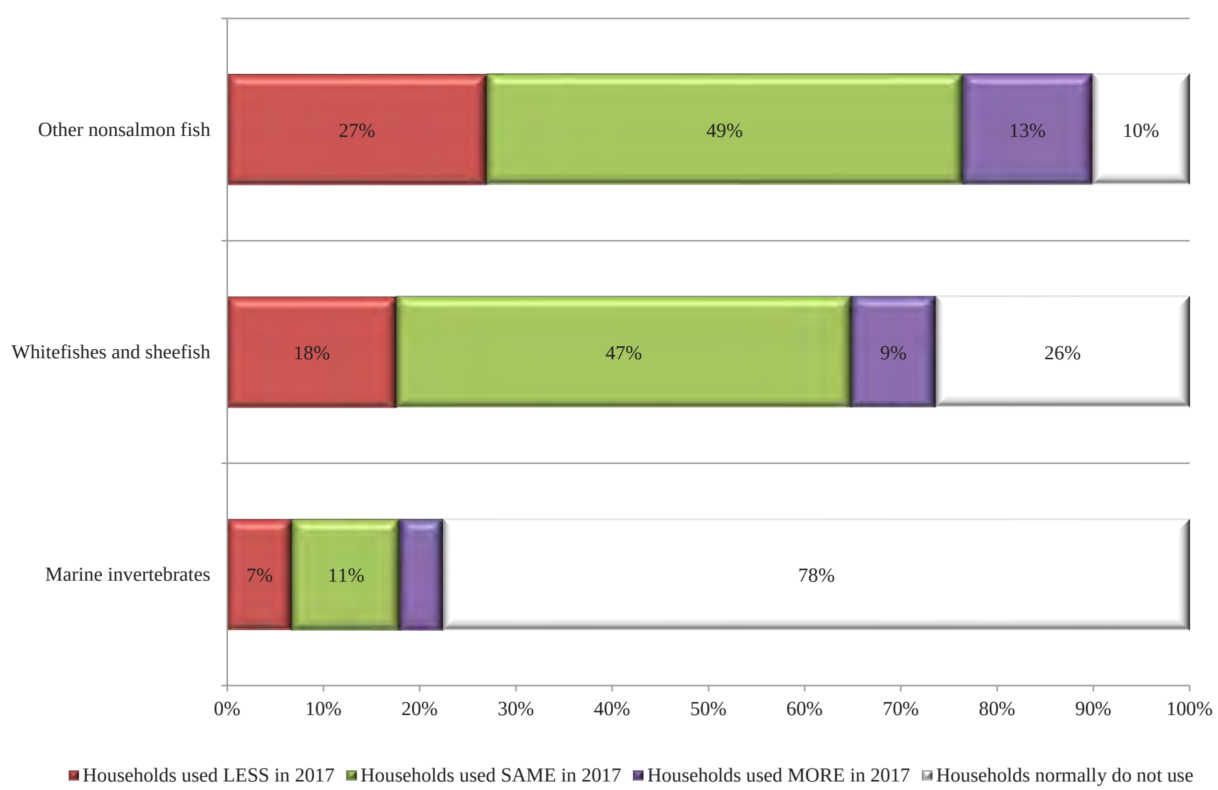
Comparing Harvests and Uses in 2017 with Previous Years

Harvest Assessments

During the surveys, researchers asked respondents to assess their use of whitefishes and sheefish, other nonsalmon fishes, and marine invertebrates in two ways. First, they asked whether the household had used more, less, or about the same amount of the resources during 2017 as compared to the last few years; if there was a change in use, researchers asked why. Second, researchers asked respondents if they got enough of the resource in 2017; if they had not gotten enough, they were asked why, how severe the impact had been, and if they had done anything differently to compensate for not getting enough.

Nearly half (47%) of households reported using about the same amount of whitefishes as usual, 18% used less, 9% used more, and a quarter (26%) said that they do not normally use whitefishes in their homes (Figure 6-8; Table D6-6). With regard to other nonsalmon fish, 62% of responding households reported using either the same or more, and 27% reported using less.

Among the households that reported reasons for using less whitefishes and sheefish, weather and environmental conditions were most often cited as the problem; some households said the fish were less available or named other reasons for a shortfall such as a lack of equipment, effort, or time (Table D6-7). More households reported reasons for using less other nonsalmon fish: a lack of effort was the most common response. They also cited family or personal reasons, weather and environmental conditions, less available resources, or a lack of equipment. Households that reported more use most often described resources as more available or that they had increased their effort; a few said that they had received more than in other recent years (Table D6-8). Most respondents who used whitefishes and other nonsalmon fish reported having gotten enough of those resources in 2017. However, 19% of responding households said



Note Percentage of surveyed households providing a valid response, unlabeled percentages are less than 5%.

Figure 6-8.–Changes in household uses of nonsalmon fish and marine invertebrates compared to recent years, Quinhagak, 2017.

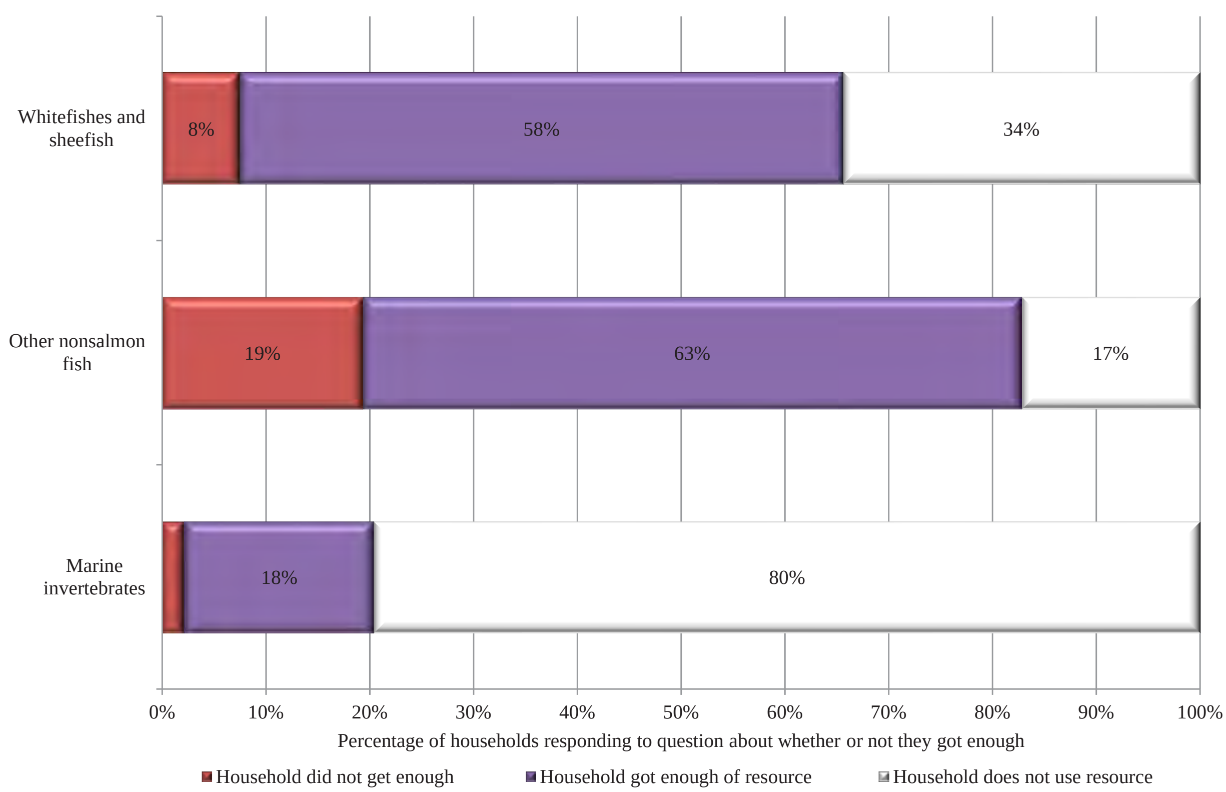
they had not gotten enough other nonsalmon fish, which compose the bulk of the nonsalmon fish harvest (Figure 6-9). Most households that had not gotten enough described the impact as minor (Table 6-9). They identified a variety of reasons that echoed the reasons given for using less, especially a lack of time, family or personal reasons, and a lack of effort (Table D6-9), and they reported using other subsistence foods or more commercial foods to make up for the shortfalls (Table D6-10).

Only 23% of households reported regular use of marine invertebrates (Table D6-6), and most of those households used about the same amount; 7% reported using less (Figure 6-8). Households describing why they used less mostly cited a lack of effort (Table D6-7); one household identified their lack of effort as related to difficult access.[28] Most households that used more shellfish said that they had received more (Table D6-8).

Appendix Table D6-10 shows nonsalmon fish and marine invertebrates that Quinhagak respondents reported using in the past but not in the present.

Harvest Data

Changes in the harvest of nonsalmon fish by Quinhagak residents can also be discerned through comparisons with findings from prior research. In 1983, ADF&G documented subsistence use patterns for the 1982 study year in four communities in Togiak NWR, including Quinhagak. The Quinhagak findings are qualified by uncertainty because the sample was limited to 12 households known for their harvest activities (Wolfe et al. 1984:23–24). In that study, salmon provided 45% of the total subsistence harvest, and nonsalmon fish contributed 19% of the total (Figure 6-10). Seventy-nine percent of the nonsalmon fish weight was char, all



Note Unlabeled percentages are less than 5%.

Figure 6-9.–Percentages of households reporting whether or not they got enough nonsalmon fish and marine invertebrates, Quinhagak, 2017.

28. Survey notes, 2018.

Table 6-9.–Reported to impact to households that did not get enough nonsalmon fish or marine invertebrates, Quinhagak, 2017.

		Households not getting enough _______ .				Impact to those not getting enough ______ .										
	Sample	Valid responses[a]		Did not get enough		No response		Not noticeable		Minor		Major		Severe		
Resource category	households	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	
Whitefishes and sheefish	93	61	65.6%	7	11.5%	2	28.6%	0	0.0%	4	57.1%	1	14.3%	0	0.0%	
Other nonsalmon fish	93	77	82.8%	18	23.4%	3	16.7%	2	11.1%	12	66.7%	1	5.6%	0	0.0%	
Marine invertebrates	93	19	20.4%	2	10.5%	0	0.0%	1	50.0%	1	50.0%	0	0.0%	0	0.0%	

Source ADF&G Division of Subsistence household surveys, 2018.

a. Includes households failing to respond to the question and those households that never used the resource.

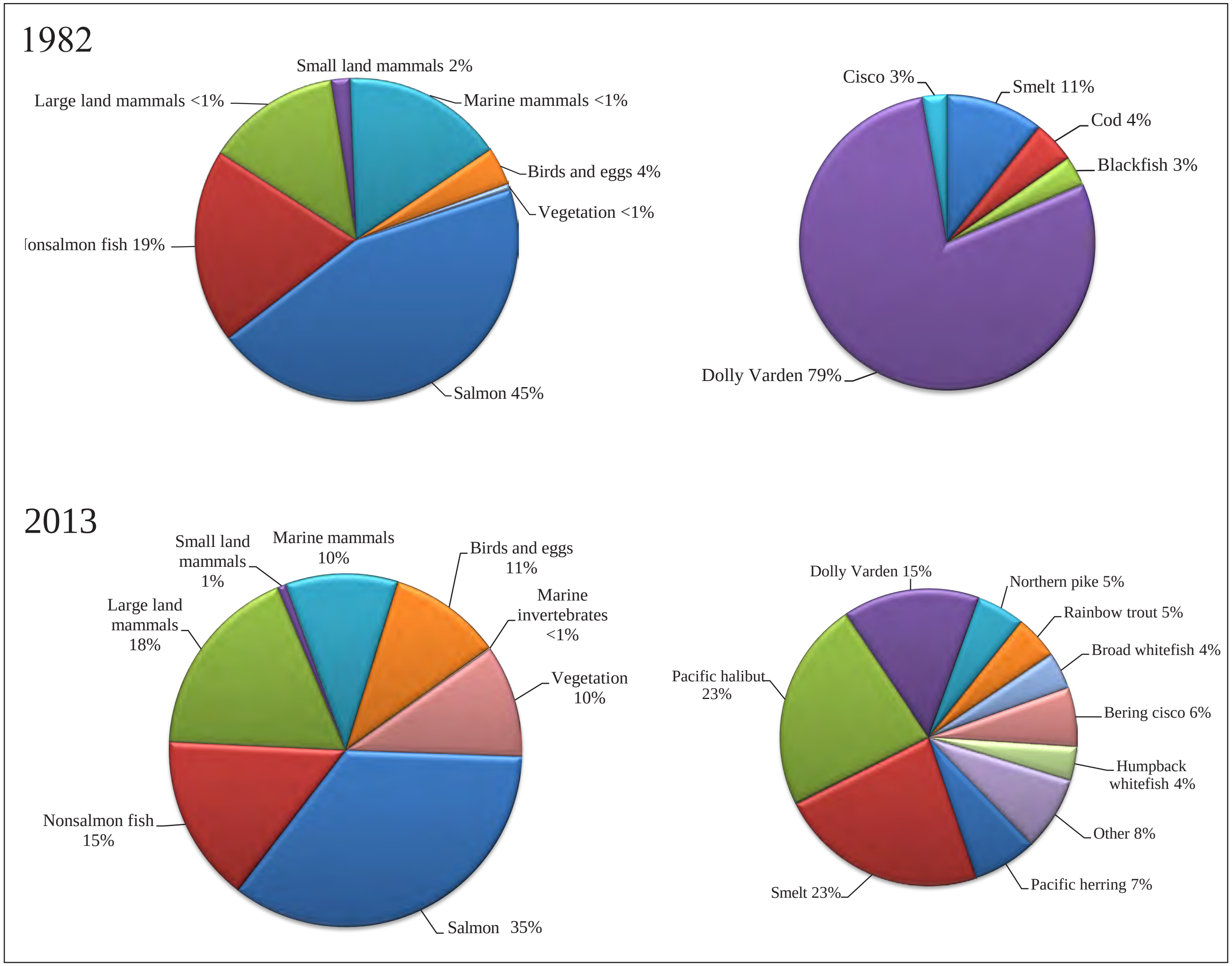


Figure 6-10.–Composition of total harvest (left) and nonsalmon fish harvest (right), Quinhagak, 1982 and 2013.

identified as Dolly Varden; smelt was the second highest nonsalmon fish harvest, providing about 11% of the weight. Saffron cod, Alaska blackfish, and whitefishes (Bering cisco and round whitefish; Wolfe et al. 1984:318), made up similar proportions of the remainder. Several resources reported as used in 2013 and 2017 were neither queried nor reported as harvested in 1982, including pike, burbot, and halibut.

For the 2013 study year, Ikuta et al. (2016) surveyed a 67% random sample of households. In 2013, all fish (salmon and nonsalmon) made up 50% of the total wild food harvest and nonsalmon fish composed about 15% of the total. The surveys for 2013 differentiated between Dolly Varden and Arctic char: of an estimated 5,121 lb of chars, about 4,938 lb was Dolly Varden that provided 15% of the nonsalmon fish harvest. Halibut made up nearly a quarter of the nonsalmon weight in 2013: the same proportion as smelt (23%). Pike, described as received in 1982 (Wolfe et al. 1984:367–368,416) accounted for 5% of the nonsalmon fish harvest in 2013 (Ikuta et al. 2016). Broad and humpback whitefish each contributed an estimated 4% of the 2013 nonsalmon weight.

The 1982 and 2013 nonsalmon harvest composition data in Figure 6-10 can be compared to Figure D6-1 2017. Results of this study indicated that chars made up about 40% of the nonsalmon fish harvest in 2017; fishers caught pike and smelt in similar proportions of the total (15% and 14%).

These figures identify the relative portions of the estimated nonsalmon fish harvest, but the actual amount of food derived from these harvests can be compared as well (Table 6-10[29]). Both total and per capita harvests of nonsalmon fish varied between study years; the more recent study years documented fewer pounds harvested than estimated in 1982. The smelt harvest estimate was remarkably consistent (between 7,500 lb and 7,700 lb in all three studies). However, the population changed between the three study years: in 1982, Quinhagak had an estimated population of 427 (Wolfe et al. 1984); in 2013, 733 (Ikuta et al. 2016); and in 2017, 666 (Table 6-1). The increase in population is reflected in the per capita harvest of smelt over time

Table 6-10.–Estimated total and per capita nonsalmon fish and marine invertebrate harvests, Quinhagak, 1982, 2013, and 2017.

	Estimated harvest in pounds usable weight								
	1982			2013			2017		
Resource	Total	Per capita	CIP	Total	Per capita	CIP	Total	Per capita	CIP
Nonsalmon fish	**70,815.0**	**149.50**	**51.0%**	**33,071.6**	**45.14**	**19.7%**	**53,299.8**	**80.05**	**18.6%**
Pacific herring	-	-		2,318.5	3.16		1,075.3	1.61	
Pacific herring roe	-	-		127.1	0.17		5.2	0.01	
Smelts	7,572.0	15.99		7,543.0	10.29		7,676.5	11.53	
Cods	3,266.0	6.90		329.2	0.45		1,472.6	2.21	
Walleye pollock (whiting)	-	-		0.0	0.00		31.3	0.05	
Flounders	-	-		13.1	0.02		98.4	0.15	
Pacific halibut	-	-		7,606.4	10.38		3,448.6	5.18	
Sculpins	-	-		0.0	0.00		13.8	0.02	
Alaska blackfish	2,286.0	4.83		437.0	0.60		457.9	0.69	
Burbot	-	-		481.5	0.66		823.7	1.24	
Chars	55,768.0	117.74		5,120.8	6.99		21,191.4	31.83	
Northern pike	-	-		367.1	0.50		8,233.3	12.37	
Sheefish	-	-		1,734.4	2.37		47.3	0.07	
Rainbow trout	-	-		258.6	0.35		738.8	1.11	
Trouts	-	-		2,021.0	2.76		746.0	1.12	
Whitefishes	1924.0	4.06		4,713.7	6.43		7,642.2	11.48	
Marine Invertebrates	**-**	**-**		**282.6**	**0.39**	**55.4%**	**364.0**	**0.55**	**81.5%**
Clams	-	-		277.9	0.38		258.2	0.39	
Mussels	-	-		4.5	0.01		2.6	0.00	
Shrimp	-	-		0.2	0.00		0.0	0.00	

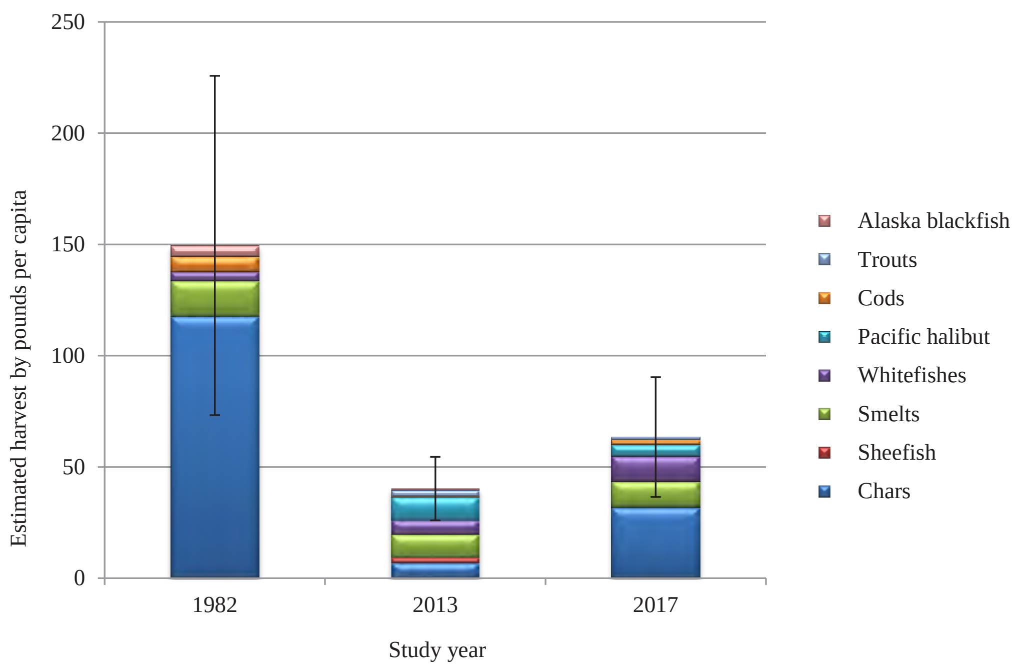
Sources For 2017, ADF&G Division of Subsistence household surveys, 2018; for previous study years, ADF&G Division of Subsistence Community Subsistence Information System (CSIS).

29. The more recent studies split groups of fish more extensively into species, in contrast with the 1982 study. In figures 6-10 and 6-11 and Table 6-10, some fish species were combined for comparison to the 1982 data. For example, "cod" includes both saffron cod and Pacific cod, and "whitefishes" includes six species: round, broad, and humpback whitefishes, Bering cisco and least cisco, and sheefish.

which decreased as roughly the same amount of fish were shared among more people (16 lb in 1982, 10 lb in 2013, and 12 lb in 2017). Whitefish harvests consistently increased, in part because fishers became accustomed to traveling to the Eek River to harvest broad and humpback whitefish (021217KWN2). Neither pike nor halibut had been reported in 1982, so no actual trend can be determined; however, fishers reported harvesting nearly four times as much pike in 2017 compared to 2013, but only about half as much halibut. Some fishers started targeting pike with nets to attempt to eliminate them (021517KWN7, 021317KWN3). Alaska blackfish harvests declined by over 75% from the 1980s, but the 2017 harvest was very slightly higher than in 2013. Figure 6-11 compares the per capita harvest by weight for eight kinds of fish that provided at least two pounds per capita during at least one of the study years.

Current and Historical Harvest Areas

In 2017, surveyed Quinhagak residents mostly fished close to home but some traveled considerable distances to harvest nonsalmon fish (Figure 6-12) or marine invertebrates (Figure 6-13). Chars were caught from the Kanektok and Arolik rivers; rainbow trout, Arctic grayling, and Bering cisco are occasionally caught incidentally to chars (figures 6-14 and 6-15). At least one resident went as far as Canyon Lake, which drains to the Goodnews River, to fish for chars and lake trout in 2017; lake trout was also occasionally caught in the Kanektok River or Arolik River. Bering cisco is targeted and often caught incidentally in the Kanektok River, and broad whitefish is occasionally caught near the mouth (Figure 6-15). One key respondent said that round whitefish and Bering cisco are reliably available in the Kanektok River, but Quinhagak fishers have to travel to catch other kinds of whitefishes (021317KWN3). Some fishers take their nets to Warehouse Creek, where Bering cisco are abundant and sheefish rare. However, to target broad and humpback whitefish, fishers travel to the Eek River or Eenayarak River, where they also catch sheefish occasionally. Blackfish are trapped in small creeks and old river channels as they move between lakes in the fall and winter.



Note Error bars represent the upper and lower bounds of the 95% confidence interval.

Figure 6-11.–Composition of nonsalmon fish harvests in pounds per capita, Quinhagak, 1982, 2013, and 2017.

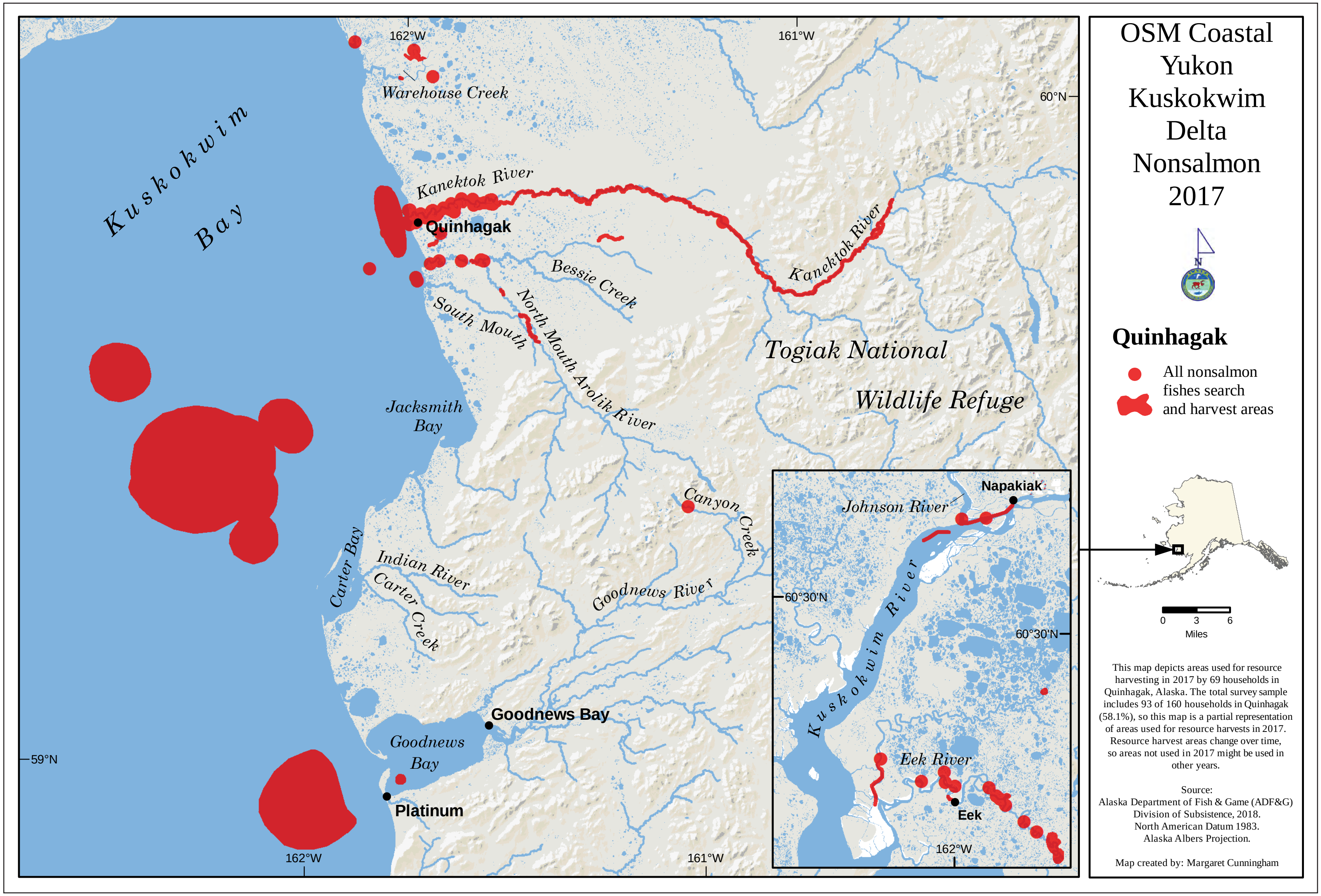


Figure 6-12.–Nonsalmon fishing areas, Quinhagak, 2017.

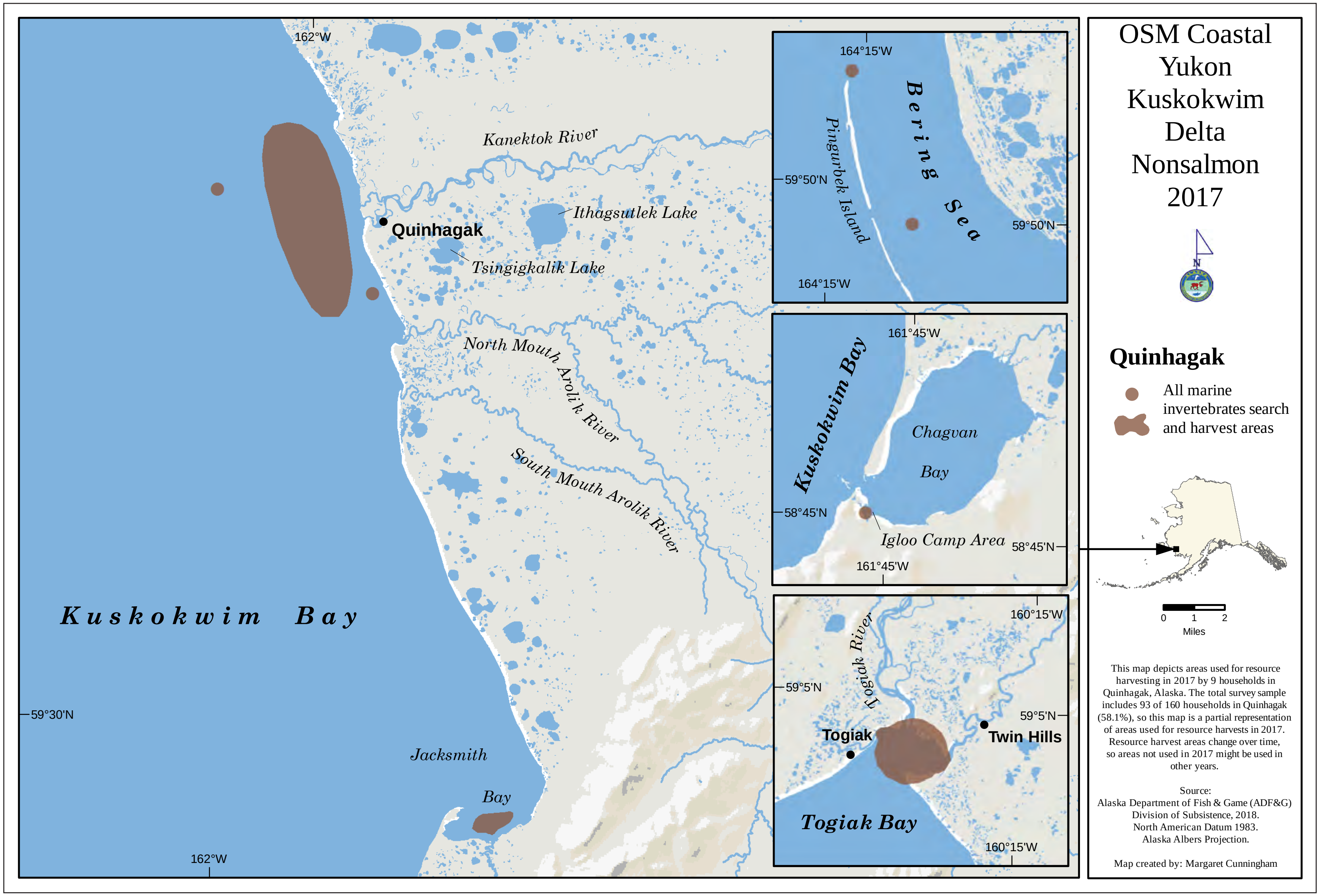


Figure 6-13.–Marine invertebrate collection areas, Quinhagak, 2017.

Figure 6-14.–Arctic grayling, chars, and trouts fishing areas, Quinhagak, 2017.

Figure 6-15.–Alaska blackfish, ciscoes, sheefish, and whitefishes fishing areas, Quinhagak, 2017.

Quinhagak residents often travel to target pike and burbot, although pike are said to have increased locally and some fishers reported catching as many as they can from the Kanektok Riverto control the population. About two thirds of the estimated pike harvest, by weight, was caught from the Eek and Kuskokwim rivers and about one third was harvested from the Kanektok River system (Figure 6-16)[30]; this was not the case historically, as described below. Burbot is not found in Quinhagak's immediate surroundings, but some is caught from the Eek and Kuskokwim rivers.

Smelt and saffron cod are also popular local targets for Quinhagak residents; these fish are mostly caught close to home, but some fishers travel to Warehouse Creek (Figure 6-17; Plate 6-7). Flounders and sculpins were harvested offshore near Quinhagak; many respondents noted that these catches were incidental to salmon or halibut fishing (021417KWN4; 020618KWN8; Figure 6-18) Herring is also caught offshore and in river mouths close to Quinhagak (Figure 6-19). Halibut fishing generally takes place farther offshore and to the south of Quinhagak near Jacksmith, Carter, and Goodnews bays (Figure 6-20); Pacific cod and walleye pollock are often caught incidentally when halibut fishing, and many of those fish are also brought home.

Harvest areas were not queried during the 1982 surveys (Wolfe et al. 1984). A different study in the same period produced a map of fishing areas used by Quinhagak fishers in 1982 (Fienup-Riordan 1982); the map does not specify the fishing locations but identifies many of the same areas that appear in the 2017 maps: Warehouse Creek, Kanektok River, north and south mouths of the Arolik River, large lakes in the vicinity of Quinhagak, and several miles of coast are marked to indicate fishing (Fienup-Riordan 1982:360). One map was produced for nonsalmon fishing in 2013; the map delineates fishing areas for whitefishes (primarily Bering cisco but including humpback, broad, and round whitefish), sheefish, pike, and burbot (Ikuta et al. 2016:148). All burbot, some whitefishes, and most of the pike were caught from the Eek River or places farther north of there. Of the fish delineated on the map, only whitefishes (Bering cisco and round whitefish) were caught from the Kanektok River. Subsistence fishers recognize traditional use of particular areas by family name (Wolfe et al. 1984:387; 021317KWN3).

Observations of Changes Affecting Nonsalmon Fisheries

Survey respondents were asked to describe changes that they have observed with respect to the harvest and use of nonsalmon fish and marine invertebrates. Respondents were first asked about local environmental conditions and whether any changes had affected their fishing. They were then asked about changes to nonsalmon fish and invertebrate resources; again, if changes had been seen, they were asked how the changes have affected their harvest and use of those resources. Respondents were then asked to describe any other changes that had affected their fishing. Surveyors paraphrased reported observations of change and related effects on the household's harvest and use of nonsalmon fish resources. In Quinhagak, about one half of surveyed households (60%) responded to these questions, so approximately one third of Quinhagak households are represented in the following summary of comments.

Respondents describing environmental change most commonly referenced warm fall and winter seasons in recent years (Table 6-11) and consistently described freeze-up in the fall of 2017 as very late. Although ice historically set in October, respondents said that ice had started to set in November but was not thick enough to withstand a warm storm in December that brought very high winds and rain. Respondents described shorter and warmer winters with little if any snow and poor ice conditions. Some respondents noted related changes to water level in recent years, which they described as higher in the fall and lower in the spring than historically. They also described summer weather as different; in particular, many respondents noted that wind has increased. Although river channels have always changed occasionally, respondents described how those changes are happening faster now; some related thawing permafrost to erosion, which many identified as a serious threat to the community, including the landfill and the sewage lagoon (021417KWN4). A few respondents described an increased beaver population; two explained that the dams block the movement of fish. One said he had come down the Arolik and "quit counting [beavers] at 150" (021317KWN3).

30. M. Cunningham, Research Analyst, ADF&G Division of Subsistence, personal communication, November 1, 2018.

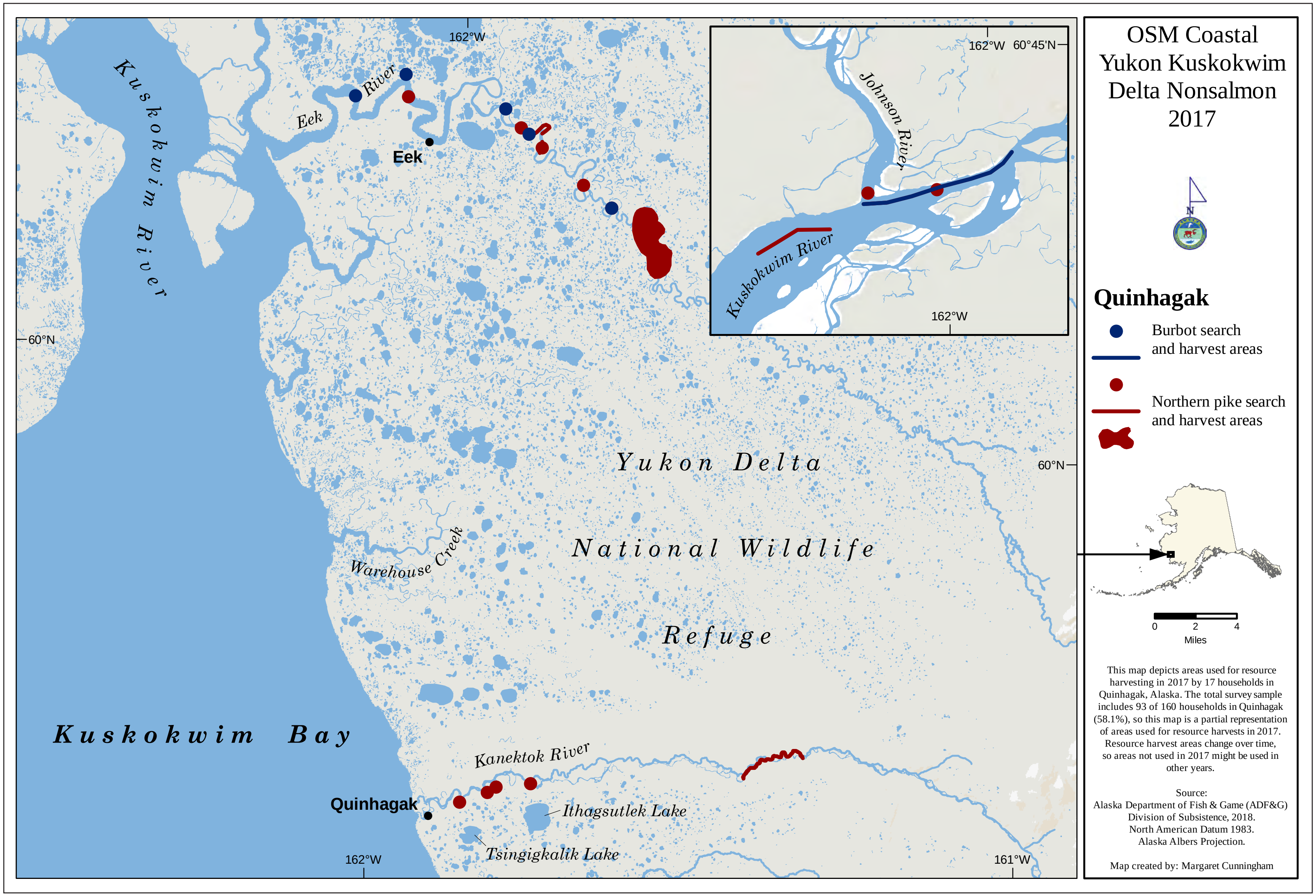


Figure 6-16.–Burbot and northern pike fishing areas, Quinhagak, 2017.

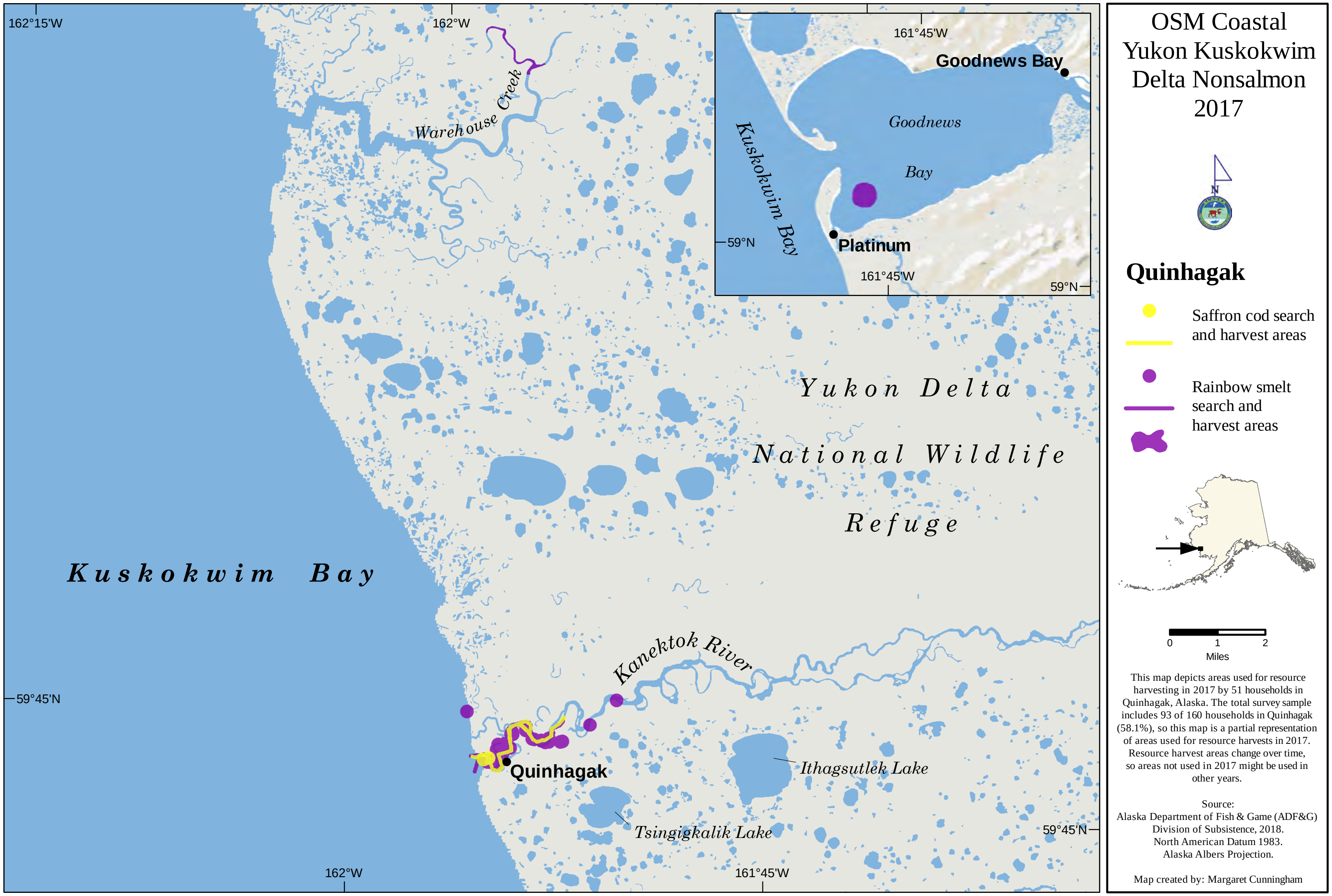


Figure 6-17.–Saffron cod and rainbow smelt fishing areas, Quinhagak, 2017.

Plate 6-7.–Aerial view of upper Warehouse Creek looking north towards the Kuskokwim River.

Many respondents who described environmental changes did not describe effects on their household's harvest of resources. Those who did identified access to resources as the primary concern with late freeze-up because poor ice conditions make both traveling and fishing more difficult, more dangerous, or impossible. One respondent explicitly stated that shorter winters result in less time to fish for nonsalmon fishes; for some households, changes near the mouth of the Kanektok River meant a longer distance to good fishing. Some households described adaptations they had employed, such as jigging through open water from the riverbank instead of through the ice. Although most households described decreasing access to fishing, at least two households stated that their access had improved in recent years: one explained that boating into November is an advantage for him, and another said that the frozen creeks are like highways without snow. Several respondents described changes to the abundance or distribution of fish that they suspect are related to environmental changes, but most did not clearly describe direct effects on the household's harvest and use of fish.

Most responses to the question about changes to nonsalmon fish resources were about fish health, and some were related to salmon (Table 6-12). Concerns for fish health were related to observations of bumps, sores, and deformities on a variety of fish, especially chars; a few of these comments indicate that sport fishing is a source of problems. Many respondents identified a new and rapidly increasing population of northern pike in the Kanektok River; they generally said that they had never seen pike locally until about ten years ago, and in the last few years the population has expanded in numbers and in area. Several comments described the abundance or general condition of fish, such as that chars were softer or nearly rotting, thinner, and less abundant, or that smelts were bigger in 2017 but less abundant. One respondent mentioned that saffron cod ("tomcod") swim farther up river than they used to, and another said the same about smelt. Beyond not eating fish that do not seem healthy, descriptions of how changes to fish had affected harvest and use were limited. Overall, the comments indicate that many households are wary of pollution and uncertain but concerned about related effects.

The other frequently mentioned change to nonsalmon fish was the presence of pike in the Kanektok River, including that pike "eat anything." One survey respondent speculated that the pike are reducing char ("trout") populations; most simply mentioned that they are new to the area. All key respondents shared these concerns and several explained that pike seem to be reducing other fish populations; they understand this as a threat to their favorite fisheries (salmon and "trout"; 021217KWN1; 021217KWN2; 021317KWN3; 021417KWN4; 021417KWN5; 021417KWN6; 021517KWN7; 020618KWN8; 110218KWN9; 110318KWN10). For example, one said "Well, some people are predicting that the pike will eat off all our trout. And I didn't

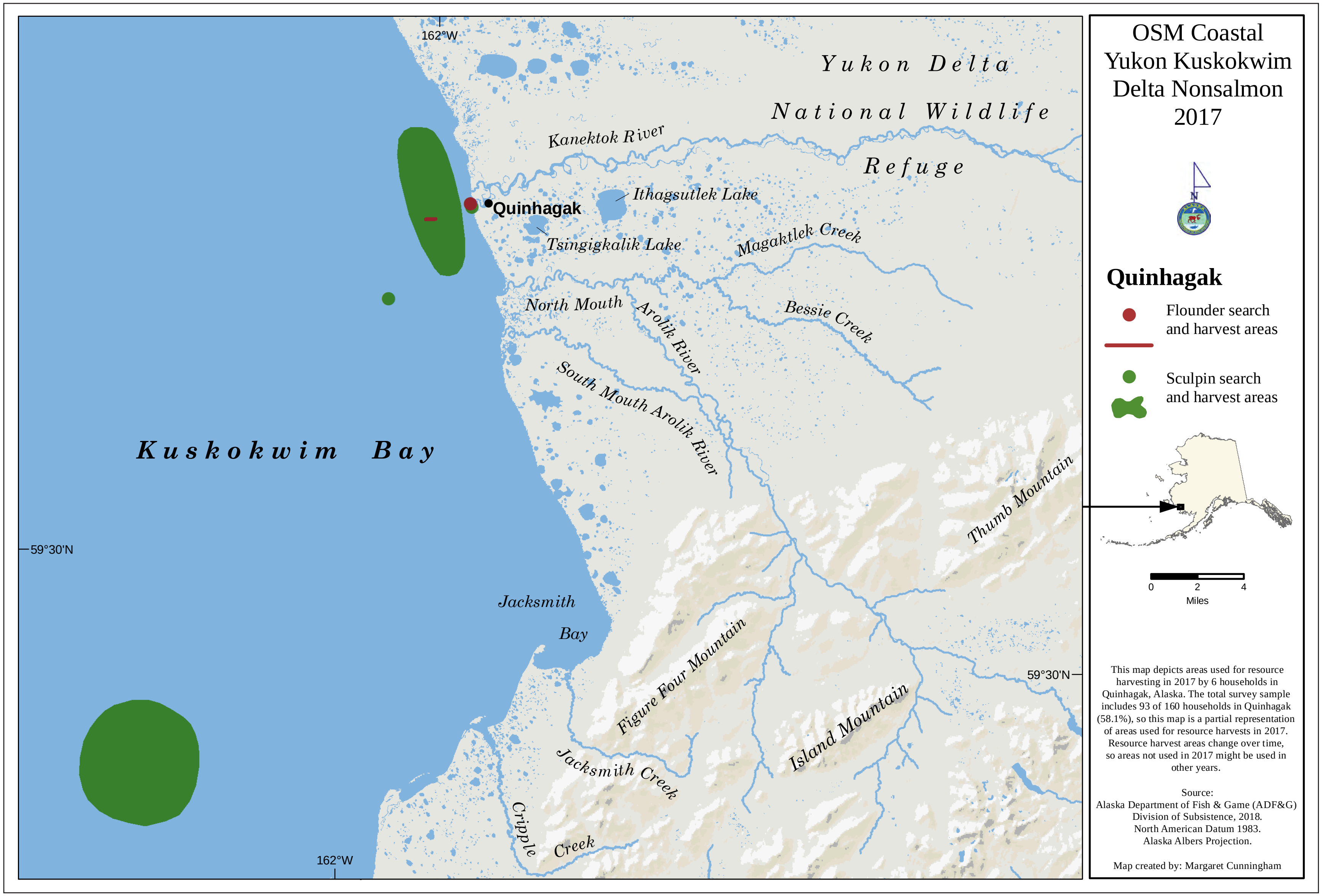


Figure 6-18.–Flounders and sculpins fishing areas, Quinhagak, 2017.

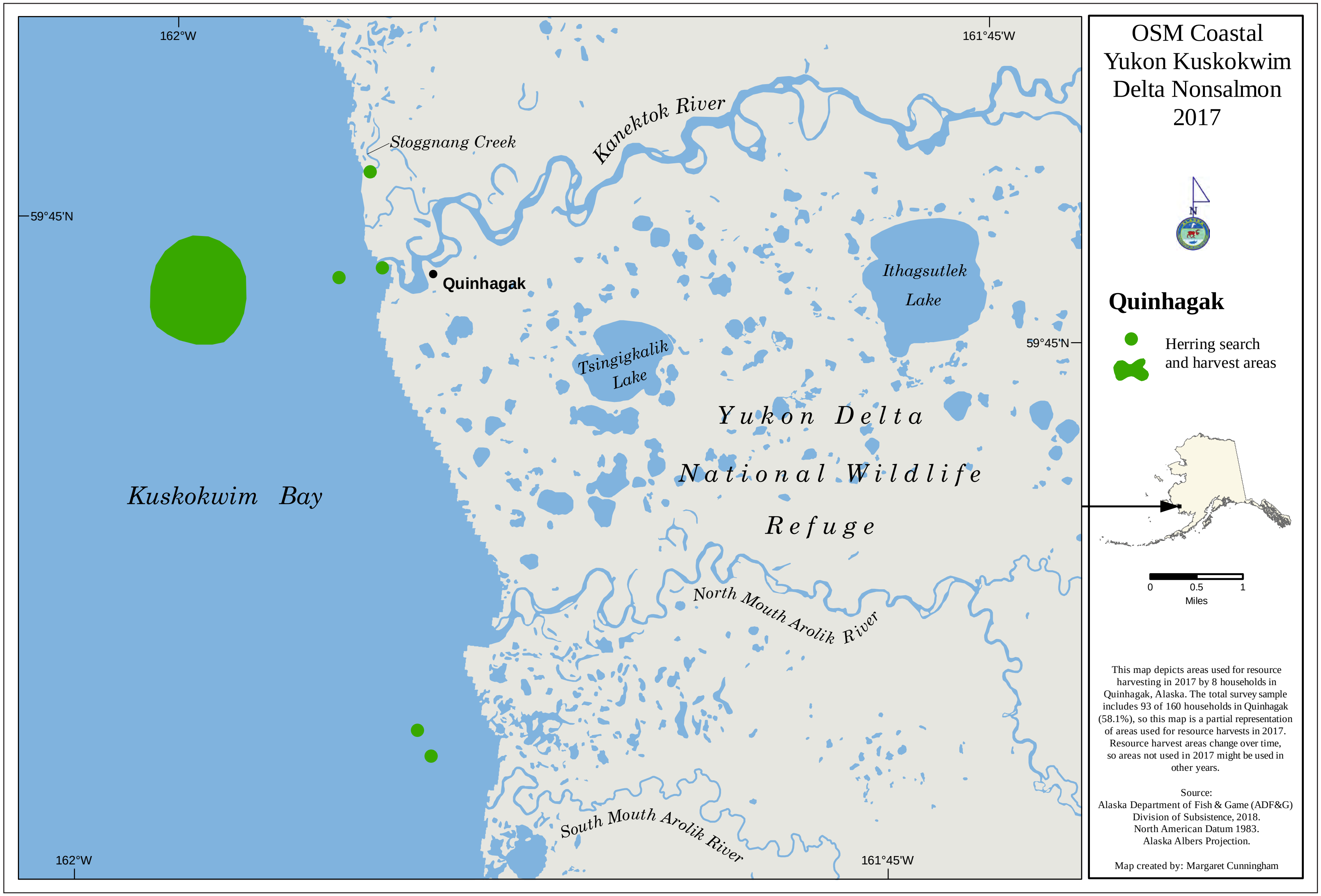


Figure 6-19.–Pacific herring fishing areas, Quinhagak, 2017.

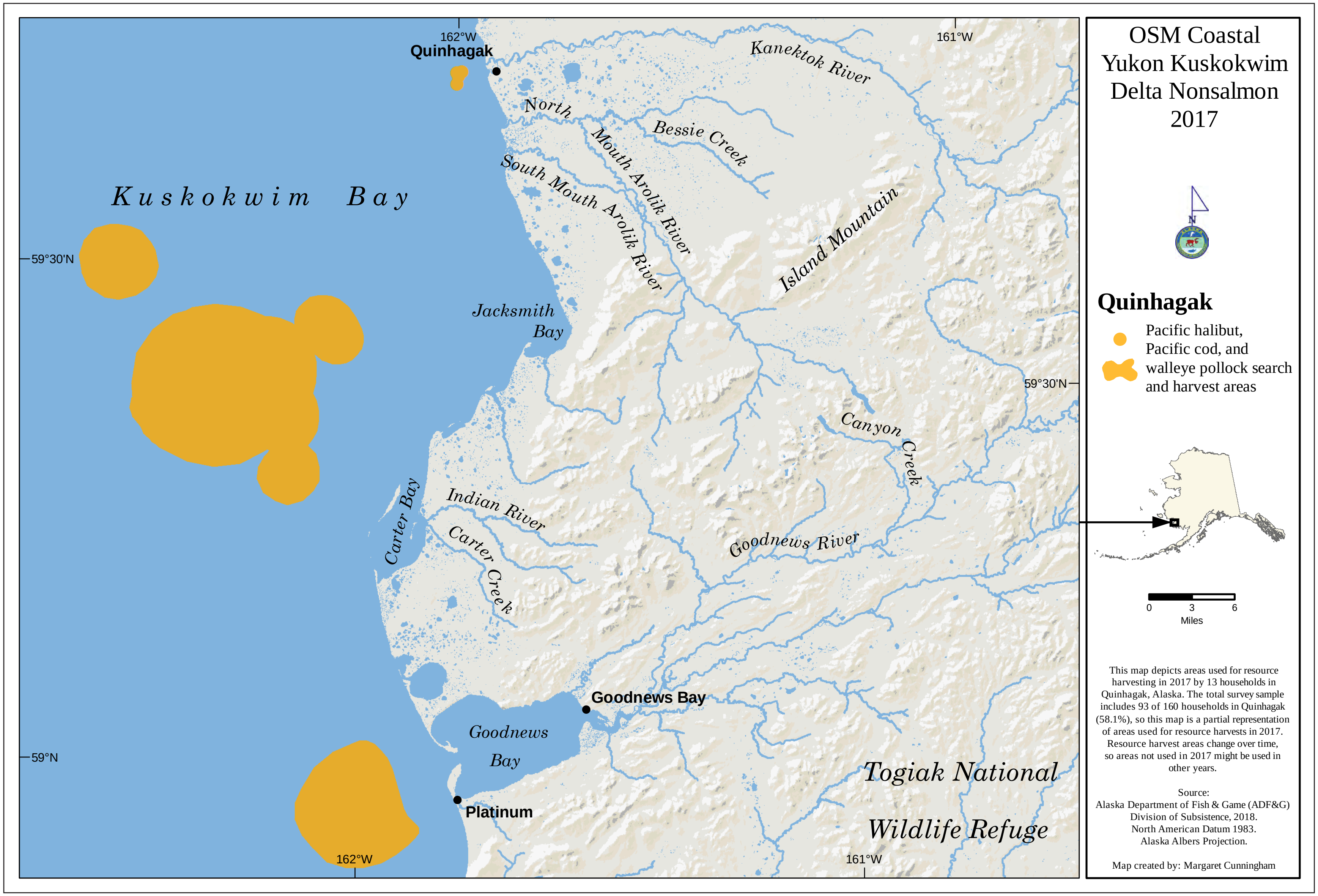


Figure 6-20.–Pacific halibut, Pacific cod, and walleye pollock fishing areas, Quinhagak, 2017.

Table 6-11.–Observations and observed effects of changes in environmental conditions, Quinhagak, 2017.

Observations	Effects
Every year the river changes so we always find new holes and good spots	Just have to find new spots, or learn them.
Less snow in 2017. Should have 50–60 feet of snow in 1900s. Lots of climate change	
Some changes on ocean shoreline [erosion].	Don't really know fish abundance during high tide.
No snow—less snow. Warmer winters, stronger winter stormes. Crazy high winds.	Boat got rolled, zero disaster relief but still hoping.
More storms, high wind, erosion.	Hard to say.
Surprised they were fishing on straight section of river farther up river than used to—calm water; warm weather.	Have to be careful aging fish because of warm weather.
Crazy winter—too hot, too cold.	Makes fishing hard.
Permafrost melt, rivers shallow. Too many beavers block off spawning grounds for sockeye, chums, pink salmon, and trout [chars].	No affect (yet?) Kings coming back, doesn't like the tagging, looks like torture. No funding for weir so need counting.
The channel is getting shallow and access very shallow.	Fishing locations are farther away. Go up river farther instead of down river.
Erosion a big problem—the river is always changing	It changes how I catch salmon
Warmer climate, the river hasn't been frozen. Little time with ice, then melted water along edges / partly open in December	Limits the time to fish
No snow, no berries, less good rain.	
Ice	Easier—rivers and creeks are like highway for 4x4.
Lots of changes 10–15 years. Drier, less berries. Everything changing. Too many beavers, rivers low, can't get upriver.	Beavers block spawning grounds; find dead fish that couldn't get through
We finally have cold weatheer this year. In the 90s, we had more snow. These winters are warmer and we have less cold fronts. The low snow creates less water in the spring.	We still harvest but less than before. Hard to travel to fishing spots.
Open water in December	Fish from bank with rod.
Weather is crazy	Fishing is good. Decrease in the 90s—kings, reds, less salmon now.
River has shifted location. Now we have to travel farther because the river has changed.	Too far to walk; our original spots were walking distance, now need ATV; get to spots less often.
Warmer water in the river and the ocean	The fish is less firm when you cook it.
Maybe	
Less snow every year. Access—late freeze and then melt, opened up again. Finally froze for real after Christmas. Finally got smelt after New Years. Last year not many to catch.	Got less fish
Lots of water, not where it's supposed to be. Maybe lakes are draining out, permafrost melt, uneven ground, weird weather, little snow, rain in December. High wind, more last few years. No snow, just ice.	4x4 instead of Snogo. Early in winter poor ice limited access.
Blackfish spot was shallow this year—Beavers? Tide was getting into it—ice water ice [layered]	Can't cross to go check when ice melts.

-continued-

Table 6-11.–Continued.

Observations	Effects
Weather warmer and warmer, less snow. More storms and more wind.	We don't go out as much—not safe.
Climate change—warmer in winter, warm except 2 weeks. Less snow, falls as rain.	Travel is difficult/dangerous until finally froze.
Very warm, no snow. Heavy storm in December. People would go fishing if the weather allowed and would share with her.	Storms have been too bad so less fishing and less sharing.
Sometimes the ice is thin and too dangerous to go out. Permafrost melting, rivers changing—lots of erosion. Tanks, drums falling into river. Higher tides.	Access getting difficult; use a longer [jigging] stick from bank, or wait.
Weather warm, no ice or snow	
Weather is warmer—late freeze-up then not biting during high tide. When tide goes out they bite. East wind best fishing like around Eek. Limited time smelting.	Less time, less fish, No snow to travel.
Less snow. Usually the rivers flood in the spring and flush everything. More beavers dam river—build dams and block spawning creeks.	Lower populations of fish and worse fishing in spring.
Yes, not enough snow.	Too hard to travel. Tussocks hard on machine and body.
Snowless winters	
Warmer even in summer. Tide is different. Higher.	
Warm weather. Summer winds.	So we can't go out on the ocean to get halibut. The seas are too rough.
Flooding comes all the way to village now, river moves around. Drought a few years ago. Now rains a lot. Winter rains, no snow, "brutal summers"—hot and dry or cold and rainy.	Not really but fish less.
Less snow, freezing later.	Making it harder to travel to fish
Warm weather affects the ice. Later freeze.	It's an advantage because I use boat and net so I cought more trout. I can fish longer.
Late freeze-up. Like this year, we had to wait till January to go ice fishing.	Less catching trouts.
No snow, no trapping, no snares. Warmer.	Difficult walking.
Rain, high water that is all there is to say. Flooding just went down [in January]	Too hard to get anywhere to fish when water too high.
The ice is thinner. Doesn't freeze up.	But still able to get out. Sons and head of household still get out on weekends.
Too warm. Less snow melt in the spring and the river takes too long to freeze.	Less time to go ice fishing and the runs are lower in the spring and summer.
Weather cause the same people on trail. ATV traffic tearing up tundra. Not all but some people.	
Climate change and ocean aciditfication is affecting salmon from what I read. Seeing different things.	
Used to walk to fishing area but channel has changed.	Now is too far to walk.
Only 3 cold weather weeks.	Weather warm, fish get fewer. [We get] less smelt now.
Weather 2012 was the last good snow. Ocean fishing gets dangerous with wind.	
Channel changed fishing spots. Now spots much further away.	Not easy to walk to fishing spots. Need ATV or ride share.
Windy now all the time. Hardly any calm days.	Dangerous on the ocean, can't go out as much.

Source ADF&G Division of Subsistence household surveys, 2018.

Table 6-12.–Observations and observed effects of changes in nonsalmon fish and marine invertebrates, Quinhagak, 2017.

Observations	Effects
4 years ago dead fish floating down river were dead and bent. Whole backbone bent and mouth crooked, not normal. Fish samples given to local Natural Resources person for testing and there was a type of sickness. Also confirmed at Goodnews River.	
Some fish swimming close [can see] lines break still have hook on mouth, eventually die—but are salmon.	
Some people talk about injured or deformed fish—so I throw them back. It's not any particular species, just trouts mostly. Trouts are sometimes scarred and we don't eat them.	We don't eat deformed fish, just throw them back.
Less salmon, less kings, more reds. Bunch got stick in slough when high water went down, never seen that before—easy fishing. Heard more pike in Kanektok River; some people don't like that they are here now.	
The trout are slushy [soft] now in the Kanektok.	
More pike around, up river.	Maybe less trout? The pike eat anything.
Orange Dolly Varden, the meat is soft and breaks up. Meat close to rotten, Kanektok meat soft, orange. Arolik Dolly Varden meat appears ok as ever.	Spend more on gas
Smelts seem a lot bigger this year due to warmer weather.	Harvested about the same, no change.
I have noticed some ailments in some species and I always have—but now I wonder if it's attributed to nuclear events and weapons testing.	Not really but I am more reluctant to eat these fish anymore.
Pike, but I don't really go after tnem.	
Fish with crooked backs, sores. Trout taste different—didn't taste like fresh trout. Concerned about radiation from Japan.	
Trouts were soft, mushy meat this year. Don't taste like they used to. Some had spots on them, skinny,	
Less halibut. We usually get smelt by the river now they are up river. New run up Kanektok. We have pike now, which is not necessarily wanted.	Harvest more smelt when we fish up river. We throw pike back.
Trouts had bumps on skin.	Did not eat,
Lots of jack salmon.	
More pikes too. There hardly were any [before].	I don't catch pikes—I throw them back.
Less fish—less trout, less smelt. The runs were lower.	
Don't notice cause don't go out as much because of weather and conditions. They do say there's less smelt.	
More pike in Kanektok.	I don't know—hear maybe less trout in the future.

-continued-

Table 6-12.–Continued.

Observations	Effects
Tomcod come further in than they used to—late September, right before freeze up.	
More pike; varies each year. One year trout were different—holes in their bodies floating down the river 2 or 3 years ago. USFWS investigated, never heard anything.	
More pike in the river. Trouts are more slender.	Worry—don't know yet. Less fish to eat.
Blessed with fish all year long, even when other villages didn't [have enough food for winter].	
Dollies—when cooked their flesh more flaky, breaks down easy when boiled. Not the usual way it appears when cooked same way. Saw 2 more times.	
Sport fishers catch and release kills fish or still alive with hooks on them.	Don't fish as much because of that [dead fish with hooks] Sometimes don't catch all day.
Blackfish not as abundant as they were—can't get there [open water] and no snow.	
Caught fish that had big wounds still with hooks on them.	Had to throw away.
Smelts are bigger this year.	Little more to eat
Kings are smaller and there are more pike.	
Lots of pike.	
People have been catching pikes, we never had it while I was growing up. Use setnet or jig for them. Pike flooded gravel pit and are now in the lakes.	They haven't [changed anything]. I don't fish for pike.
When we are cutting up some would have sores, bubbles in meat, eyes are red.	We don't use sick fish. We leave them outside.
Pike, tomcod, and needlefish	Some tomcod now.
Trouts are skinnier than usual. Smelts are bigger.	We use both [trouts and smelts]
People saw dark spots 2 or 3 years ago.	
Trout from Kanektok are not as firm as last year. The meat is softer.	Just live with it—use different piece.
Seeing different lice and bumps on trout and salmon working as tech in Natural Resources.	Sending out samples of fish with odd bumps or abnormalities of any kind and parasites. Don't eat if fish look sick.
Fish meat is softer than used to be. Meat certain part will be soft and like rotting—aging.	All the fish tastes different.
Numbers seem good. Lots of fish whole 10 years. Salmon numbers up and down. Pike—none 10 years ago, last 5 years [gotten bad]. Local teacher caught record 27" [pike].	
Some wart-like skin on char.	Did not eat.

Source ADF&G Division of Subsistence household surveys, 2018.

Table 6-13.–Additional observations, Quinhagak, 2017.

Observations
One trout had worms when cutting—threw out.
Stored in box, cold, instead of underground cache, sometimes get moldy. High wind Dec 21 rolled boat off trailer.
Lots of fish (salmon) because no commercial fishing. Need a buyer.
Rainbow gills had pink warts; cut head off, ate rest of fish.
No 4x4, got to walk.
No commercial fishing—no income.
One fish had yellow spots inside.
Trouts couple years ago—missing dorsal fin, bites on head area. Pike had bit trout. Kanektok has pike now.

Source ADF&G Division of Subsistence household surveys, 2018.

believe it, but now I'm starting to, seems like we are not catching as much here in Kanektok River" (021417KWN6). Another key respondent explained that about ten years prior to the surveys, the first time anyone had seen a pike locally, it was in an oxbow lake along the lower river; for a few years it seemed like they were restricted to these old river channels (021317KWN3). Eventually fishers were catching pike in the main river, and in 2016, a pike was caught about 22 miles upriver, the farthest upriver that he has heard. He said, "We try to catch many pike as possible, they eat the salmon, little baby salmon and the trout." This fisher had not caught very many, but he mentioned a friend who used a net "a little bit" to try reducing the pike population: "he caught like 200 hundred…The pikes are the problem. They're hardly seeing trout and we used to catch like 20, in less than an hour. Now we fish them all day and hardly get ten" (021317KWN3).

Few respondents identified "other" changes not related to either environmental conditions or the fish themselves. Two respondents mentioned the lack of commercial fishing, and one described a lack of transportation (Table 6-13).

Local Comments and Concerns

At the end of the survey, researchers asked respondents if they had any questions, comments, or concerns, and paraphrased their responses (Table 6-14). Many respondents had already elaborated on their concerns as described above, and did not respond to this question. However, 31 households are represented in the table. Several comments reflect the general importance of fish. For example, one respondent said, "there should be a tee-shirt: fishing isn't everything, but it's way ahead of whatever is next." Most comments echo concerns described above: pollution, especially from local sport fishing operations and the nuclear power plant disaster at Fukushima, the economic vacuum left in the absence of commercial fish buyers since 2015, and the appearance and rapid proliferation of pike in recent years.

Beyond describing the incidental catches of nonsalmon fish in commercial nets historically, most respondents who mentioned commercial fishing expressed a desire for a return of those opportunities. At least one respondent identified the absence of commercial herring fishing as related to Fish and Game funding: "No funding for Fish and Game, no commercial for herring"

Comments such as "barely surviving as a community" demonstrate a deep anxiety about a wide variety of concerns, some of which key respondents spoke to in depth. Two concerns warrant additional description: sport fishing and erosion.

The intensity and variety of fishery uses on the Kanektok River is sometimes a source of friction. Several sport fishing guides operate with limited interaction in Quinhagak. According to respondents, pollution from human waste, refueling, and "everything they use," all goes into the river; some guided groups park on sharp bends, tell young fishers to move, or otherwise behave "like they own the river"[31]. Several key

31. A. Pleasant, Quinhagak resident, personal communication, November 3, 2018.

Table 6-14.–Respondent comments, Quinhagak, 2017.

Alaska West—Sewage and grey water making fish "slushy" soft meat. Arolik when coal mining—slushy meat. Now it's reversing—Kanektok River fish is bad, Arolik is better. Parents and grandpa told that when king salmon eggs are used as bait in winter, they'll bite at first and then quit.
All dry fish when she was young. Mom dried; Grandma raised her. When she became aware she ate dry fish.
Better to fish when river low. There are better holes where they stay.
Boiled willow branches for tea and cold sickness chased out. Also craved fish broth and kumleneq. Sport fishing—dead trout; maybe catch and release; If people catch more than enough (of anything), they announce on VHF; herring eggs are best aged a little inside the fish; just cover with water, river water, and let sit 2–3 days.
Daughter brings meals; lots of fish
Fuel barges have trouble getting in to leave fuel delivery, more shallow access for goods, supplies to be delivered.
Hope we have commercial fishing. No funding for Fish and Game, no commercial for herring
How far is radiation spreading? Seals, whales, beluga whales—worried about Fukushima
I grew up eating fish, now I don't eat it.
I have PTSD. I am not going to say any more. I learned my lesson with the white man, any thing I tell you will turn into more regulations, I will not show you any places we catch blackfish or any fish. I talked to fall salmon survey and all that happened was more restrictions, regulations on us. I learned my lesson.
I need a new boat (weldable) and motor. Wind storm in December rolled their boat—the boat is probably repairable but the motor destroyed. Hoping for disaster relief before summer.
If people are stingy the fish will dissapear
Lack of snow doesn't really affect fishing, but does hunting. Terrible for snow machine. More pike every year.
My husband fishes
Need commercial fishing here—need a buyer/processor
Please maintain yearly testing on subsistence species.
Seem to be catching more salmon—need to open commercial fishing
Something has to be done about this pike. They are taking over the river. My main concern is without commercial fishing the river might be overpopulation and we don't know how much escapement and the river could crash. Also a lot of people come here and fish so it needs to be managed. There is a lot of use on this river and we are stuck between a rock and a hard place.
Sport fishing harms fish when released, they die. Sport fish is polluting water, they pee in water. If find sick fish is the pollution or whatever chemicals they put in the water. Ever since sport fishing come water not clear just white powder (turbid cloudy)

-continued-

Table 6-14.–Continued.

Spots on red salmon. Only seen condition in red salmon.
The river changes all the time. My mom used to tell me the land went further out. Now the rivers are bigger. I have no transportation. The way it's going we're barely surviving as a community and fishing helps.
There is less drift wood now.
There should be a tee-shirt: Fishing isn't everything, but it's way ahead of whatever is next.
They need to watch sportfishing—make sure they aren't contributing to delinquency of our people and they think that they own the river.
Trouts are getting thinner especially in winter
We used to travel to mountains but now there are lots of fish down here and it's hard to get up there. It's all the same species.
What is cauirrutnaq? Looks like a graying without a big dorsal, whitefish. Golden sheen to body, belly golden yellow, white meat: round whitefish
When I get survey in the mail I just put it in the trash—never does us any good, never hear back about what is learned, what is happening.
Work too much to have time to fish
Worried about pike in river. Never had pike and now we do in Kanektok River

Source ADF&G Division of Subsistence household surveys, 2018.

respondents described additional decades-old concerns about sport fishing (021417KWN4; 110218KWN9; 020618KWN8), including the practice of catch and release and the use of rafts in shallow mountain spawning streams during a critical period of life history for important fish. A key respondent described rafts laden with guests, guides, and gear literally dragging along a creek bed, disturbing the gravel and the process of salmon and char reproduction (020618KWN8), and another described the historic tension between residents and fish guides:

> Even though we don't want them to be hanging around out there. We say, how are those salmon that arrived here to our river to lay their eggs with people hanging around them while they breed to lay eggs? How can they pass those people who are fly fishing? Lots of white people, even ladies and guys and men, hanging around on the mouth of those streams where they lay eggs. But they always say they can fish anywhere they want. That's what they always say. (021217KWN2)

Coastal and riverine erosion is also a concern in Quinhagak (Plate 6-8). One elder key respondent provided a detailed description of coastal erosion as well as damage resulting from mini-breakups that send ice down river in the late fall:

> It's very noticeable because especially on the coast when it used to be frozen solid out on the bay. Apparently, the ice protects the coast from deteriorating, and because the ground itself is frozen, it's hard to be damaged by the current and waves. Since it's gotten too warm the ice is disappearing along the coast and when there are strong winds coming against the banks, river banks are being torn very fast in too, towards the inland. And it's been measured and, the banks of the coast can come in twenty feet a year. That's really bad and we have a sewage lagoon close to the shore and it's less then fifteen years now. So, the bank is coming into it now and

people are beginning to worry seriously if it will be eaten up in another fifteen, twenty years. And so, there is a same front in the river. In the spring time and in the fall time high waters flow through the river as the ice goes from the mountains and flows into the river and the rivers are flooded and sometimes overflowing and it's like a race through the top and it eats, eats away the sand and gravel and then in the fall time after the heavy rains we have floods again [with ice carried in the river] and I—when that first happened our river banks are eaten up faster than they used to do in the old times. (021417KWN4)

Acknowledgments

ADF&G Division of Subsistence wishes to thank the Native Village of Kwinhagak Tribal Council and residents of Quinhagak for participating in this project and for extending genuine kindness at every opportunity. Local research assistants Albert Cleveland, Thaddeus Foster, Louisa Kuku, Charlene Nikori, Jessica Simon, and Jamie Small each did a great job of describing the surveys to potential respondents and also provided much helpful insight about how fishing works in Quinhagak to ADF&G staff. Additionally, eleven individuals including John Fox, Adolph Pleasant, Joshua Cleveland, John Smith, Grace Anaver, Jacqueline Cleveland, Frank Matthew, and Martha Matthew participated in ten extended interviews; three key respondents chose to remain anonymous. The author extends special thanks to Adolph Pleasant and Frank Matthew for time on the water, during which she learned a lot.

Quyana Kuinerraq!

Plate 6-8.–Blocks of eroded tundra on the bank of the Kanektok River. Inset: eroded bank.

7. DISCUSSION AND CONCLUSION

Anna R. Godduhn, Caroline L. Brown, and David M. Runfola

This study documents 2017 harvests and uses of nonsalmon fish and marine invertebrates by residents of five communities and demonstrates the importance of subsistence nonsalmon fisheries along the Bering Sea coast in the Yukon-Kuskokwim Delta (YKD) region. The report presents estimated harvest levels and rates of household participation in the production and distribution of food from nonsalmon resources, and it provides contextual detail about variation in the fisheries both across the study area and over time.

As noted in previous chapters of this document, subsistence nonsalmon fisheries in the study area are well documented, but not well quantified. Pacific herring[1] surveys from up to nine communities and three comprehensive subsistence harvest surveys from study communities provide limited documentation of quantitative subsistence nonsalmon fish harvest and use data (Table 7-1). Therefore, this research provides the first detailed quantification of nonsalmon fisheries.

Themes of both continuity and change emerged from the study communities throughout the project. Local nonsalmon resources have long held high value for families despite variation between local habitats and species availability and uncertainty regarding future conditions. Many fishers continued to return to the places their ancestors fished, and they continued to adapt learned methods of catching, processing, and storing fish to suit ecological conditions, time constraints, and new technologies. However, older respondents described very different winters from what they experienced in their childhoods, and even younger fishers recounted changing seasons.

This study's field data collection occurred during a period of dramatic ecological transformation in eastern Bering Sea ecosystems; the data include local observations of climate and environment that reflect themes documented in contemporary scientific research in the region (Grebmeier et al. 2006; Hunt Jr. et al. 2011; Jorgenson et al. 2018). Described in more detail below, residents observe that recent environmental changes, especially reductions to solid ice, have affected fishing for many households. Phenomena such as accelerated erosion have less direct effects, but they raise uncertainty and concern among respondents.

Coastal Alaska residents have described increasingly problematic weather and ice conditions, permafrost thaw, coastal erosion, and related concerns for at least 20 years (Callaway et al. 1998; Fall et al. 2012; Fienup-Riordan and Rearden 2012; Huntington 2000; Ikuta et al. 2016; La Vine et al. 2007; Ray et al. 2010;

Table 7-1.–Previous research, study communities.

Community	Study year	Citation
Scammon Bay	1982	Fienup-Riordan 1986
	2013	Ikuta et al. 2016
Nightmute	1986	Pete and Kreher 1986
	1987	Pete et al. 1987
	1988	Pete 1991a
	1990	Pete 1991b
Kipnuk	1985 1987	Pete et al. 1987
Mekoryuk	1990	Pete 1991b
Quinhagak	1982	Wolfe et al 1984
	2013	Ikuta et al. 2016

Source ADF&G Division of Subsistence, 2019.

1. Hereinafter *herring.*

Runfola et al. 2018). In recent decades, the annual pattern of ice extent in the eastern Bering Sea has been increasingly variable with a strong trend toward less ice each winter because of warmer air, warmer water, and shifting wind patterns (Stabeno and Bell 2019). For example, in 2013 ice in the Bering Sea covered an area relatively close to the historical average. Following several years of record-breaking warmth and a marine heat wave known as "the blob"[2] (Walsh et al. 2018), sea ice formation in the fall of 2017 was unprecedentedly late. Much of the Bering Sea study area did not freeze until January of 2018 (Stabeno and Bell 2019).

This chapter synthesizes the research findings and includes the available historical subsistence harvest data for context; it describes observations of rapid change that underlie common community concerns and provides related information; it makes recommendations regarding the need for ongoing monitoring and documentation of change in regional subsistence nonsalmon fisheries; and it draws general conclusions with respect to the state of the fisheries in 2017.

Comparisons to Historical Data

To compare changes in harvests over time or communities of different sizes, variation in population is statistically controlled by considering the average amount of food harvested per individual or household. Per capita harvests should not be considered typical for any individual person, but they are useful in analyzing the food supply over time or between differently sized communities. This section uses limited historical data to consider variation in harvest levels over time in terms of per capita harvest.

Alaska Department of Fish and Game (ADF&G) research described herring harvests in coastal YKD region communities from 1985–1990 (Pete 1984; 1991a–c; Pete et al. 1987; Pete and Kreher 1986). The research identified the long distance between Nelson Island and major salmon run locations as a primary reason that the island's communities, such as Nightmute, depend more heavily on herring than other coastal communities (Table 7-2). This study also finds herring to be a key staple in the study area, especially in communities farther from major salmon runs; Nightmute fishers' estimated per capita harvest of herring in 2017 was more than twice that of other study communities except Scammon Bay (tables 2-5, 3-5, 4-5, 5-5, and 6-5). For the three communities that participated in the 1985–1990 herring project as well as this study (Nightmute, Kipnuk, and Mekoryuk), herring harvests were substantially lower in 2017 than in the 1980s (tables 3-5, 4-5, 5-5, and 7-2). Mekoryuk harvests show the most extreme difference between the

Table 7-2.–Estimated total and per capita Pacific herring harvests, Nightmute, Kipnuk, and Mekoryuk, 1985–1990.

	Study	Estimated harvest (lb)	
Community	year	Total	Per capita
Nightmute	1986	42,806.0	289.23
	1987	28,895.0	175.12
	1988	32,007.0	196.36
	1990	35,065.0	215.12
Kipnuk	1985	18,864.0	43.17
	1987	28,878.0	57.99
Mekoryuk	1990	8,925.0	46.48

Source ADF&G Division of Subsistence Community Subsistence Information System (CSIS).

2. Di Liberto, T. 2016. "Where, oh where, has Alaska's winter gone?" National Oceanic and Atmospheric Administration. Accessed November 4, 2019. https://www.climate.gov/news-features/event-tracker/where-oh-where-has-alaska's-winter-gone

available study years: the 2017 per capita harvest of herring was only 16% of the 1990 harvest. However, it is difficult to put this change into historical context of the total wild food harvest for these communities. The 1980s herring project did not query about harvest for other nonsalmon fish or other resources, and these communities have not participated in other subsistence harvest surveys.

In contrast, Scammon Bay and Quinhagak have each participated in prior surveys (1982 and 2013) that documented the harvest and use of all types of subsistence resources, including nonsalmon fish (Fienup-Riordan 1986; Ikuta et al. 2016; Wolfe et al. 1984). The 1982 study employed different methods than the 2013 and 2017 studies. In 1982, surveys were conducted opportunistically with active harvesting households in both communities, such that the data are not necessarily representative of all community households (Fienup-Riordan 1986:218–226; Wolfe et al. 1984:24). For the 2013 study year, random samples of households were surveyed such that per capita averages and related comparisons are more robust (Ikuta et al. 2016). However, the data from all earlier studies provide some context within which to consider contemporary nonsalmon fish harvests.

In Scammon Bay, nonsalmon fish composed an average of 36% of wild food harvests by weight among sampled households in 1982 with an average household harvest of 1,799 lb of nonsalmon fish (Fienup-Riordan 1986:220–221). Households harvested eight types of nonsalmon fish including Alaska blackfish[3] (20% of the nonsalmon harvest), broad whitefish (17%), burbot (16%), saffron cod (14%), Bering cisco (12%), pike (9%), herring (9%), and smelts (4%; Fienup-Riordan 1986:220). In 2013, nonsalmon fish composed 24% of wild food harvest in Scammon Bay. The estimated weight of the average household nonsalmon fish harvest in Scammon Bay 2013 was substantially lower: 527 lb (Table 2-10). Scammon Bay fishers harvested 6,356 lb of nonsalmon fish more in 2017 than in 2013. As discussed in the Scammon Bay chapter, herring and pike harvests were higher, and halibut harvests were lower overall.

In Quinhagak, nonsalmon fish accounted for 19% of the wild food supply by weight in surveyed households in 1982 (Figure 6-2). Nonsalmon fish provided slightly more food than that from marine mammals (16%) and land mammals (15%). The 1982 nonsalmon fish harvest composition in Quinhagak was dominated by chars (79%), but included smaller amounts of smelts (11%), cods (5%), whitefishes (likely Bering cisco; 3%), and blackfish (Table 6-10). In 2013, nonsalmon fish composed 15% of wild food harvests. As in Scammon Bay, the estimated weight of the average household nonsalmon fish harvests in Quinhagak in 2013 was substantially lower than in 1982 (204 lb in 2013 and 723 lb in 1982). Quinhagak fishers harvested 20,228 lb more of nonsalmon fish in 2017 than in 2013. As discussed in the Quinhagak chapter, herring and halibut harvests were lower and pike harvests were higher in 2017.

Respondents in 2017 did indicate a general reduction of nonsalmon harvests over the last few decades. However, the shifts in the species composition of the nonsalmon harvest in each community during different years attest to the adaptability and flexibility fishers employ responding to a variety of pressures during their fishing activities, including weather, species availability, access to fishing areas, and multiple other reasons. For example, changes in the halibut harvests in these communities may be related to the salmon harvests in any given year. Either halibut or salmon can fulfill substantial portions of need in many households, depending on preference and availability, but the fishing occurs during an overlapping time period, such that there are competitive and compensatory elements between these different kinds of fishing.

Observations and Concerns

Many aspects of life have changed for families in the YKD region over the last century and much of the change has occurred in living memory. Some elder key respondents to this project grew up as seminomadic people who relied partially on locally sourced materials for housing and equipment needs as well as dogs for transportation; they remembered settling into permanent communities where motorboats, all-terrain vehicles, snowmachines, commercial fishing gear, and freezers were increasingly available over decades (041217KPN1; 041217KPN2; 051217MYU1; 051417MYU3; 011319MYU7; 021417KWN5; Andrew 2008; Fienup-Riordan 1986; 2011; Fienup-Riordan and Rearden 2012; Rearden and Fienup-Riordan 2013).

3. Hereinafter, *blackfish*.

Motors reduced the need for fish to feed dogs and increased the diversity of fishes available for subsistence as well as the ability to catch them quickly and efficiently. Respondents also described how weather patterns in the study area have changed and the annual formation of sea ice in the eastern Bering Sea has changed significantly in recent years.

This section summarizes common themes and identifies variation about environmental changes, changes in nonsalmon populations and health, and changes in use of nonsalmon resources. Respondents from all study communities affirmed that diverse factors affect fishing practices and the annual harvest of nonsalmon fish. Observations of change generally varied more widely within the study communities than between them.

Environmental Changes

Respondents noted multiple observed environmental changes throughout the course of this research including the assertion that conditions are always changing (tables 2-10, 3-10, 4-10, 5-10, and 6-10). Some respondents described dramatic change including unprecedentedly warm weather, especially in the fall, and increased wind intensity and frequency all year long. Respondents in all communities described higher temperatures in fall and winter that resulted in delayed freeze-up, accelerated breakup, a lack of snow, and poor ice conditions throughout recent winters. Respondents also described more frequent high water, especially in the fall; some respondents implicated higher storm surge tides, others pointed to heavy rain.

These changes primarily affected access to fishing areas: respondents indicated that access to fishing locations when desired fish are most abundant or in prime condition has become increasingly problematic and dangerous. Access is affected by weather and ice conditions; respondents described favorable weather as less common, the season of stable ice as shorter, and planning fishing trips as more difficult because of rapid and unpredictable shifts in weather. A few respondents described boating later in the fall as advantageous, but most who addressed it said that ocean travel was difficult to impossible in both spring and fall of 2017 because of unusually dangerous ice conditions. Historically, late fall storms typically followed the formation of ice that prevented wind-driven floodwaters from inundating the coast and precipitation fell as snow rather than rain; occasional winter rains would saturate the snow and refreeze, extending the life of the snowpack and trails (Fienup-Riordan and Rearden 2012:157) rather than melting them. Although early winter storms that break ice and carry it inland are not new, respondents in all communities described early storms as more frequent and more destructive.

More generally, respondents in all communities provided detailed observations of a changing landscape, they described rivers as increasingly wide and shallow, water as higher (and less often as lower) and the tundra itself as sinking. For example, a key respondent in Kipnuk said “I noticed when we first built our house here, the ground was higher. Now it seems like everything’s, there used to be even like big hills around my house. Now there’s none.” She also expressed concern that the flooding events described earlier will eventually make infrastructure, such as her home, impossible to maintain (041417KPN6). Respondents often identified thawing permafrost as the reason that riverbanks and shorelines are eroding faster than they did historically.

Although general statements about warmer weather and delayed freeze-up dominated observations in each community, emphasis on related issues did vary somewhat. Scammon Bay respondents most often noted changes to the timing of seasons and poor ice conditions (Table 2-10). Nightmute respondents emphasized water conditions (e.g., higher water, decreased clarity) and wind (Table 3-10). Kipnuk residents mentioned erosion most often (Table 4-10). Mekoryuk respondents most often mentioned increased wind, and they sometimes identified the phenomenon as problematic because halibut fishing depends on good weather (Table 5-10). In Quinhagak, respondents most often described changes in fall and winter precipitation (i.e, more rain and less snow; Table 6-10).

Plate 7-1.–Small fish carefully preserved.

Resource Changes

Respondents in all communities described changes to fish populations (tables 2-11, 3-11, 4-11, 5-11, and 6-11). Many comments were related to general abundance or timing, and some were related to specific fisheries. For example, Scammon Bay respondents described how high-water events inundate freshwater habitats with saltwater and push fish inland; a Kipnuk respondent identified the 2017 herring run as "super early;" and a Mekoryuk respondent noticed that the halibut had gotten fat earlier than expected. Multiple respondents in all study communities noticed an increased abundance of Pacific cod and walleye pollock, especially as compared to the generally preferred halibut. A Kipnuk elder who had fished for subsistence most of his life and for commercial halibut in the 1980s and 1990s had heard of Pacific cod and walleye pollock but never caught one himself (041217KPN2). A few respondents in Kipnuk said that smelts had been unusually large in 2017.

Concerns related to fish health dominated responses to the query about changes to the resources themselves Many respondents in several communities reported not eating sick fish. Some also indicated that although these observations are disconcerting, diseased fish were not necessarily having significant effects on their food supply. A respondent in Quinhagak described how some fish processors have started to fillet their smelts, in part to inspect them more carefully (110218KWN9; Plate 7-1); likewise, a respondent in Mekoryuk described at least partially processing fish before he shares them with elders, to avoid the offense of sharing anything unhealthy. Many respondents connected unhealthy fish to pollution and sometimes to warm water. The most commonly reported disease of fish in all communities was a fungal plaque described as a one- to two-inch black spot that primarily affected saffron cod and rainbow smelt (Plate 7-2). A key respondent in Kipnuk estimated that about 5% of these fish bear the plaques (041417KPN5).[4]

Plate 7-2.–"Black spots" on saffron cod.

Respondents in three communities (Scammon Bay, Kipnuk, and Quinhagak) described an increasing population of pike, which is voracious predator on other fish (041417KPN6, 031218KPN7, 111016SCM02, 033018SCM01, 111016SCM03, 021217KWN2, 021417KWN5, 021517KWN7). Chars are both the most harvested and also the most widely used nonsalmon fish in Quinhagak. Residents expressed concern about pike populations negatively affecting char and salmon through predation.

4. These plaques are identified as paeohyphomycoses: fungal skin infections (Meyers et al. 2019:36). Infected fish generally do not exhibit internal signs of illness, and the infections are rarely harmful to people. Preliminary research indicates that these lesions are associated with flooding that exposes fish to plant material and terrestrial fungi; fish with small skin injuries may be prone to developing infection (Meyers et al. 2019b).

Changes in Use

Researchers asked respondents to identify changes in the nonsalmon fish that their households target; just a few fish were named by more than ten respondents in all communities combined. Sticklebacks, blackfish, and flounders were named as no longer regularly used by many residents; and Pacific halibut[5] (especially in Scammon Bay) and northern pike[6] (especially in Quinhagak) were named as new resources. Although mentioned by relatively few of the 363 total responding households, ethnographic information supports that these changes constitute general trends.

Historically, sticklebacks and blackfish were key staples in the YKD region, but multiple respondents said that they no longer use them. Elder respondents remembered these fish as reliable and abundant, especially on the north side of Kuskokwim Bay (110916SCM05, 041217KPN2, 041217KPN1, 021417KWN5, 021217KWN2). Respondents described blackfish (110916SCM05) and sticklebacks (041217KPN2) as starvation food, because they could be found even when other foods were scarce.

> All the little settlements that are out there. Each one had a very distinct feature and that's a lake and a slough where people set traps for blackfish. That's what they're doing here. And that meant something to us as a special species of fish. So blackfish…just to my dad, my parents, was probably the most important species. It was there during times of scarce, when things were scarce, they were there. Salmon were never guaranteed. Blackfish…would sustain us through the winter. (110916SCM05)

One Kipnuk elder explained that his family used to catch sticklebacks ("needlefish") nearly every day to feed dogs, but now once a year suffices: "just enough to, you know, have something for the freezer" (041217KPN1). A Mekoryuk elder remembered catching blackfish for her grandparents (051417MYU3), although the fish are found in limited areas on Nunivak Island, where marine fishes dominate nonsalmon fisheries.

Respondents in all communities also mentioned that they no longer use flounders at the same levels as in the past. Key respondents generally indicated that flounders are still popular traditional foods but were more avidly targeted historically (041217KPN1, 041217KPN2, 031218KPN7, 051417MYU3, 051417MYU4). In Quinhagak, a pair of respondents explained that flounders and other flatfish were caught more often when commercial fishing for salmon was active (110318KWN10). Because subsistence salmon fishing occurs mostly in the river instead of offshore, flatfish are not caught as often now.

Multiple respondents described the harvests of two fish as new or increasing: halibut and pike. Fishing for halibut has increased over recent decades. Halibut is traditionally used widely on Nunivak Island, where small halibut are caught with Pacific cod, flounders, and sculpins in small bays and around the capes, especially Cape Etolin. After 1999[7], commercial fishers in Quinhagak and other coastal communities invested in equipment and localized experimentation with different fishing methods that made halibut a regular part of the subsistence food supply in all study communities.

Recommendations

This project provides initial quantification of fisheries in which residents have observed substantial change over decades and was designed in part to document those changes. With this work completed for the study area, department staff have multiple recommendations to improve our understanding of these nonsalmon fisheries and how management actions are experienced locally.

---

5. Hereinafter *halibut*.
6. Hereinafter *pike*.
7. Commercial Fisheries Entry Commission, n.d. "Fishery Statistics – Participation & Earnings." Accessed August 9, 2019. https://www.cfec.state.ak.us/fishery_statistics/earnings.htm Hereinafter *CFEC, n.d.*

Harvest Monitoring

Harvest data remain one of the primary inputs to sustainable resource management. Although a single year of harvest data can be useful for showing harvest levels at a moment in time, it cannot provide the harvest trend information necessary for management that is responsive to changes in harvest levels, use patterns, access issues, resource abundances, and other factors. Harvest estimates also assist managers in understanding the diversity and abundance of resources, and potential effects on food security if some or several species decline in abundance or become inaccessible. As a result, coastal YKD communities would benefit from regular harvest assessments of important subsistence resources such as nonsalmon fishes. The fishers who regularly harvest these species can contribute a baseline of information about their relative importance to local subsistence economies; their role in the seasonal round and diversity of resources; patterns of abundance, presence, or absence observed over time; changes to these patterns; and how subsistence activities have changed with environmental change.

However, an accurate description of the role of these resources in local subsistence economies requires contextualizing these harvests within a total subsistence harvest picture. According to Andersen et al. (2004:142), "fisheries management has as much to do with understanding the actions of people as it does the biology of fish." Baseline subsistence harvest data have been collected for only two of the five study communities; documenting the total subsistence harvests of the remaining three communities would provide much needed context for and an information source that would augment the dataset provided here. There is a critical need for additional quantitative harvest data for species like herring and halibut, where commercial opportunities exist, or other species that are harvested in in large quantities for subsistence, such as whitefishes, saffron cod, or rainbow smelt (Brown et al. 2012).

Household surveys have documented halibut harvest amounts in a small number of coastal YKD subsistence fishing communities since 2003. That year the North Pacific Fishery Management Council (NPFMC) created a system of federal management and regulation of the subsistence halibut fishery in Alaska. To participate, subsistence halibut fishers who are residents of eligible communities or members of eligible tribes are required to obtain a Subsistence Halibut Registration Certificate (SHARC). The SHARC program acts as a tool to manage eligible fishers' entry into the subsistence fishery and to obtain annual harvest amounts and other information through mailed and in-person surveys. Since 2003, SHARC program surveys completed by ADF&G have documented significant subsistence halibut harvests in a small number of coastal YKD communities (see Fall and Koster 2020). However, participation in the SHARC program is poor in the area, and household survey efforts are limited to two communities biannually. As a result, comprehensive subsistence halibut harvest amounts in the region are sparse, and annual SHARC registration among coastal YKD halibut fishers is low. Although very few fishers in the region independently register for SHARCs each year, in-person household survey respondents typically choose to do so when prompted in person by ADF&G survey staff and local research assistants in their home communities. Thus, more frequent and widespread subsistence halibut survey efforts in coastal YKD would provide a more complete record of subsistence halibut harvests in the region as well as increased participation in the SHARC program. A more comprehensive subsistence halibut harvest database and greater participation in the SHARC program would improve the precision of halibut fishery management while documenting the extent of coastal YKD residents' reliance upon the resource.

Although better quantitative harvest data sources would be essential to developing more precise management strategies when necessary, another benefit to a study such as this is the value of documenting methods and means of harvest that are poorly described or even unknown to management agencies. Subsistence nonsalmon fishing gear that this study documents includes mostly those gear types that are well known to be used by subsistence fishers throughout Alaska, including gillnet, hook and line, dipnet, and handline. Ethnographic research in some communities also documented fishers' use of dipnets into which people drive saffron cod or rainbow smelt by striking the surface of a slough with poles or canoe paddles. Fishers in Quinhagak and Kipnuk also described using small homemade trawl nets that they towed from boats in coastal streams to catch the same species. Documenting novel gear types or new applications of traditional fishing gear can improve fishery managers' knowledge of subsistence fishing practices. Recording these practices can also ensure that regulatory bodies such as the Alaska Board of Fisheries recognize them as customary and traditional activities and include them in fishing regulations.

Additional Ethnographic Documentation

The significant body of traditional ecological knowledge (TEK) documented in this report makes important contributions to our understanding of the historical and cultural context surrounding nonsalmon fisheries in the coastal YKD region. There has been minimal documentation of the local knowledge of these fisheries or the contemporary levels of harvest and use. As such, this research provides information regarding some poorly understood historical and contemporary harvests and uses of various species. The documentation of TEK in this project can be used by resource managers and biologists to provide a regional perspective on the nature and scope of nonsalmon fisheries. For example, the ethnographic investigation of customary and traditional practices associated with whitefish harvests contributes to larger regional understandings of the seasonal movements and other biological aspects of whitefish life histories (Brown et al. 2010; 2012).

Nearshore Marine Fisheries

Coastal Western Alaska communities are most likely to observe changes in nearshore marine subsistence fisheries. Local observations may provide insight or indicators of broader scale changes to the Bering Sea environment (see Fall et al. 2012) or other aspects of marine ecology not detected by managers and researchers. These could include observed changes to population size, fish health, spawning or seasonal migrations, recent arrival of or significantly more frequent observations of species that fishers historically observed less frequently (e.g., Pacific cod, salmon shark, orca, etc.). Furthermore, depending on the use patterns of these species, ethnographic documentation could explore the effects of these changes on the community level.

Other Fisheries

Ethnographic data collection could also document observations of fish biology of specific interest to subsistence fishing households and researchers. For example, with guidance from Quinhagak key respondents, fish biologists could explore the effects on local fisheries of the increased abundance (or recent arrival) of pike in the Kanektok River drainage. Although the Kanektok River and other nearby rivers and streams are within the documented normal range of pike populations in Alaska, Quinhagak fishers and fishery scientists have only recently observed their presence in these drainages. Subsistence fishers have expressed concerns about the effects of pike predation on salmon, rainbow trout, and Dolly Varden populations particularly in the Kanektok River; however, biologists have not initiated any investigations into any possible effects. Additionally, Quinhagak fishers described the presence of Arctic char and lake trout (char) in the area. In this region, these two char species are normally lake residents; however, fishers report harvesting them in rivers and streams. Biological studies could improve managers' understanding of the range and distribution of these two species that are highly prized by both subsistence and sport fishers.

Finally, ethnographic work, especially in conjunction with linguistic analysis and biological research, could assist in the species identification of smelts and other species of family Osmeridae harvested by coastal YKD fishers. Quantitative and qualitative information from YKD fishers and ethnographic participant observations indicate that the majority of smelts caught by residents of the study communities are rainbow smelt. However, four similar species are present in the region, and all species are classified in the same taxonomic family.[8] This study documented rainbow smelt harvests in four study communities and capelin harvests in three. Fishers could potentially have also harvested eulachon and pond smelt without identifying them specifically; or they may have failed to recall their harvests when the survey instrument did not prompt them with a question about these species. Although experienced fishers are likely to have specific knowledge of various Osmeridae species, many individuals—surveyors and survey respondents alike—have difficulty in distinguishing these four different fishes. Collaboration among coastal YKD key respondents, ethnographic researchers, and fishery biologists would elucidate the presence of different

8. Extant species of family Osmeridae in western Alaska include rainbow smelt *Osmerus mordax*, pond smelt *Hypomesus olidus*, capelin *Mallotus villosus*, and eulachon *Thaleichthys pacificus*.

Osmeridae species within local subsistence harvests while refining the documentation of their ranges and life histories. Because these are important forage species for many fishes, including Chinook salmon and other Pacific salmon, an improved understanding of Osmeridae family distribution and abundance in the eastern Bering Sea could provide crucial information to support salmon conservation efforts (Moss et al. 2016; Riddell et al. 2018).

Land Use and Place Name Documentation

Local knowledge is highly experiential: an individual's knowledge is based on their own and sometimes family or other group histories and experiences. As a result, related events and phenomena may be experienced and remembered in highly personal ways, challenging the systematic collection of qualitative data, especially about changes, either in the environment, in harvest and use patterns, or in other experiences. Additional TEK studies should include intensive land-use and place-name mapping in order to document the wealth of individual and family-based use histories into a regional understanding of landscape change and the effects on nonsalmon fisheries.

Community Observation Networks

Together, additional quantitative and ethnographic data collection suggest a potentially rich opportunity for community observation networks that would provide a critical piece of information for the larger study of environmental change and subsistence fisheries. Area residents are highly knowledgeable about the environments and resources they utilize. Thus, they are uniquely suited to describe changes that are occurring, how those changes affect people's ability to get the nonsalmon resources they need, and how these changes affect fish populations. As witnessed by the example of the Atlantic cod fishery in the Canadian Maritime Provinces, especially Newfoundland, local fishers may be the best (or only) observation network available to detect potentially significant changes to marine populations and ecological communities (Hutchings and Myers 1994; Kurlansky 1997). The following paragraphs describe two possible areas of inquiry for community observation networks.

Study community residents have described damage to environmental systems from the effects of climate change and how this damage has affected their harvests and uses of nonsalmon fishes. Observed damages affecting subsistence fishers include coastal erosion from storms, unusual changes to riparian habitats, increased salinity in coastal ponds, changing ice conditions, and others. Effective responses to mitigate damage require environmental monitoring and the development of adaptation strategies. Due to their remoteness, small populations, and marginal economic status, coastal YKD communities experiencing negative effects of climate change typically lack direct access to agencies and services that may assist them in mitigating or otherwise adapting to damaged infrastructure and natural systems. As such, community governments and other local organizations must initiate assistance from outside agencies (e.g., state and federal departments of transportation or health and social services, U.S. Fish and Wildlife Service [USFWS], U.S. Coast Guard, U.S. Army Corps of Engineers). Agencies require collaboration with local governments to organize and implement community development planning procedures, which often requires extensive documentation of community losses due to changes caused by extrinsic forces such as climate change. Development of community observation networks with guidance from state and federal agencies could be integral to this process. Due to many residents' significant dependence upon subsistence fishing, hunting, and gathering, food systems in rural Alaska may be severely negatively affected by climate change. Thus, a central focus of community observation networks may be monitoring of and adaptation to environmental damage that limits people's ability to get the nonsalmon resources they need. Residents could also collaborate with their local Alaska Native corporations, tribes, and other organizations to develop similar climate change adaptation planning efforts.

Some coastal YKD residents have also identified their concerns regarding nearshore marine commercial fishing operations in proximity to their communities. Fishers have described their observations of commercial vessels that appear to be fishing in areas where residents harvest various nonsalmon fish species for subsistence. Fishers have also linked this perceived activity to observed changes to the abundance and size of important subsistence fish species such as halibut. Federal marine fisheries management agencies have clear regulations of time and area under which commercial fishing is permitted. If coastal YKD residents observe commercial fishing activity that they feel has negatively affected their ability to harvest the fish they need, they can obtain information and share their concerns with management agencies. Unfortunately, many residents in study communities are unaware of marine fishing regulations and the agencies enforcing them. Better communication between fishery managers and communities can alleviate some of these concerns and limit any negative effects that may be occurring in local coastal subsistence fisheries. Development of community observation networks in the coastal YKD region is one method of improving communication channels between communities and agencies.

Management

Another recurring theme during 2017 research was concern regarding fisheries management. Although Western Alaska coastal subsistence nonsalmon fisheries are minimally regulated by state (ADF&G) and federal (USFWS) agencies, respondents identified conflicts between subsistence fishers and managers that are sometimes antithetical to traditional values. As discussed in the Results chapters of this document, residents expressed concern about how the commercialization of their fisheries might lead to the imposition of regulations on subsistence fishing (see also Bista [*n.d.*]; Hemming et al. 1978; Pete 1990). Commercial fishing has long been integrated with subsistence activities, and the income supported subsistence fishing directly and indirectly (see Jack 2002; Langdon 1991; Wolfe et al. 1984). However, the limited nearshore commercial salmon and nonsalmon fishing opportunities in the Kuskokwim and Yukon management areas have resulted in financial hardships for some families (tables 4-13, 5-13, and 6-13). Survey respondents in Kipnuk, Mekoryuk, and Quinhagak often described the negative economic effect caused by the recent closure of local fish processing plants. Commercial fishing was historically a major economic activity for many households in the study area, but declines in the Kuskokwim and Yukon river salmon populations have threatened the financial foundation provided in part by commercial fishing. The ancillary small-scale commercial halibut fishery has ceased operation partially as an effect of limited commercial salmon fishing opportunities in the area.

Currently YKD communities are largely dissatisfied with their role in the management process or their access to it. Better relationships between managers and local fishers could support direct and active community engagement in management forums such as the NPFMC[9] and International Pacific Halibut Commission (IPHC). They could also assist communities in collaborating with fishery management agencies, the NPFMC, and the IPHC to explore commercial fishery development. For example, ADF&G, National Marine Fisheries Service, and community development corporations like Coastal Villages Region Fund could collaborate with communities to improve subsistence fishers' access to management and regulatory systems and potentially increase the likelihood that communities could development local commercial fishing opportunities.

Conclusion

Nonsalmon fish harvests remain vitally important for communities situated along the Bering Sea coast of Western Alaska, both as a major contributor to the total wild food harvests of most communities and as a supplement and replacement for salmon. For example, in Quinhagak, a key respondent confirmed that if fishers cannot catch enough salmon, "We just [catch more of] those fish then, the whitefish and trout" (021317KWN3). The variety of freshwater and marine nonsalmon resources harvested, the effective utilization of several different gear types, and the extent of search and harvest areas used in 2017 were indicative of the breadth of nonsalmon knowledge among fishers living in these five Western Alaska coastal communities. Specific fishing locations and the methods employed therein reflect of the transmission of knowledge from one generation to the next. The variable abundance of and substitutional capacity for many kinds of nonsalmon fish available to a community strengthen the adaptive capacity of communities

9. The NPFMC has a committee that is charged with identifying and recommending strategies for the Council to provide effective community engagement with rural and Alaska Native communities. NPFMC 2020. "Community Engagement Committee." Accessed January 24, 2020. https://www.npfmc.org/committees/cec/

from year to year. Community well-being is equally supported by actual harvests and the integral system of sharing between households.

Some coastal communities have experienced recent changes in nonsalmon fisheries. In addition, technological advances have helped to decrease the demand on some nonsalmon fish species that were historically harvested to feed dog teams. All five participating communities also experienced environmental changes that interrupted the timing of the seasonal round and affected their ability to access productive fishing locations. These types of challenges have directly affected nonsalmon subsistence fishing activities for fishers living in all of the coastal communities that participated in this study. Despite these challenges, residents continued to demonstrate resilience, determination, and adaptability.

REFERENCES

Ackerman, R.E.
1985. *Southwestern Alaska archeological survey*. National Geographic Society Research Reports 19, pages 67–82.

ADLWD (Alaska Department of Labor and Workforce Development)
n.d. *Population of Alaska by economic region, borough and census area, 2010–2019*. State of Alaska Department of Labor and Workforce Development, Research and Analysis Homepage: Population: Juneau. http://live.laborstats.alaska.gov/pop/

AECOM
2016. *Kipnuk engineering analysis and design study*. Prepared for Kipnuk Traditional Council: Anchorage, AK.

Alaska Department of Fish and Game
1977. *Status of Bering Sea herring stocks and fisheries, a report to the Alaska Board of Fisheries*. Alaska Department of Fish and Game, Commercial Fisheries Division, A-Y-K Region, Bristol Bay Area.

1987. *Annual management report Kuskowkim Area 1985–1986*. Alaska Department of Fish and Game: Bethel.

Amos, M.M. and H.T. Amos
2003. *Cup'ig Eskimo dictionary*. Alaska Native Language Center: Fairbanks.

Andersen, D.B.
1992. *The use of dog teams and the use of subsistence-caught fish for feeding sled dogs in the Yukon River drainage*, *Alaska.* Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 210: Juneau.

Andersen, D.B., C.L. Brown, R.J. Walker, and K. Elkin
2004. *Traditional ecological knowledge and contemporary subsistence harvest of non-salmon fish in the Koyukuk River drainage, Alaska.* Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 282.

Andersen, D.B. and C.L. Scott
2010. *An update on the use of subsistence-caught fish to feed sled dogs in the Yukon River drainage, Alaska*. U.S. Fish and Wildlife Service, Office of Subsistence Management, Fisheries Resource Monitoring Program.

Andrew, F.
2008. *Paitarkiutenka: my legacy to you.* University of Washington Press: Seattle.

Association of Canadian Universities for Northern Studies
2003. *Ethical principles for the conduct of research in the North*. The Association = L'Association: Ottawa. ISBN 0-921421-10-9

Bering Sea Elders Advisory Group
2011. *The Northern Bering Sea: our way of life*. Bering Sea Elders Adivsory Group and Alaska Marine Conservation Council.

Berkes, F.
2012. *Sacred ecology*, 3rd ed edition. Routledge: New York.

Bista, Y.
n.d. *Does one way of life have to die so another can live? A report on subsistence and the conservation of the Yupik life-style*.

Breu, M.
2009. *Last letters from Attu*. Graphic Arts Center Publishing Company: Portland, OR.

Brodersen, N.B. and H.C. Carroll
2011. *Activities of the Kuskokwim River Salmon Management Working Group, 2010*. Alaska Department of Fish and Game Fishery Management Report No. 11-45: Anchorage.

Britton, K., R. Knecht, O. Nehlich, C. Hillerdal, R.S. Davis, and M.P. Richards
2013. *Maritime adaptations and dietary variation in prehistoric Western Alaska: Stable isotope analysis of permafrost-preserved human hair*. American Journal of Physical Anthropology 151(3), pages 448–461.

Brown, C.L., A.R. Brenner, H. Ikuta, E. Mikow, B. Retherford, L.J. Slayton, A. Trainor, J. Park, D. Koster, and M.L. Kostick
2015. *The harvest and uses of wild resources in Mountain Village, Marshall, Nulato, Galena, and Ruby, Alaska, 2010*. Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 410: Fairbanks.

Brown, R.J., C. Brown, N.M. Braem, W.K. Carter III, N. Legere, and L. Slayton
2012. *Whitefish biology, distribution, and fisheries in the Yukon and Kuskokwim River drainages in Alaska: a synthesis of available information*. U.S. Fish and Wildlife Service: Fairbanks.

Brown, C., J. Burr, K. Elkin, and R.J. Walker
2005. *Contemporary subsistence uses and population distribution of non-salmon fish in Grayling, Anvik, Shageluk, and Holy Cross.* Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 289: Fairbanks.

Brown, C., D. Koster, and P. Koontz
2010. *Traditional ecological knowledge and harvest survey of nonsalmon fish in the middle Yukon River region, Alaska 2005–2008*. Alaska Department of Fish and Game Division of Subsistence, Technical Paper No. 358: Fairbanks.

Brown, C.L., J.S. Magdanz, D.S. Koster, and N.S. Braem
2013. *Subsistence harvests in 6 communities in the lower and central Kuskokwim River drainage, 2010*. Alaska Department of Fish and Game Division of Subsistence Technical Paper No. 379: Fairbanks.

Byersdorfer, S.C.
2004. *Common fish and marine invertebrates of the Pribilof Islands, a field guide*. Alaska Department of Fish and Game, Division of Commercial Fisheries Regional Information Report No. 4K04-18: Kodiak.

Callaway, D., J. Eamer, E. Edwardsen, C. Jack, S. Marcy, A. Olrun, M. Patkotak, D. Rexford, and A. Whiting
1998. *Effects of climate change on subsistence communities in Alaska*: *Assessing the consequences of climate change for Alaska and the Bering Sea region.* Center for Global Change and Arctic System Research, University of Alaska Fairbanks: Fairbanks.

Cheung, W.W.L., R.D. Brodeur, T.A. Okey, and D. Pauly
2015. *Projecting future changes in distributions of pelagic fish species of Northeast Pacific shelf seas*. Progress in Oceanography 130, pages 19–31.

Chythlook, J.
2015. *Fishery management report for sport fisheries in the Kuskokwim-Goodnews Management Area, 2013*. Alaska Department of Fish and Game Fishery Management Report Series No. 15-38: Anchorage.

2018. *Fishery management report for sport fisheries in the Kuskokwim-Goodnews Management Area, 2017*. Alaska Department of Fish and Game Fishery Data Series No. 18-29: Anchorage.

Coastal and Ocean Resources
2015. *ShoreZone coastal habitat mapping data summary: Yukon-Kuskokwim Delta*. Project report for NOAA NMFS Alaska Region. MCORI Project 14-38. : Juneau.

Coastal Villages Region Fund
2007. *Neqsurtet Nepiit.* “The sound of the fishermen,” 10(5). : Anchorage.

2011. *Neqsurtet Nepiit.* “The sound of the fishermen,” 12(4). : Anchorage.

2017. *2017 Annual Report*. Coastal Villages Region Fund: Anchorage.

Cochran, W.G.
1977. *Sampling techniques*, 3rd edition. John Wiley & Sons: New York.

Drozda, R.M.

2010. *Nunivak Island subsistence cod, red salmon and grayling fisheries—past and present*. U.S. Fish and Wildlife Service, Office of Subsistence Management, Final Report for Study 05-353.

Drozda, R.M. and H.I. Kiokun

2002. *Qikertamteni Nunat Atrit Nuniwarmiuni / "The names of places on our island, Nunivak*," Nunivak Island place name project cultural map.

Estensen, J.L., H.C. Carroll, S.D. Larson, C.M. Gleason, B.M. Borba, D.M. Jallen, A.J. Padilla, and K.M. Hilton

2018. *Annual management report Yukon Area, 2017*. Alaska Department of Fish and Game, Divisions of Sport Fish and Commercial Fisheries, Fishery Management Report No. 18-28: Anchorage.

Fall, J.A., C.L. Brown, N.M. Braem, L. Hutchinson-Scarbrough, D.S. Koster, T.M. Krieg, and A.R. Brenner

2012. *Subsistence harvests and use in three Bering Sea communities, 2008: Akutan, Emmonak, and Togiak*. Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 371: Anchorage.

Fall, J.A., A. Godduhn, H. Gabriela, L. Hutchinson-Scarbrough, B. Jones, E. Mikow, L.A. Sill, A. Trainor, A. Wiita, and T. Lemons

2018. *Alaska subsistence and personal use salmon fisheries 2015 annual report*. Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 440: Anchorage.

Fall, J.A., D. Holen, T.M. Krieg, R. La Vine, K. Stickman, M. Ravenmoon, J. Hay, and J. Stariwat

2010. *The Kvichak watershed subsistence salmon fishery: an ethnographic study*. Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 352: Anchorage.

Fall, J.A. and D. Koster

2018. *Subsistence harvests of Pacific halibut in Alaska, 2016*. Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 436: Anchorage.

2020. *Subsistence harvests of Pacific halibut in Alaska, 2018*. Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 456: Anchorage.

Fienup-Riordan, A.

1982. *Navarin Basin sociocultural systems baseline analysis*. Alaska OCS Socioeconomic Studies Program Technical Report No. 70: Springfield, VA.

1983. *The Nelson Island Eskimo: social structure and ritual distribution.* Book No. 40 in the The Alaskana book series. Alaska Pacific University Press: Anchorage, Alaska.

1984. *Regional groups on the Yukon-Kuskokwim Delta.* Etudes/Inuit Studies 8 (supplementary issue), pages 63–93.

1986. *When our bad season comes: a cultural account of subsistence harvesting and harvest disruption on the Yukon Delta.* Alaska Anthropological Association: Anchorage.

2007. *The way we genuinely live = Yuungnaqpiallerput: masterworks of Yup'ik science and survival*. University of Washington Press; in association with Anchorage Museum of History and Art and Calista Elders Council: Seattle: [Anchorage].

editor.

2011. *Qaluyaarmiuni Nunamtenek Qanemciput/ Our Nelson Island stories*. University of Washington Press with Calista Elders Council: Seattle and Anchorage.

Fienup-Riordan, A. and A. Rearden

2012. *Ellavut: our Yup'ik world and weather. Continuity and change on the Bering Sea Coast*. University of Washington Press with Calista Elders Council: Seattle.

2016. *Anguyiim Nalliini/Time of Warring: the history of bow-and-arrow warfare in southwest Alaska.* University of Alaska Press: Fairbanks.

Fienup-Riordan, A., A. Rearden, and M. Knecht

2015. *Irr'inarqellriit/Amazing things: Quinhagak elders reflect on their past*. Alaska Journal of Anthropology 13(2).

Fortuine, R.
1989. *Chills and fever: health and disease in the early history of Alaska*. University of Alaska Press: Fairbanks.

Frost, J.
2013. *Memorandum: Final Summary Report: federal interest in lands underlying Kuskokwim River in the Kuskokwim Bay subregion, Alaska*. https://www.blm.gov/sites/blm.gov/files/LandsRealty_Alaksa_RDI_KuskokwimRiver_FinalReport_05012013.pdf

Georgette, S. and A. Shiedt
2005. *Whitefish: traditional ecological knowledge and subsistence fishing in the Kotzebue Sound region, Alaska*. Alaska Department of Fish and Game Division of Subsistence and Maniilaq Association, Technical Paper No. 290: Kotzebue.

Goldman, E.A.
1935. *Edward William Nelson: Naturalist, 1855–1934*. The Auk 52(2), pages 135–148.

Grebmeier, J.M., J.E. Overland, S.E. Moore, E.V. Farley, E.C. Carmack, L.W. Cooper, K.E. Frey, J.H. Helle, F.A. McLaughlin, and S.L. McNutt
2006. *A major ecosystem shift in the Northern Bering Sea*. Science 311(5766), pages 1461–1464.

Griffin, D.
2001. *Nunivak Island, Alaska: a history of contact and trade*. Alaska Journal of Anthropology 1(1), pages 77–99.

2002. *A history of human settlement on Nunivak Island, Alaska: insights from recent investigations at Nash Harbor Village*. Arctic Anthropology 36(1/2), pages 51–68.

Hemming, J.E., G.S. Harrison, and S.R. Braund
1978. *The social and economic impacts of a commercial herring fishery on the coastal villages of the Arctic/Yukon/Kuskokwim Area*. North Pacific Management Council. Dames and Moore: Anchorage.

Henkelman, J.W. and K.H. Vitt
1985. *The history of the Alaska Moravian Church, 1885–1985.* Moravian Seminary & Archives: Bethlehem, PA.

Himes-Cornell, A., K. Hoelting, C. Maguire, L. Munger-Little, J. Lee, J. Fisk, R. Felthoven, C. Geller, and P. Little
2013. *Community profiles for North Pacific fisheries—Alaska.* U.S. Department of Commerce, NOAA Technical Memo NMFS-AFSC-259.

Hout, J.L.
1966. *Fish and wildlife resources of Nunivak Island. Part 1: fisheries*. U.S. Fish and Wildlife Service: Nunivak National Wildlife Refuge.

Hunt Jr., G.L., K.O. Coyle, L.B. Eisner, E.V. Farley, R.A. Heintz, F. Mueter, J.M. Napp, J.E. Overland, P.H. Ressler, S. Salo, and P.J. Stabeno
2011. *Climate impacts on eastern Bering Sea foodwebs: a synthesis of new data and an assessment of the Oscillating Control Hypothesis*. ICES Journal of Marine Science 68(6), pages 1230–1243.

Huntington, H.P.
2000. *Native observations capture impacts of sea ice changes*. Witness the Arctic: chronicles of the NSF Arctic Sciences Program 8(1).

Huntington, H.P., M. Nelson, and L.T. Quakenbush
2017. *Traditional knowledge regarding marine mammals near Mekoryuk, Alaska.* Final report to the Eskimo Walrus Commission, the Iceseal Committee, and the Bureau of Ocean Energy Management for contract #M13PC00015.

Hutchings, J.A. and R.A. Myers
1994. *What can be learned from the collapse of a renewable resource? Atlantic cod, Gadus morhua, of Newfoundland and Labrador*. Canadian Journal of Fisheries and Aquatic Sciences 51(9), pages 2126–2146.

Ikuta, H., C.L. Brown, and D.S. Koster

2014. *Subsistence harvests in 8 communities in the Kuskokwim River drainage and lower Yukon River, 2011*. Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 396: Fairbanks.

Ikuta, H., D.M. Runfola, J.J. Simon, and M.L. Kostick

2016. *Subsistence harvests in 6 communities on the Bering Sea, in the Kuskokwim River drainage, and on the Yukon River, 2013*. Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 417: Fairbanks.

Jack, C.T.

2002. *Canenermiut lifeways and worldview and western fish and wildlife management*. University of Alaska Fairbanks: Fairbanks.

Jacobson, S.A.

1995. *A practical grammar of the Central Alaskan Yup'ik Eskimo language*. Alaska Native Language Center, University of Alaska: Fairbanks.

1998. *Yup'ik dialect atlas and study*. Alaska Native Language Center: Fairbanks.

2012. *Yup'ik Eskimo Dictionary*, 2nd edition. Alaska Native Language Center, University of Alaska: Fairbanks.

Jorgenson, M.T.

2000. *Hierarchical organization of ecosystems at multiple spacial scales on the Yukon-Kuskokwim Delta, Alaska, U.S.A.* Arctic, Antarctic, and Alpine Research 32(3), pages 221–239.

Jorgenson, M.T., G.V. Frost, and D. Dissing

2018. *Drivers of landscape changes in coastal ecosystems on the Yukon-Kuskokwim Delta, Alaska*. Remote Sensing 10(8), page 1280.

Khromchenko, V.S.

1973. *V.S. Khromchenko's coastal explorations in southwestern Alaska, 1822*. Fieldiana Anthropology, 64. Field Museum Press: Chicago.

Kluwe, J. and E.E. Krumpe

2003. *Interpersonal and societal aspects of use conflicts: a case study of wilderness in Alaska and Finland*. International Journal of Wilderness 9(3), pages 28–33.

Knapp, G., C. Wiese, and J. Henzler

2001. *A village fish plant: yes or no? A planning handbook*. Institute of Social and Economic Research, University of Alaska Anchorage: Anchorage.

Korsakovskiy, P. and I.Y. Vasilev

1988. *Russian exploration in Southwest Alaska: the travel journals of Petr Korsakovskiy (1818) and Ivan Ya. Vasilev (1829)*, v. 4 book in the The Rasmuson Library historical translation series. University of Alaska Press: Fairbanks.

Kowalik, Z.

1999. "*Bering Sea tides*" [in] T.R. Loughlin and K. Ohtani *Dynamics of the Bering Sea: a summary of physical, chemical, and biological characteristics, and a synopsis of research on the Bering Sea*. University of Alaska: Fairbanks.

Kurlansky, M.

1997. *Cod: a biography of the fish that changed the world*. Penguin Classics: New York.

Langdon, S.

1991. *The integration of cash and subsistence in Southwest Alaskan Yup'ik Eskimo communities*. SENRI Ethnological Studies 30, pages 269–291.

Lantis, M.
1946. *The social culture of the Nunivak Eskimo*. Transactions of the American Philosophical Society 35(3), pages 153–323.

1972. *Factionalism and leadership: a case study of Nunivak Island.* Arctic Anthropology 9(1), pages 43–65.

La Vine, R., M.J. Lisac, and P. Coiley-Kenner
2007. *Traditional ecological knowledge of 20th-century ecosystems and fish populations in the Kuskokwim Bay region*. U.S. Fish and Wildlife Service, Office of Subsistence Management, Fisheries Resource Monitoring Program, Project No. FIS 04-351: Anchorage.

Ledger, P.M., V. Forbes, E. Masson-Maclean, and C. Hillerdal
2018. *Three generations under one roof? Bayesian modeling of radiocarbon data from Nunalleq, Yukon-Kuskokwim Delta, Alaska*. American Antiquity 83(3), pages 505–524.

Lipka, C. and A. Tiernan
2018. *2017 Kuskokwim Area management report*. Alaska Department of Fish and Game, Fishery Management Report No. 18-22: Anchorage.

Litecky, A.
2011. *The dwellers between: Yup'ik shamans and cultural change in westen Alaska*. University of Montana: Missoula, MT.

Loughlin, T.R. and K. Ohtani editors.
1999. *Dynamics of the Bering Sea*. University of Alaska Sea Grant: Fairbanks.

McPhail, J.D. and C.C. Lindsey
1970. *Freshwater fishes of northwestern Canada and Alaska*. Fisheries Research Board of Canada: Ottawa.

Mecklenburg, C.W., T.A. Mecklenburg, and L.K. Thorsteinson
2002. *Fishes of Alaska*. American Fisheries Society: Bethesda, MD.

Meyers, T.R., T. Burton, C. Bentz, and J. Ferguson
2019a. *Diseases of wild and cultured fishes in Alaska*, 3rd edition. Alaska Department of Fish and Game Fish Pathology Laboratories: Anchorage.

Meyers, T.R., J. Ferguson, C. Bentz, and T. Burton
2019b. *Opportunitsic phaeohyphomycoses in wild saffron cod Eleginus gracilis from waterways of Norton Sound and Tooksook Bay, Alaska, USA*. Diseases of Aquatic Organisms 135, pages 211–226.

Moss, J., J.M. Murphy, E. Fergusson, and R. Heintz
2016. *Allometric relationships between body size and energy density of juvenlie Chinook (Oncorhynchus tshawytscha) and chum (O. keta) salmon across a latitudinal gradient*. North Pacific Anadromous FIsh Commission Bulletin 6, pages 161–168.

Napoleon, H.
1990. *Yuuyaraq: the way of the human being*. Alaska Native Knowledge Network: Fairbanks.

National Research Council
1996. *The Bering Sea ecosystem*. The National Academies Press: Washington DC.

Nelson, E.W.
1882. *A sledge journey in the delta of the Yukon, northern Alaska.* Proceedings of the Royal Geographical Society and Monthly Record of Geography 4(11), pages 660–670.

1983rev. *[1899] The Eskimo about Bering Strait*. Smithsonian Institution Press: Washington D.C.

Nord, E.H.
1995. *Evolution of a public health nursing program, Yukon Kuskokwim Delta, Alaska, 1983–1993*. Public Health Nursing 12(4), pages 249–255.

Nowak, M.
1975. *Subsistence trends in a modern Eskimo community*. Arctic 28(1), pages 21–34.

Numiwarmiut Taqnelluit and D. Griffin
2018. *Numiwami navcit cenallat-ilu / Nunivak plant and seashore life: the ethnobotany of the Nuniwarmiut Eskimo, Nunivak Island, Alaska*. Alaska Native Language Center: Fairbanks.

Orth, D.J.
1971rep. *[1967] Dictionary of Alaska Place Names*. United States Government Printing Office.

Pete, M.C.
1984. *Subsistence use of herring in the Nelson Island Region of Alaska.* Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 113: Juneau.

1990. *Subsistence herring fishing in the eastern Bering Sea region: Nelson Island, Nunivak Island, and Kuskokwim Bay.* Proceedings of the International Herring Symposium: Anchorage.

1991a. *Subsistence herring fishing in the Nelson Island and Nunivak Island districts, 1990.* Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 196: Juneau.

1991b. *Subsistence herring fishing in the Nelson and Nunivak Island districts, 1991.* Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 211: Juneau.

1991c. *Subsistence herring fishing in the eastern Bering Sea region: Nelson Island, Nunivak Island, and Kuskokwim Bay.* Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 192: Fairbanks.

1992. *Subsistence herring fishing in the Nelson Island and Nunivak Island districts, 1992.* Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 221: Juneau.

Pete, M.C., D.E. Albrecht, and R.E. Kreher
1987. *Subsistence herring fishing in the Nelson Island District and Northern Kuskokwim Bay, 1987.* Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 160: Juneau.

Pete, M.C. and R.E. Kreher
1986. *Subsistence herring fishing in the Nelson Island district, 1986*. Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 144: Bethel.

Pratt, K.L.
1997. *Historical fact or historical fiction? Ivan Petroff's 1891 census of Nunivak Island, southwestern Alaska*. Arctic Anthropology 34(2), pages 12–27.

2001. *The ethnohistory of caribou hunting and interior land use on Nunivak Island.* Alaska Journal of Anthropology 1(1), pages 28–55.

2012. *Introduction to "Tribal divisions of the western Eskimo" by Frank H. Waskey (1950).* Alaska Journal of Anthropology 10.

2013. *Deconstructing the Aglurmiut migration: an analysis of accounts from the Russian-America period to the present.* Alaska Journal of Anthropology 11(1&2), pages 17–36.

Ravens, T.M. and J. Allen
2012. *Modeling storm-induced inundation on the Yukon-Kuskokwim Delta for present and future climates*.

Ray, L., C. Brown, A. Russell, T. Krauthoefer, C. Wassillie, and J. Hooper
2010. *Local knowledge and harvest monitoring of nonsalmon fishes in the lower Kuskokwim River region, Alaska, 2005–2009. Final report to the U.S. Fish and Wildlife Service, Office of Subsistence Management, to fulfill obligations for Study No. FIS 06-351*. Alaska Department of Fish and Game Division of Subsistence, Technical Paper No. 356: Fairbanks.

Reagan, R.
1983. "*Proclamation 5030 of March 10, 1983: Exclusive Economic Zone of the United States of America*" [in] *Federal Register Volume 48, Number 50*. U.S. Government Printing Office: Washington D.C.

Rearden, A. and A. Fienup-Riordan
2013. *Erinaput Unguvaniartut / So our voices will live: Quinhagak history and oral traditions*. Calista Elders Council and the Alaska Native Language Center, University of Alaska Fairbanks: Fairbanks.

Regnart, R.I.
1975. *Alaska marine environmental assessment project herring spawning surveys, southern Bering Sea*. Alaska Department of Fish and Game Division of Commercial Fisheries, Arctic Yukon Kuskokwim Herring Report AYK.Herring.03: Anchorage.

Regnart, R.I., R. Baxter, and M.F. Geiger
1968. *1967 annual report Arctic-Yukon-Kuskokwim Area*. Alaska Department of Fish and Game Division of Commercial Fisheries: Anchorage.

Regnart, R.I. and A.P. Kingsbury
1980. *Pacific herring stocks and fisheries in the eastern Bering Sea, a report to the Alaska Board of Fisheries, December 1980*. Alaska Department of Fish and Game Division of Commercial Fisheries, Arctic Yukon Kuskokwim Herring Board Report 3: Anchorage.

Regnart, R., R. Randall, L. Barton, I. Warner, P. Jackson, D. Blackenbeckler, M. Nelson, and V. Wespestad
1978. *Briefing report on the fishery management plan for herring in the eastern Bering Sea.* Alaska Department of Fish and Game, AYK Region Herring Report #3.

Riddell, B.R., R.D. Brodeur, A.V. Bugaev, P. Moran, J.M. Murphy, J.A. Orsi, M. Trudel, L.A. Weitkamp, B.K. Wells, and A.C. Wertheimer
2018. "*The ocean ecology of Chinook salmon*" [in] R.J. Beamish, editor *Ocean ecology of Pacific salmon and trout*. American Fisheries Society: Bethesda, MD.

Royer, T.C. and C.E. Grosch
2006. *Ocean warming and freshening in the northern Gulf of Alaska*. Geophysical Research Letters 33(16).

Runfola, D.M., A.R. Godduhn, C.R. McDevitt, and M.L. Kostick
2018. *Subsistence harvest and use of nonsalmon fish in 6 lower Yukon River communities, 2014 and 2015*. Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 438: Fairbanks.

Runfola, D.M., H. Ikuta, A.R. Brenner, J.J. Simon, J. Park, D.S. Koster, and M.L. Kostick
2017. *Bethel subsistence, 2012: wild resource harvests and uses, land use patterns, and subsistence economy in the hub community of the Yukon–Kuskokwim Delta*. Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 393: Fairbanks.

Seely, N.
2012. *Decontaminating Kipnuk: preparing the site for a new school*. Alaska Business Monthly, pages 104–107.

Shaw, R.D.
1998. *An archaeology of the Central Yupik: a regional overview for the Yukon-Kuskokwim Delta, northern Bristol Bay, and Nunivak Island*. Arctic Anthropology 35(1), pages 234–246.

Sheffield, G.L., J. Duffy-Anderson, A.C. Matarese, C.W. Mordy, J.M. Napp, and P.J. Stabeno
2014. *Understanding climate control of fisheries recruitment in the eastern Bering Sea: long-term measurements and process studies*. Oceanography 27(4), pages 90–103.

Siddon, E. and S. Zador editors.
2018. *Ecosystem status report 2018: Eastern Bering Sea 2018*. North Pacific Fishery Management Council: Anchorage.

Simeone, W.E. and J. Kari
2002. *Traditional knowledge and fishing practices of the Ahtna of the Copper River, Alaska.* Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 270.

Spencer, D.L. and C.J. Lensink
1970. *The muskox of Nunivak Island, Alaska*. Alaska Department of Fish and Game: Alaska.

Stabeno, P.J. and S.W. Bell
2019. *Extreme conditions in the Bering Sea (2017–2018): record-breaking low sea-ice extent*. Geophysical Research Letters 46(15), pages 8952–8959.

Stickney, A.
1984. *Coastal ecology and wild resource use in the central Bering Sea area: Hooper Bay and Kwigillingok*. Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 85: n.p.

U.S. Army Corps of Engineers
2008. *Erosion information paper—Mekoryuk, Alaska*, Alaska Baseline Erosion Assessment. U.S. Army Corps of Engineers, Alaska District.

2009. *Community erosion assessment, Kipnuk, Alaska.* U.S. Army Corps of Engineers, Alaska District.

U.S. Census Bureau
n.d. *2010 Decennial Census and American Community Survey data*. U.S. Department of Commerce, Bureau of the Census, American FactFinder Homepage: Washington, D.C. http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml

2011. *2010 census*. U.S. Department of Commerce, Bureau of the Census, American FactFinder Homepage: Washington, D.C. http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml

VanStone, J.W.
1984. *"Mainland Southwest Alaska Eskimo"* [in] W.C. Sturtevant, editor Handbook of North American Indians, 5: Arctic. Smithsonian Institution Press: Washington, D.C.

1989. *"Nunivak Island Eskimo (Yuit) technology and material culture"* [in] Fieldiana. Anthropology. Field Museum of Natural History: Chicago.

Walsh, J., R.L. Thoman, U.S. Bhatt, P.A. Bieniek, B. Brettschneider, M. Brubaker, S. Danielson, R. Lader, F. Fetterer, K. Holderied, K. Iken, A. Mahoney, M. McCammon, and J. Partain
2018. *The high latitude marine heat wave of 2016 and its impacts on Alaska*. Special Supplement to the Bulletin of the American Meteorological Society 99(1).

Weiss, D.
2015. *Excavations near a Yup'ik village in Alaska are helping its people reconnect with the epic stories and practices of their ancestors*. Archaeology (September/October).

Wolfe, R.J.
1987. *The super-household: specialization in subsistence economies*. Paper presented at the 14th annual meeting of the Alaska Anthropological Association, March 1987, Anchorage, Alaska. Alaska Department of Fish and Game Division of Subsistence: Juneau.

1988. *The fish are not to be played with": Yup'ik views of sport fishing and subsistence-recreation conflicts along the Togiak River.* Alaska Department of Fish and Game, Division of Subsistence Special Publication No. SP1988-002: Anchorage.

Wolfe, R.J., J.J. Gross, S.J. Langdon, J.M. Wright, G.K. Sherrod, L.J. Ellanna, and V. Sumida
1984. *Subsistence-based economies in coastal communities of Southwest Alaska*. Alaska Department of Fish and Game, Division of Subsistence Technical Paper No. 89; Minerals Management Service, Alaska Region, U.S. Department of the Interior.

Wolfe, R.J., C.L. Scott, W.E. Simeone, C.J. Utermohle, and M.C. Pete
2010. *The "super-household" in Alaska Native subsistence economies*. Final Report to the National Science Foundation, Project ARC 0352611.

Wood, C.A. and J. Kienle editors.
1992. *Volcanoes of North America*. Cambridge University Press: Cambridge.

Woodby, D., D. Carlile, S. Siddeek, F. Funk, J.H. Clark, and L. Hulbert
2005. *Commercial fisheries of Alaska*. Alaska Department of Fish and Game, Division of Sport Fish Special Publication 05-09: Anchorage.

APPENDIX A–ETHNOGRAPHIC INTERVIEW GUIDE

BEFORE YOU BEGIN RECORDING **be sure you're in a quiet place. If not (e.g. TV or radio on), ask respondent(s) to turn off the source of the noise, ask if you can talk somewhere else, or if there's a better time.**

ALWAYS start recording by stating the following information:
YOUR NAME
YOUR POSITION
DATE
TIME
LOCATION
NAME OF RESPONDENT(S)
NAME OF PROJECT
YOUR PURPOSE
NAME(S) OF OTHER PEOPLE IN THE ROOM (DO NOT interview minors or identify them on the recording. If anyone present is under the age of 18 and audible in the background, ask their guardian if they give consent to the child's voice possibly being recorded.)

If you reach a point in the interview when you need to stop and restart the recording, state the information above once more. This will help in the event that your recording device started a new mp3 file after the break.

EXAMPLE: *"This is Jane Smith, Subsistence Resource Specialist with the Alaska Department of Fish and Game Subsistence Division. It's Friday February 24th, 2017 at 2 PM. I'm in Marshall, Alaska, in the home of Mary and John Williams. I'm here for the OSM Lower Yukon Nonsalmon project and we'll be talking about their experiences fishing for whitefish and other nonsalmon in the area. Assisting me is our Marshall research assistant, Michael Jones."*

The following is a recommended outline to help organize your interviews. Keep in mind that this interview is semi-structured, which means the respondent's knowledge and experience MUST drive the course of the interview. The interviewer is just acting as a guide to the conversation when needed. There is no expectation to cover each topic if it's not within a respondent's experience or knowledge, or if it's otherwise unnecessary. Skip around if that works better for you and your respondent.

If you're using maps, label each with the following information: project name, interviewer initials, respondent initials, date, and map number of total number of maps (e.g., 1 of 5). The map number will come in handy during the interview when marking a location. You can use it to connect the marking of the location with a specific map. If it's not inconvenient, you should also label the marked location on the map with a time stamp from the audio recorder for reference during interview analysis.

OSM Lower Yukon Nonsalmon Ethnographic Interview Guide

1. **Demographic Information**

   In the beginning of each interview, ask some basic demographic questions. It's often useful to take the seasonal round approach when doing interviews and let people answer the questions below. They may choose to answer by describing the parts of the seasonal round that they participate in. That way, you can also document seasonal camps used in the past or currently used by respondents. Identify locations on the map. If using Yup'ik names, be as careful as possible about getting a good spelling (phonetic if necessary) and a good, slow pronunciation on the recording.

   a. name

   b. year/location born (or family home at birth)

   c. parents' names and where from

   d. how long been fishing for nonsalmon

   If respondent was born or grew up in a historical village or campsite, this will be an opportunity to get some information about that location. It has the potential to begin a conversation about that place as it relates (or once related) to the seasonal round and nonsalmon harvests. Some sites were settled due to the prevalence of whitefishes, which are a readily available source of food year-round.

2. **Species Identification**

   This section has the potential of leading to an interview that covers all aspects of information that we are hoping to get. When people see pictures of fish accompanied with a map, you can expect to get more than just species names. If the respondent is knowledgeable and the conversation flows naturally, you will get information about fish locations throughout the seasons, movements, harvest timing, campsites, fishing gear, interesting and hopefully relevant family or community history, etc.

   The principal nonsalmon species common to all study communities are whitefishes including sheefish, as well as northern pike, burbot, and Alaska blackfish. Marshall and Mountain Village fishers also have experience harvesting large numbers of lamprey in the fall. Coastal communities generally harvest numerous saffron cod (locally known as tomcod), rainbow smelt, and possibly sticklebacks (two species locally known as needlefish). Some coastal fishers may have experience fishing for Pacific halibut, as well as a few other marine species.

   Provide the respondent with high quality photographs of various species of nonsalmon. Ask the respondent to identify each species by name, both in English and Yup'ik if possible. Some species will be known only by their Yup'ik name. When the respondent states the name of a fish that he or she is looking at, remember to say something like, "we're looking at a picture of a humpback whitefish", for easy identification later.

   The following are common species and Yup'ik names to ask about or listen for when talking about nonsalmon fishes, but be ready to hear other fish names and terms that are used locally. Be prepared for most people not knowing English names for whitefish, except sheefish, or the English names of several other species listed below.

List of nonsalmon fishes commonly harvested in lower Yukon River area:

Sheefish: *ciiq* (pron. *CHEEK* In Yup'ik, the "q" is the sound of a soft *k* on the soft palate.), everyone will call it shee-, chee-, or "seefiss".

Humpback whitefish: *cingikeggliq* (*ching-EEK-thlik*), in English "one with a pointed head"

Broad whitefish (generic): *qaurtuq* (*KOWHH-took*), referring to the forehead or brow, some people translate it "one with the wide (broad) forehead"

Broad whitefish (large): *akakiik* (*ah-GAA-geek*), referring to rolling or tumbling, possibly a description of how very large broad whitefish exit from ponds through freshets during high water events.

Bering cisco: *imarpinraq* (pron. *ee-MAHH-bin-hhrahk*), "one from the ocean"

Least cisco: *iituliq* (pron. *EE-doo-leek*), "one with big eyes". This is a name not widely known to most people we'll talk to. Many people will have difficulty distinguishing leasts from Berings, but our key respondents should be able to.

Many people will discuss small whitefish by one or more of the following terms: *qassaq* (*kah-SUCK*), *qassayaq* (*kah-SAI-yak*), or *qassayagaq* (*kah-SAI-ya-ghak*). These all translate as "(small) whitefish eaten raw or frozen". It's actually a food term, not really a species identification. It's like calling a pig "pork". Many fishers (and fish eaters) now use these terms as a catch-all for whitefish that look small regardless of species, or whitefish species that they think of as small (i.e., Bering cisco and least cisco). It can be confusing, so beware of it and do your best to clarify what you're talking about when the name is used. If the respondent doesn't seem to know any other way of distinguishing two or more species except by referring to them as *qassaqs*, then you might want to move onto another topic or species.

Northern pike: *keggsuli* or *cukvak*, the former having to do with teeth, the latter possibly having to do with speed, "very fast". Everyone will call them "pike".

Burbot: *manignaq* (*mah-NIGHH-n-ak*), mostly called *lush* but everyone knows the Yup'ik name and many might use it.

Alaska blackfish: *immangaq*, everyone calls them "blackfish".

Saffron cod: *iqalluaq*, everyone calls them "tomcod".

Sticklebacks: *quaruq*, two species, ninespine and threespine. Everyone calls them "needlefish".

Rainbow smelt: *qusuuq*, almost everyone calls them "smelt". Widely known to smell like cucumber.

Capelin: *cemerliq*, rarely harvested in Yukon delta coast nowadays. Widely known to smell like cucumber. No one will know the English name.

Pacific herring: *iqalluarpak*, almost everyone calls them "herring".

Pacific halibut: halibut.

Arctic lamprey: eels.

3. Harvest locations, timing, and gear

Take a simple, straightforward approach to these topics. Just ask questions like:

- Where do you usually fish for these?
- Are there any other places to catch them? Historically? Family or community ‘territory’?
- When do you catch them?
- Do they move around throughout the year, the seasons, the day?
- How does their movement affect catching them?
- What is the aquatic environment like where they’re caught? (e.g., slough, mainstem, salt, fresh, brackish, ponds, tides)
- How do you catch those, or what do you use to catch those?
- If the fisher uses some unique gear type, ask how it’s made and how it’s deployed. Ask about construction materials and tools. Take pictures if they have a trap or some other gear type readily available. Consider possible participant observation opportunities.
- How do you take care of those fish after you catch them? In the field? At home or at camp?
- How do you prepare and eat those? If they describe something unique, ask how that type of food is processed (e.g. aged or fermented fish).

4. Other topics

Questions and conversation related to the sections above all have the potential of getting into discussions of places. Conversations about places might include other villages (contemporary and historical), campsites, different parts of the drainage, fishing and travel in the context of seasons and times of year, community history, family stories, learning how to fish and other information about older generations teaching younger fishers, lifestyle, celebrations such as potlatches, etc.

Let the respondent’s comments guide which questions you ask. If they talk a lot about fish camp then map it and ask questions about that place. If they talk about giving away fish at potlatches then ask about what kinds of fish they caught for that event, how much, who received, what’s the history of that phenomenon, etc. Some people who have memories of moving between camps throughout the year might just start talking about their seasonal round and describe aspects of fish presence, fish movements, campsites, gear, seasonal timing that prompts moving to another location, etc.

Some people might talk about their concerns regarding fish. Be very careful *not* to guide their conversation too much here. Stick to their observations. Never suggest explanations like climate change, or new or more prevalent diseases. Don’t assume that people know why or how changes are occurring. In the best interview, the interviewer will never say the words “climate change”. Let the respondent talk about it if they like; but like most humans (including climate scientists and fish biologists) they probably have no concept of what is actually happening. All they can be certain of is what they have observed or otherwise experienced firsthand, including memorable changes over time. Try to get that on tape as opposed to their interpretations or presumed explanations.

APPENDIX B–SURVEY INSTRUMENT

OSM COASTAL Y-K DELTA NONSALMON

KIPNUK, ALASKA

From January 1, 2017 to December 31, 2017

OSM COASTAL
YUKON KUSKOKWIM
DELTA

printed: 2018-03-05

This survey is used to estimate subsistence harvests of nonsalmon fish and to describe their importance in your community. We will publish a short summary report, that will be available to community members. We share this information with the U.S. Fish and Wildlife Service and other divisions of the Alaska Department of Fish and Game. We work with the Federal Regional Advisory Councils and with local Fish and Game Advisory Committees to better manage subsistence, and to implement state and federal subsistence priorities.

We will NOT identify your household. We will NOT use this information for enforcement. Participation in this survey is voluntary. Even if you agree to be surveyed, you may stop at any time.

HOUSEHOLD ID:		
COMMUNITY ID:	190	**190**
INTERVIEWER #1:		
INTERVIEWER #2:		
INTERVIEW DATE:		
START TIME:		
STOP TIME:		
DATA CODED BY:		
DATA ENTERED BY:		
SUPERVISOR:		

Photo by Anna Godduhn, ADF&G

KIPNUK TRADITIONAL COUNCIL
P.O. BOX 57
KIPNUK, AK 99614
907-896-5431

ALASKA DEPARTMENT OF FISH AND GAME
1300 COLLEGE RD
FAIRBANKS, AK 99701
907-459-7320

HOUSEHOLD MEMBERS

HOUSEHOLD ID

First, I would like to ask some questions about the permanent members of your household who lived here for at least six months in 2017. This includes students who returned home in the summer or household members who were in the military.

Last year, that is, between January 1, 2017 and December 31, 2017 WHO were the head or heads of your household?

Is this person answering questions on this survey?		How is this person related to HEAD 1?	Is this person MALE or FEMALE?	Is this person an ALASKA NATIVE?	WHAT YEAR WAS THIS PERSON BORN?	Where were parents living when this person was born?	How many years has this person lived in Kipnuk?
ID #	*(circle)*	*(relation)*	*(circle)*	*(circle)*	*(year)*	*(AK city or state)*	*(number)*
HEAD 1	Y N		M F	Y N			
1							
NEXT enter spouse or partner. If a household has a SINGLE HEAD, leave HEAD 2 row BLANK and move to PERSON 3.							
HEAD 2	Y N		M F	Y N			
2							
BELOW, enter children (oldest to youngest), grandchildren, grandparents, or anyone else living full-time in this household.							
PERSON 03	Y N		M F	Y N			
3							
PERSON 04	Y N		M F	Y N			
4							
PERSON 05	Y N		M F	Y N			
5							
PERSON 06	Y N		M F	Y N			
6							
PERSON 07	Y N		M F	Y N			
7							
PERSON 08	Y N		M F	Y N			
8							
PERSON 09	Y N		M F	Y N			
9							
PERSON 10	Y N		M F	Y N			
10							
PERSON 11	Y N		M F	Y N			
11							
PERSON 12	Y N		M F	Y N			
12							
PERSON 13	Y N		M F	Y N			
13							

RETAINED COMMERCIAL HARVESTS

HOUSEHOLD ID

1. Do you or members of your household USUALLY participate in any commercial fishery?.. Y N

2. During the last year (between January 1, 2017 and December 31, 2017) did you, or members of your household PARTICIPATE in any commercial fishery?... Y N

IF the answer to QUESTION 2 is NO, go to the *NEXT PAGE*.

IF the answer is *YES*, continue on this page …

While you fished commercially during the last year[1]

which species did you or members of your household…

A ...KEEP from your commercial catch for your own use[2] or to share?

B Did you FISH COMMERCIALLY for____?

C Was the ____ that you kept INCIDENTAL[3] catch?

for each species in "A"

Estimate how many fish ALL COMMERCIAL FISHERS[4] IN YOUR HOUSEHOLD removed from commercial harvests for personal use during the last year.

Include fish that members of this household ate fresh, fed to dogs, lost to spoilage, or gave away to another household. DO NOT INCLUDE fish that a COMMERCIAL FISHING PARTNER from another household kept for his/her own use that he/she caught while you fished together.

A List all species that household members kept while fishing commercially.	B COMM FISH?	C INCI?	How many did you keep for your OWN HOUSEHOLD'S USE or to GIVE TO OTHERS? *number*	Units[5] *specify*	*comments*
	Y N	Y N			
	Y N	Y N			
	Y N	Y N			
	Y N	Y N			
	Y N	Y N			
	Y N	Y N			
	Y N	Y N			
	Y N	Y N			
	Y N	Y N			

1 *"LAST YEAR" means between January 1, 2017 and December 31, 2017.*
2 *"USE" includes eating, feeding to dogs, sharing or trading with others, etc.*
3 *"INCIDENTAL CATCH" means the fish kept was not being commercially fished. For example, a king salmon kept from a chum commerical fishery.*
4 *A "COMMERCIAL FISHER" is a person who fished with a COMMERCIAL PERMIT or CREWMEMBER'S LICENSE.*
5 *UNITS will differ by species and situation. Units may be pounds (lb), individuals (ind), portions of individuals (1/4), buckets, sacks, tubs, etc.*

HARVESTS: WHITEFISH AND SHEEFISH

HOUSEHOLD ID

1. Do you or members of your household USUALLY fish for whitefish and sheefish?... Y N

2. During the last year (between January 1, 2017 and December 31, 2017) did you, or members of your household USE or TRY TO HARVEST whitefish and sheefish?... Y N

IF the answer to QUESTION 2 is NO, go to the *NEXT PAGE* .

IF the answer is *YES* , continue on this page …

During the last year,[1]

did you or members of your household…

- **A** … use[2] _______?
- **B** …receive _____ from another HH or community
- **C** …give _____ to another HH or community?
- **D** …try[2] to harvest _____?
- **E** …actually harvest any _____?

if harvest is "yes"

Please estimate how many whitefish and sheefish ALL MEMBERS OF YOUR HOUSEHOLD got for subsistence uses during the last year. How many were harvested with ….

INCLUDE whitefish and sheefish that members of this household gave away, ate fresh, fed to dogs, lost to spoilage, or got by helping others. If fishing with or helping others, report ONLY THIS HOUSEHOLD'S share of the harvest. DO NOT INCLUDE whitefish and sheefish that you caught and released or retained from commercial harvests.

Read names below in blanks above	A USE	B REC	C GIVE	D TRY	E HAR	OPEN WATER SET GILL NET	UNDER ICE SET GILL NET	OPEN WATER JIGGING or ROD & REEL[3]	UNDER ICE JIGGING or ROD & REEL[4]	OTHER GEAR (specify type)	UNITS[4]	# of those used just for dog food?
						(number harvested by each gear type)				amount / type	specify	amt.
SHEEFISH *CIIQ*	Y N	Y N	Y N	Y N	Y N					/		
125600000												
HUMPBACK WHITEFISH *CINGIKEGGLIQ*	Y N	Y N	Y N	Y N	Y N					/		
126408000												
BROAD WHITEFISH *AKAKIIK*	Y N	Y N	Y N	Y N	Y N					/		
126404000												
BERING CISCO *IMARPINRAQ*	Y N	Y N	Y N	Y N	Y N					/		
126406040												
LEAST CISCO *IITULIQ*	Y N	Y N	Y N	Y N	Y N					/		
126406060												
ROUND WHITEFISH *CEV'EQ*	Y N	Y N	Y N	Y N	Y N					/		
126412000												
UNKNOWN WHITEFISH	Y N	Y N	Y N	Y N	Y N					/		
126499000												
	Y N	Y N	Y N	Y N	Y N					/		
	Y N	Y N	Y N	Y N	Y N					/		
	Y N	Y N	Y N	Y N	Y N					/		

During the last year, did your household use any other kind of Whitefish and sheefish?.. Y N

IF YES, enter the name in a blank row above, and answer the questions in that row.

1 *"LAST YEAR" means between January 1, 2017 and December 31, 2017.*
2 *"USE" includes harvesting, processing, eating, trading, feeding to dogs, etc. "TRY" includes looking, hunting, fishing, or any attempt to get.*
3 *"OPEN WATER JIGGING or ROD AND REEL" includes jigging with a stick or fishing with a rod & reel ONLY in open water.*
4 *"UNDER ICE JIGGING or ROD AND REEL" includes jigging with a stick or fishing with a rod & reel ONLY through the ice or from the ice edge.*
5 *UNITS will differ by species and situation. Units may be pounds (lbs), individuals (ind), portions of individuals (1/4), buckets, sacks, tubs, etc.*

SUBSISTENCE SUMMARY: WHITEFISH AND SHEEFISH

HOUSEHOLD ID

If this household DID NOT USE or HARVEST whitefish and sheefish last year, go to the ASSESSMENT section below.
Otherwise, continue with mapping and assessment sections...

MAPPING

Refer to data collection maps and mapping instructions to map whitefish and sheefish...

ASSESSMENTS: WHITEFISH AND SHEEFISH

126,400,000

During the last year[1],

…did your household use LESS, SAME, or MORE whitefish and sheefish than in recent years?.................... X L S M

If LESS or MORE… *X = do not use*

WHY was your use different?............................ 1 ______ 2 ______

During the last year[1],

…did your household GET ENOUGH whitefish and sheefish?.. Y N

If NO…

WHY did your household NOT get enough whitefish and sheefish?.......................... 1 ______ 2 ______

How would you describe the impact to your household of not getting enough whitefish and sheefish last year?... not noticable? (0) minor? (1) major? (2) severe? (3)

Did your household do anything DIFFERENTLY because you did NOT get enough whitefish and sheefish?............. Y N

IF YES…

What did your household do differently?... 1 ______ 2 ______

If LESS or MORE… *X = do not use*

WHY was your use different?............................ 1 ______ 2 ______

HARVESTS: OTHER NONSALMON FISH

HOUSEHOLD ID

1. Do you or members of your household USUALLY fish for other nonsalmon fish?... Y N

2. During the last year (between January 1, 2017 and December 31, 2017) did you, or members of your household USE or TRY TO HARVEST other nonsalmon fish?... Y N

IF the answer to QUESTION 2 is NO, go to the *NEXT PAGE* .

IF the answer is *YES* , continue on this page …

During the last year,[1]

did you or members of your household…

- **A** … use[2] _______?
- **B** …receive _____ from another HH or community
- **C** …give _____ to another HH or community?
- **D** …try[2] to harvest _____?
- **E** …actually harvest any _____?

if harvest is "yes"

Please estimate how many other nonsalmon fish ALL MEMBERS OF YOUR HOUSEHOLD got for subsistence uses during the last year. How many were harvested with ….

Include other nonsalmon fish that members of this household gave away, ate fresh, fed to dogs, lost to spoilage, or got by helping others. If fishing with or helping others, report ONLY THIS HOUSEHOLD'S share of the harvest. DO NOT INCLUDE other nonsalmon fish that you caught and released or retained from commercial harvests.

Read names below in blanks above	A USE	B REC	C GIVE	D TRY	E HAR	OPEN WATER SET GILL NET	UNDER ICE SET GILL NET	OPEN WATER JIGGING or ROD & REEL[3]	UNDER ICE JIGGING or ROD & REEL[4]	OTHER GEAR (specify type)	UNITS[5]	*# of those used just for dog food?*
						(number harvested by each gear type)				*amount / type*	*specify*	*amt.*
HERRING *IQALLUARPAK* 120200000	Y N	Y N	Y N	Y N	Y N					/		
HERRING EGGS *MELUCUAQ* 120300000	Y N	Y N	Y N	Y N	Y N					/		
TOMCOD (SAFFRON COD) *CETURRNAQ* 121010000	Y N	Y N	Y N	Y N	Y N					/		
SMELTS *QUSUUQ* 120406000	Y N	Y N	Y N	Y N	Y N					/		
HALIBUT *NATERNARPAK* 121800000	Y N	Y N	Y N	Y N	Y N					/	LBS	
FLATFISH (FLOUNDER) *NATERNAQ* 121400000	Y N	Y N	Y N	Y N	Y N					/		
DEVILFISH (SCULPIN) *NIRTULII* 123000000	Y N	Y N	Y N	Y N	Y N					/		
PACIFIC COD *MANIGNAALLERYAQ* 121004000	Y N	Y N	Y N	Y N	Y N					/		
CAPELIN 120402000	Y N	Y N	Y N	Y N	Y N					/		
OTHER MARINE FISH 129900000	Y N	Y N	Y N	Y N	Y N					/		

Continued on next page.

1 *"LAST YEAR" means between January 1, 2017 and December 31, 2017.*
2 *"USE" includes harvesting, processing, eating, trading, feeding to dogs, etc. "TRY" includes looking, hunting, fishing, or any attempt to get.*
3 *"OPEN WATER JIGGING or ROD AND REEL" includes jigging with a stick or fishing with a rod & reel ONLY in open water.*
4 *"UNDER ICE JIGGING or ROD AND REEL" includes jigging with a stick or fishing with a rod & reel ONLY through the ice or from the ice edge.*
5 *UNITS will differ by species and situation. Units may be pounds (lbs), individuals (ind), portions of individuals (1/4), buckets, sacks, tubs, etc.*

HARVESTS: OTHER FISH

HOUSEHOLD ID

…continued from previous page

During the last year,[1]
did you or members of your household…

- A … use[2] _______?
- B …receive _____ from another HH or community
- C …give _____ to another HH or community?
- D …try[2] to harvest _____?
- E …actually harvest any _____?

if harvest is "yes"

Please estimate how many other fish ALL MEMBERS OF YOUR HOUSEHOLD got for subsistence uses during the last year. How many were harvested with ….

INCLUDE other fish that members of this household gave away, ate fresh, fed to dogs, lost to spoilage, or got by helping others. If fishing with or helping others, report ONLY THIS HOUSEHOLD'S share of the harvest. DO NOT INCLUDE other fish that you caught and released or retained from commercial

Read names below in blanks above	A USE	B REC	C GIVE	D TRY	E HAR	OPEN WATER SET GILL NET	UNDER ICE SET GILL NET	OPEN WATER JIGGING or ROD & REEL[3]	UNDER ICE JIGGING or ROD & REEL[4]	OTHER GEAR (specify type)	UNITS[5]	# of those used just for dog food?
						(number harvested by each gear type)				amount / type	specify	amt.
PIKE *LUQRUUYAK*	Y N	Y N	Y N	Y N	Y N					/		
125500000												
LUSH (BURBOT) *MANIGGNAQ*	Y N	Y N	Y N	Y N	Y N					/		
124800000												
BLACKFISH *CAN'GIIQ*	Y N	Y N	Y N	Y N	Y N					/		
124600000												
DOLLY VARDEN	Y N	Y N	Y N	Y N	Y N					/		
125006000												
GRAYLING *CULUGPAUK*	Y N	Y N	Y N	Y N	Y N					/		
125200000												
NEEDLEFISH (STICKLEBACK) *QUARUQ*	Y N	Y N	Y N	Y N	Y N					/		
123800000												
UNKNOWN FRESHWATER FISH	Y N	Y N	Y N	Y N	Y N					/		
129900000												
	Y N	Y N	Y N	Y N	Y N					/		
	Y N	Y N	Y N	Y N	Y N					/		
	Y N	Y N	Y N	Y N	Y N					/		
	Y N	Y N	Y N	Y N	Y N					/		

During the last year, did your household use any other kind of other fish?.. Y N

IF YES, enter the name in a blank row above, and answer the questions in that row.

1 *"LAST YEAR" means between January 1, 2017 and December 31, 2017.*
2 *"USE" includes harvesting, processing, eating, trading, feeding to dogs, etc. "TRY" includes looking, hunting, fishing, or any attempt to get.*
3 *"OPEN WATER JIGGING or ROD AND REEL" includes jigging with a stick or fishing with a rod & reel ONLY in open water.*
4 *"UNDER ICE JIGGING or ROD AND REEL" includes jigging with a stick or fishing with a rod & reel ONLY through the ice or from the ice edge.*
5 *UNITS will differ by species and situation. Units may be pounds (lbs), individuals (ind), portions of individuals (1/4), buckets, sacks, tubs, etc.*

SUBSISTENCE SUMMARY: NON-SALMON FISH

HOUSEHOLD ID

If this household DID NOT USE or HARVEST non-salmon fish last year, go to the ASSESSMENT section below.
Otherwise, continue with mapping and assessment sections...

MAPPING

Refer to data collection maps and mapping instructions to map non-salmon fish...

ASSESSMENTS: NON-SALMON FISH

120,000,000

During the last year[1],

…did your household use LESS, SAME, or MORE non-salmon fish than in recent years?.................... X L S M

If LESS or MORE… *X = do not use*

WHY was your use different?............................ 1 2

During the last year[1],

…did your household GET ENOUGH non-salmon fish?.. Y N

If NO…

WHY did your household NOT get enough non-salmon fish?.................................... 1 2

How would you describe the impact to your household of not getting enough non-salmon fish last year?... not noticable? (0) minor? (1) major? (2) severe? (3)

Did your household do anything DIFFERENTLY because you did NOT get enough non-salmon fish?........................ Y N

IF YES…

What did your household do differently?.. 1 2

If LESS or MORE… *X = do not use*

WHY was your use different?............................ 1 2

SUBSISTENCE HARVESTS: MARINE INVERTEBRATES

HOUSEHOLD ID

1. Do you or members of your household USUALLY fish for marine invertebrates for subsistence, such as CLAMS, SHRIMP, or any other marine invertebrates?........ Y N
2. During the last year (between JANUARY 1, 2017 AND DECEMBER 31, 2017), did you or members of your household USE or TRY TO FISH FOR marine invertebrates?........ Y N

IF the answer to QUESTION 2 is NO, go to the MARINE INVERTEBRATES summary page.

IF the answer is YES, continue on this page…

During the last year[1], did you or members of your household….

- A …use[2] _____?
- B …receive _____ from another HH or community?
- C …give _____ to another HH or community?
- D …try[2] to harvest _____?
- E ...actually harvest any _____?

IF harvest is YES

Please estimate how many marine invertebrates ALL MEMBERS OF YOUR HOUSEHOLD got for subsistence uses during the last year.

INCLUDE marine invertebrates that members of this household gave away, ate fresh, lost to spoilage, or got by helping others. If fishing with or helping others, report ONLY this household's share of the harvest.

Read names below in blanks above	A USE?	B REC?	C GIVE?	D TRY?	E HAR?	How many did your HH harvest? *Amount*	Units[3] *specify*	*comments*
CLAMS	Y N	Y N	Y N	Y N	Y N		GAL	
500,600,000								
MUSSELS	Y N	Y N	Y N	Y N	Y N		GAL	
502,000,000								
SHRIMP	Y N	Y N	Y N	Y N	Y N		GAL	
503,400,000								
RED KING CRAB	Y N	Y N	Y N	Y N	Y N		IND	
501,008,080								
OTHER INVERTEBRATES	Y N	Y N	Y N	Y N	Y N			
509,900,000								
	Y N	Y N	Y N	Y N	Y N			
	Y N	Y N	Y N	Y N	Y N			
	Y N	Y N	Y N	Y N	Y N			
	Y N	Y N	Y N	Y N	Y N			
	Y N	Y N	Y N	Y N	Y N			

During the last year, did your household use any other kind of marine invertebrates?........ Y N

IF YES, enter the name in a blank row above, and answer the questions in that row.

1 *"LAST YEAR" means between 2017.*

2 *"USE" includes harvesting, processing, eating, trading, feeding to dogs, etc. "TRY" includes looking, hunting, fishing, or any attempt to get.*

3 *UNITS will differ by species and situation. Units may be pounds (lbs), individuals (ind), portions of individuals (1/4), buckets, sacks, tubs, etc.*

KIPNUK: 190

SUBSISTENCE SUMMARY: MARINE INVERTEBRATES

HOUSEHOLD ID

If this household DID NOT USE or HARVEST marine invertebrates last year, go to the ASSESSMENT section below.
Otherwise, continue with mapping and assessment sections...

MAPPING

Refer to data collection maps and mapping instructions to map marine invertebrates...

ASSESSMENTS: MARINE INVERTEBRATES

500,000,000

During the last year[1],
…did your household use LESS, SAME, or MORE marine invertebrates than in recent years?.................... X L S M

If LESS or MORE… *X = do not use*

WHY was your use different?............................ 1 2

During the last year[1],

…did your household GET ENOUGH marine invertebrates?.. Y N

If NO…

WHY did your household NOT get enough marine invertebrates?............................ 1 2

How would you describe the impact to your household of not getting enough marine invertebrates last year?.. not noticable? (0) minor? (1) major? (2) severe? (3)

Did your household do anything DIFFERENTLY because you did NOT get enough marine invertebrates?............... Y N

IF YES…

What did your household do differently?... 1 2

If LESS or MORE… *X = do not use*

WHY was your use different?............................ 1 2

SUBSISTENCE SUMMARY: NON-SALMON FISH & INVERTEBRATES

HOUSEHOLD ID

ASSESSMENTS: NON-SALMON FISH & INVERTEBRATES CONTINUED

120,000,000

Are there any kinds of non-salmon fish & invertebrates that your household used IN THE PAST that you DO NOT USE anymore?.. Y N

If YES…

Which kinds of non-salmon fish & invertebrates did your household STOP using? (Specify resource)	WHY did your household STOP using ____________________? (Write reasons households stopped using each resource in spaces below)
1	
2	
3	
4	

Are there any kinds of non-salmon fish & invertebrates that your household RECENTLY STARTED using that you DID NOT USE in the past?... Y N

If YES…

Which kinds of non-salmon fish & invertebrates did your household RECENTLY START using? (Specify resource)	WHY did your household RECENTLY START using ____________________? (Write reasons households recently started using each resource in spaces below)
1	
2	
3	
4	

OBSERVED CHANGES: NONSALMON FISH AND INVERTEBRATES

HOUSEHOLD ID

If this household does NOT USUALLY USE or HARVEST nonsalmon fish and invertebrates, go to the COMMENTS PAGE.
Otherwise, continue with THIS PAGE.

We'd like to ask some questions about any changes that may have affected your household's use of nonsalmon fish and invertebrates.

Have you noticed any ENVIRONMENTAL CHANGES?

IMPORTANT! *IF RESPONDENT NEEDS CLARIFICATION, ONLY RESPOND WITH THE FOLLOWING STATEMENT:*

"Possible changes could be related to things like **ICE, STORMS, TIDES, PERMAFROST**, or other things you see or experience in nature."

DO NOT OFFER ANY OTHER PROMPTS. REPEAT IF NECESSARY.

Y N

If yes…

What kinds of environmental changes have you noticed?

How have these environmental changes affected your household's harvest and use of nonsalmon fish and invertebrates?

Have you noticed any changes to NONSALMON FISH AND INVERTEBRATES?

IMPORTANT! *IF RESPONDENT NEEDS CLARIFICATION, ONLY RESPOND WITH THE FOLLOWING STATEMENT:*

"Possible changes could be related to things like the **places where you harvest fish or invertebrates, the numbers of fish or invertebrates you can find there, their health or physical condition**, or other things household members have observed."

DO NOT OFFER ANY OTHER PROMPTS. REPEAT IF NECESSARY.

Y N

If yes…

What kinds of changes to nonsalmon fish and invertebrates have you noticed?

How have these changes affected your household's harvest and use of nonsalmon fish and invertebrates?

Have you or members of your household observed any OTHER changes that have affected your harvest or use of nonsalmon fish and invertebrates?... Y N

If yes…

What kinds of other changes have affected your household's harvest and use of nonsalmon fish and invertebrates?

OBSERVED CHANGES NONSALMON FISH AND INVERTEBRATES: 66, 67

COMMENTS

HOUSEHOLD ID

DO YOU HAVE ANY QUESTIONS, COMMENTS OR CONCERNS?

DON'T FORGET TO FILL IN THE STOP TIME ____________________

INTERVIEW SUMMARY:

APPENDIX C–CONVERSION FACTORS

The following table presents the conversion factors used in determining how many pounds were harvested of each resource surveyed. For instance, if respondents reported harvesting 3 qt of smelt, the quantity would be multiplied by the appropriate conversion factor (in this case 1.5) to show a harvest of 4.5 lb of smelt.

Resource name	Reported unit	Conversion factor
Pacific herring	Individual	0.18
Pacific herring	Pound	1.00
Pacific herring	Gallon	6.00
Pacific herring roe	Pound	1.00
Pacific herring roe	Gallon	6.00
Pacific herring roe	Quart	1.50
Capelin (grunion)	Individual	0.18
Capelin (grunion)	Pound	1.00
Capelin (grunion)	Gallon	6.00
Rainbow smelt	Individual	0.18
Rainbow smelt	Pound	1.00
Rainbow smelt	Gallon	6.00
Rainbow smelt	6-gallon bucket	36.00
Rainbow smelt	Plastic shopping bag	6.00
Unknown smelts	Individual	0.18
Unknown smelts	Gallon	6.00
Pacific (gray) cod	Individual	3.20
Pacific (gray) cod	Pound	1.00
Saffron cod	Individual	0.21
Saffron cod	Pound	1.00
Saffron cod	Gallon	6.00
Saffron cod	6-gallon bucket	36.00
Saffron cod	Plastic shopping bag	6.00
Walleye pollock (whiting)	Individual	1.40
Walleye pollock (whiting)	Pound	1.00
Eels	Individual	3.00
Flounders	Individual	1.10
Flounders	Pound	1.00
Flounders	Gallon	6.00
Unknown flounders	Individual	1.10
Unknown flounders	Gallon	6.00
Pacific halibut	Individual	21.10
Pacific halibut	Pound	1.00
Sculpins	Individual	1.00
Sculpins	Pound	1.00
Sculpins	Gallon	6.00
Unknown sculpins	Individual	1.00
Sticklebacks (needlefish)	Individual	0.20
Sticklebacks (needlefish)	Pound	1.00
Sticklebacks (needlefish)	Gallon	6.00
Sticklebacks (needlefish)	Plastic shopping bag	6.00
Wolffish	Individual	0.50
Alaska blackfish	Individual	0.07
Alaska blackfish	Pound	1.00
Alaska blackfish	Gallon	6.00
Alaska blackfish	Quart	1.50

-continued-

Resource name	Reported unit	Conversion factor
Burbot	Individual	4.20
Burbot	Gallon	6.00
Arctic char	Individual	3.30
Arctic char	Pound	1.00
Arctic char	Gallon	6.00
Arctic char [CF retention]	Individual	3.30
Dolly Varden–unknown	Individual	3.30
Lake trout	Individual	2.70
Unknown chars	Individual	3.30
Unknown chars	Pound	1.00
Unknown chars	Gallon	6.00
Unknown chars [CF retention]	Individual	3.30
Arctic grayling	Individual	0.70
Northern pike	Individual	3.30
Northern pike	Gallon	6.00
Northern pike	Individual	3.30
Northern pike	Pound	1.00
Northern pike	Gallon	6.00
Sheefish	Individual	5.50
Sheefish	Pound	1.00
Sheefish [CF retention]	Individual	5.50
Rainbow trout	Individual	1.40
Rainbow trout	Gallon	6.00
Unknown trouts	Individual	1.40
Alaska blackfish	Individual	0.07
Alaska blackfish	Pound	1.00
Alaska blackfish	Gallon	6.00
Alaska blackfish	Quart	1.50
Burbot	Individual	4.20
Burbot	Pound	1.00
Burbot	Gallon	6.00
Broad whitefish	Pound	1.00
Broad whitefish	Gallon	6.00
Broad whitefish	Plastic shopping bag	6.00
Broad whitefish [CF retention]	Individual	4.00
Bering cisco	Individual	1.40
Bering cisco	Pound	1.00
Bering cisco	Gallon	6.00
Bering cisco	Plastic shopping bag	6.00
Least cisco	Individual	0.70
Least cisco	Pound	1.00
Least cisco	Gallon	6.00
Humpback whitefish	Individual	1.75
Humpback whitefish	Pound	1.00
Humpback whitefish	Gallon	6.00
Humpback whitefish	Plastic shopping bag	6.00
Humpback whitefish [CF retention]	Individual	1.75
Round whitefish	Individual	1.00
Round whitefish	Pound	1.00
Unknown whitefishes	Individual	1.79

-continued-

Appendix C.–Page 3 of 3.

Resource name	Reported unit	Conversion factor
Unknown nonsalmon fish	Individual	0.00
Unknown nonsalmon fish [CF retention]	Individual	0.00
Chitons (bidarkis, gumboots)	Gallon	3.00
Unknown chitons	Individual	0.50
Unknown chitons	Gallon	3.00
Butter clams	Individual	0.12
Butter clams	Pound	1.00
Butter clams	Gallon	3.00
Butter clams	Quart	0.75
Razor clams	Individual	0.25
Razor clams	Gallon	3.00
Razor clams	Quart	0.75
Unknown clams	Individual	0.25
Unknown clams	Gallon	3.00
Unknown clams	Quart	0.75
Unknown cockles	Individual	0.42
Unknown cockles	Gallon	3.00
Unknown cockles	Quart	0.75
Blue king crab	Individual	2.30
Red king crab	Individual	2.30
Red king crab	Gallon	3.00
Unknown mussels	Individual	0.26
Unknown mussels	Pound	1.00
Unknown mussels	Gallon	1.50
Unknown mussels	Quart	0.38
Sea anemones	Individual	0.50
Shrimps	Gallon	2.00
Unknown marine invertebrates	Gallon	2.53
Unknown marine invertebrates	Pints	0.32

Source ADF&G Division of Subsistence household surveys, 2018.

APPENDIX D–ADDITIONAL TABLES AND FIGURES

Table D2-1.–Selected study findings, Scammon Bay, 2017.

Category	Community Scammon Bay
Demography	
Population	576.0
Percentage of population that is Alaska Native	98.1%
Percentage of household heads born in Alaska	95.0%
Average length of residency of household heads (year)	37.4
Nonsalmon fish and marine invertebrate harvest and use	
Per capita harvest, pounds usable weight	125.9
Average household harvest, pounds usable weight	549.2
Number of resources used by 50% or more households	9.0
Average number of resources used per household	8.9
Average number of resources attempted to be harvested per household	6.1
Average number of resources harvested per household	5.9
Average number of resources received per household	3.5
Average number of resources given away per household	3.1
Percentage of total harvest taken by top 25% ranked households	67.7%
Percentage of households that harvested 70% of harvest	26.1%
Per capita harvest by lowest ranked 50% of households	12.4
Percentage of total harvest taken by lowest ranked 50% of harvesting households	9.8%
Average number of resources used by lowest ranked 50% of households	7.5
Average number of resources used by top 25% ranked households	11.4

Source ADF&G Division of Subsistence household surveys, 2018.

Table D2-2.–Population profile, Scammon Bay, 2017.

	Male			Female			Total		
Age	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage
0–4	26.3	8.4%	8.4%	32.5	12.4%	12.4%	58.8	10.2%	10.2%
5–9	40.3	12.9%	21.3%	26.3	10.0%	22.4%	66.6	11.6%	21.8%
10–14	29.4	9.4%	30.7%	18.6	7.1%	29.4%	48.0	8.3%	30.1%
15–19	37.2	11.9%	42.6%	27.9	10.6%	40.0%	65.0	11.3%	41.4%
20–24	18.6	5.9%	48.5%	23.2	8.8%	48.8%	41.8	7.3%	48.7%
25–29	18.6	5.9%	54.5%	15.5	5.9%	54.7%	34.1	5.9%	54.6%
30–34	15.5	5.0%	59.4%	18.6	7.1%	61.8%	34.1	5.9%	60.5%
35–39	10.8	3.5%	62.9%	10.8	4.1%	65.9%	21.7	3.8%	64.2%
40–44	17.0	5.4%	68.3%	7.7	2.9%	68.8%	24.8	4.3%	68.5%
45–49	7.7	2.5%	70.8%	9.3	3.5%	72.4%	17.0	3.0%	71.5%
50–54	6.2	2.0%	72.8%	6.2	2.4%	74.7%	12.4	2.2%	73.7%
55–59	13.9	4.5%	77.2%	10.8	4.1%	78.8%	24.8	4.3%	78.0%
60–64	9.3	3.0%	80.2%	4.6	1.8%	80.6%	13.9	2.4%	80.4%
65–69	13.9	4.5%	84.7%	6.2	2.4%	82.9%	20.1	3.5%	83.9%
70–74	1.5	0.5%	85.1%	4.6	1.8%	84.7%	6.2	1.1%	84.9%
75–79	4.6	1.5%	86.6%	4.6	1.8%	86.5%	9.3	1.6%	86.6%
80–84	1.5	0.5%	87.1%	6.2	2.4%	88.8%	7.7	1.3%	87.9%
85–89	1.5	0.5%	87.6%	1.5	0.6%	89.4%	3.1	0.5%	88.4%
90–94	0.0	0.0%	87.6%	0.0	0.0%	89.4%	0.0	0.0%	88.4%
95–99	0.0	0.0%	87.6%	0.0	0.0%	89.4%	0.0	0.0%	88.4%
100–104	0.0	0.0%	87.6%	0.0	0.0%	89.4%	0.0	0.0%	88.4%
Missing	38.7	12.4%	100.0%	27.9	10.6%	100.0%	66.6	11.6%	100.0%
Total	**312.8**	**100.0%**	**100.0%**	**263.2**	**100.0%**	**100.0%**	**576.0**	**100.0%**	**100.0%**

Source ADF&G Division of Subsistence household surveys, 2018.

Table D2-3.–Birthplaces of household heads, Scammon Bay, 2017.

Birthplace	Percentage
Alakanuk	0.7%
Emmonak	0.7%
Hooper Bay	9.1%
Kongiganak	0.7%
Kotzebue	0.7%
Mountain Village	0.7%
Napaskiak	0.7%
Nunapitchuk	1.4%
Scammon Bay	74.1%
Selawik	0.7%
Nunam Iqua (Sheldon Point)	0.7%
Shishmaref	0.7%
Toksook Bay	0.7%
Balance of Koyukuk-Mid Yukon Census	0.7%
Other U.S.	4.9%
Missing	2.8%

Source ADF&G Division of Subsistence household surveys, 2018.
Note "Birthplace" means the place of residence of the parents of the individual when the individual was born.

Table D2-4.–Birthplaces of population, Scammon Bay, 2017.

Birthplace	Percentage
Alakanuk	0.3%
Emmonak	0.5%
Hooper Bay	3.4%
Kongiganak	0.3%
Kotzebue	0.5%
Mountain Village	0.3%
Napaskiak	0.3%
Nunapitchuk	0.5%
Scammon Bay	80.8%
Selawik	0.3%
Nunam Iqua (Sheldon Point)	1.0%
Shishmaref	0.3%
Toksook Bay	0.3%
Numan Iqua (Sheldon Point) & Black R.	0.3%
Balance of Koyukuk-Mid Yukon Census	0.3%
Other U.S.	1.8%
Missing	9.1%

Source ADF&G Division of Subsistence household surveys, 2018.
Note "Birthplace" means the place of residence of the parents of the individual when the individual was born.

Table D2-5.–Nonsalmon fish and marine invertebrate resources used, Scammon Bay, 2017.

Resource	Scientific name
Pacific herring	*Clupea pallasi*
Pacific herring roe	*Clupea pallasi*
Rainbow smelt	*Osmerus mordax*
Pacific (gray) cod	*Gadus macrocephalus*
Saffron cod	*Eleginus gracilis*
Walleye pollock (whiting)	*Theragra chalcogramma*
Unknown flounders	
Pacific halibut	*Hippoglossus stenolepis*
Unknown sculpins	
Sticklebacks (needlefish)	
Alaska blackfish	*Dallia pectoralis*
Burbot	*Lota lota*
Unknown chars	*Salvelinus spp.*
Northern pike	*Esox lucius*
Sheefish	*Stenodus leucichthys*
Broad whitefish	*Coregonus nasus*
Bering cisco	*Coregonus laurettae*
Least cisco	*Coregonus sardinella*
Humpback whitefish	*Coregonus pidschian*
Round whitefish	*Prosopium cylindraceum*
Unknown whitefishes	
Chitons (bidarkis, gumboots)	
Butter clams	*Saxidomus gigantea*
Razor clams	*Siliqua spp.*
Unknown clams	
Unknown cockles	
Unknown mussels	*Mytilus spp.*
Unknown marine invertebrates	

Source ADF&G Division of Subsistence household surveys, 2018.

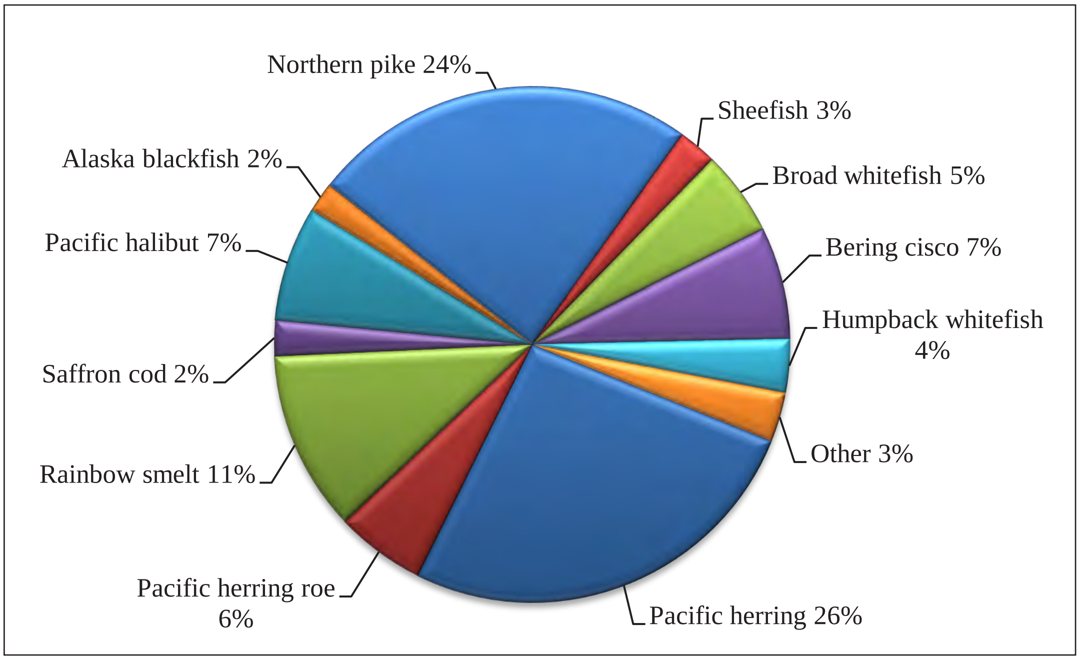


Figure D2-1.–Composition of nonsalmon fish harvest by weight, Scammon Bay, 2017.

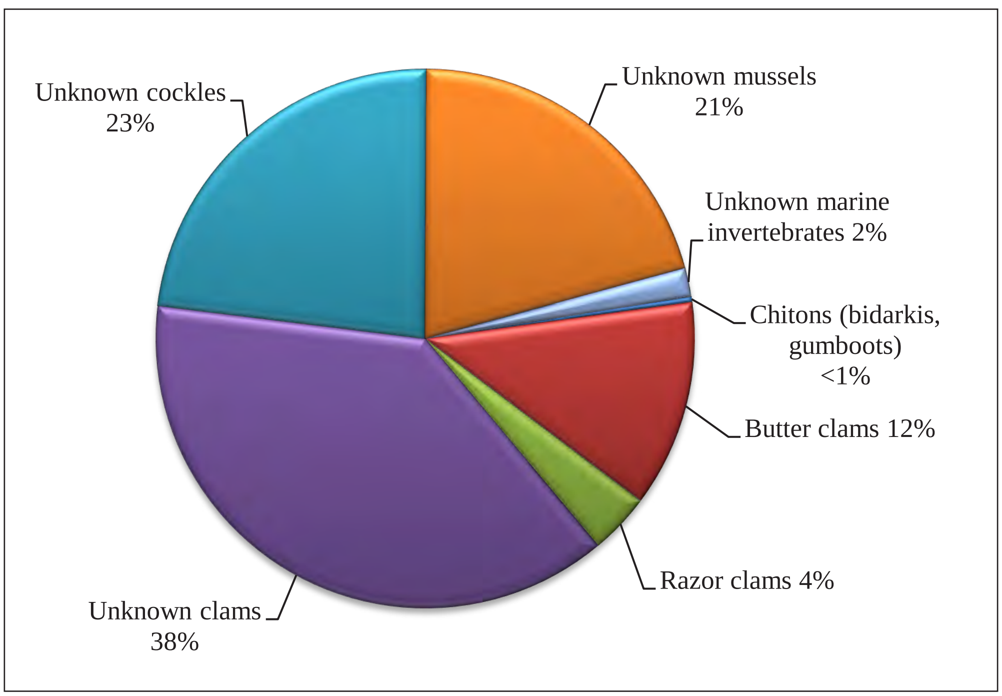


Figure D2-2.–Composition of marine invertebrate harvest by weight, Scammon Bay, 2017.

Table D2-6.–Changes in household uses of nonsalmon fish and marine invertebrates compared to recent years, Scammon Bay, 2017.

			Households reporting use								Households not using	
	Sampled	Valid	Total households		Less		Same		More			
Resource category	households	responses[a]	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	88	86	81	94.2%	18	20.9%	47	54.7%	16	18.6%	5	5.8%
Other nonsalmon fish	88	84	84	100.0%	27	32.1%	50	59.5%	7	8.3%	0	0.0%
Marine invertebrates	88	85	66	77.6%	23	27.1%	36	42.4%	7	8.2%	19	22.4%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Valid responses do not include households that did not provide any response.

Table D2-7.–Reasons for less household uses of nonsalmon fish and marine invertebrates compared to recent years, Scammon Bay, 2017.

Resource category	Valid responses[a]	Households reporting reasons for less use	Family/ personal		Resources less available		Too far to travel		Lack of equipment		Less sharing		Lack of effort		Unsuccessful		Weather/ environment	
			Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	84	17	2	11.8%	3	18%	0	0.0%	2	12%	1	6%	3	18%	1	5.9%	1	5.9%
Other nonsalmon fish	86	24	4	16.7%	4	17%	0	0.0%	3	13%	3	13%	3	13%	3	12.5%	5	20.8%
Marine invertebrates	85	20	4	20.0%	3	15%	0	0.0%	3	15%	0	0%	5	25%	1	5.0%	2	10.0%

-continued-

Table D2-7.–Continued.

Resource category	Valid responses[a]	Households reporting reasons for less use	Other reasons		Working/ no time		Regulations		Small/ diseased animals		Did not need		Equipment/ fuel expense		Used other resources		Too much competition	
			Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	84	17	0	0%	3	17.6%	0	0.0%	0	0.0%	1	5.9%	0	0.0%	0	0.0%	0	0.0%
Other nonsalmon fish	86	24	0	0%	3	12.5%	0	0.0%	0	0.0%	0	0.0%	2	8.3%	0	0.0%	0	0.0%
Marine invertebrates	85	20	0	0%	2	10.0%	0	0.0%	0	0.0%	0	0.0%	2	10.0%	0	0.0%	0	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Valid responses do not include households that did not provide any response and households reporting never using the resource.

Table D2-8.–Reasons for more household uses of nonsalmon fish and marine invertebrates compared to recent years, Scammon Bay, 2017.

Resource category	Valid responses[a]	Households reporting reasons for more use	Increased availability		Used other resources		Favorable weather		Received more		Needed more		Increased effort		Had no substitution	
			Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	84	14	4	28.6%	0	0.0%	0	0.0%	5	35.7%	1	7.1%	2	14.3%	0	0.0%
Other nonsalmon fish	86	6	1	16.7%	0	0.0%	0	0.0%	1	16.7%	0	0.0%	4	66.7%	0	0.0%
Marine invertebrates	85	7	1	14.3%	0	0.0%	1	14.3%	0	0.0%	1	14.3%	3	42.9%	0	0.0%

-continued-

Table D2-8.–Continued.

Resource category	Valid responses[a]	Households reporting reasons for more use	Other		Regulations		Traveled farther		More success		Had more time		Store-bought expense		Got/ fixed equipment	
			Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	84	14	2	14.3%	0	0.0%	0	0.0%	1	7.1%	0	0.0%	0	0.0%	1	7.1%
Other nonsalmon fish	86	6	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	16.7%
Marine invertebrates	85	7	0	0.0%	0	0.0%	0	0.0%	1	14.3%	0	0.0%	0	0.0%	1	14.3%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Valid responses do not include households that did not provide any response and households reporting never use.

Table D2-9.–Reasons that households did not get enough nonsalmon fish or marine invertebrates, Scammon Bay, 2017.

Resource category	Valid responses[a]	Family/personal		Resources less available		Too far to travel		Lack of equipment		Less sharing		Lack of effort		Unsuccessful		Weather/ environment	
		Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	5	1	20.0%	1	20.0%	0	0.0%	1	20.0%	0	0.0%	1	20.0%	0	0.0%	0	0.0%
Other nonsalmon fish	15	3	20.0%	2	13.3%	0	0.0%	2	13.3%	1	6.7%	2	13.3%	2	13.3%	1	6.7%
Marine invertebrates	14	3	21.4%	1	7.1%	0	0.0%	2	14.3%	0	0.0%	3	21.4%	1	7.1%	1	7.1%

-continued-

Table 2-9.–Continued.

Resource category	Valid responses[a]	Other reasons		Working/no time		Regulations		Small/diseased animals		Equipment/fuel expense		Unspecified		Too much competition	
		Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	5	0	0.0%	1	20.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Other nonsalmon fish	15	2	13.3%	1	6.7%	0	0.0%	0	0.0%	1	6.7%	0	0.0%	0	0.0%
Marine invertebrates	14	1	7.1%	2	14.3%	0	0.0%	0	0.0%	1	7.1%	0	0.0%	0	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Includes households failing to respond to the question and those households that never used the resource.

Table D2-10.–Things households did differently because they did not get enough nonsalmon fish or marine invertebrates, Scammon Bay, 2017.

Resource category	Valid responses[a]	Bought/bartered		Used more commercial foods		Replaced with other subsistence foods		Asked others for help		Made do without	
		Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	4	0	0.0%	0	0.0%	3	75.0%	1	25.0%	0	0.0%
Other nonsalmon fish	7	3	42.9%	0	0.0%	2	28.6%	3	42.9%	0	0.0%
Marine invertebrates	2	0	0.0%	0	0.0%	1	50.0%	0	0.0%	1	50.0%

-continued-

Table D2-10.–Continued.

Resource category	Valid responses[a]	Increased effort to harvest		Got a job		Obtained food from other sources		Got public assistance		Other	
		Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	4	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Other nonsalmon fish	7	0	0.0%	0	0.0%	1	14.3%	0	0.0%	0	0.0%
Marine invertebrates	2	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Includes households failing to respond to the question and those households that never used the resource.

Table D2-11.–Nonsalmon fish and marine invertebrates used in the past but not in the present, Scammon Bay, 2017.

Resource	Reason
Chinook salmon	Big kings, don't see them anymore
Capelin (grunion)	Timing has to be perfect, easy to miss right after herring. Right before salmon
Flounders	I don't go hooking anymore
Sticklebacks (needlefish)	Less burbot, dad used to travel to get them
Sticklebacks (needlefish)	Been a long time; they make your mouth tingle
Sticklebacks (needlefish)	Doesn't see much anymore
Sticklebacks (needlefish)	Lots of puppies, people taste
Sticklebacks (needlefish)	Dogs in the 1980s, dad's team
Sticklebacks (needlefish)	Used to get it for dog teams
Sticklebacks (needlefish)	Doesn't see anymore
Sticklebacks (needlefish)	Used to use for dog food
Alaska blackfish	Far away, gone—disappearing slowly
Alaska blackfish	Beaver dams affecting small creeks
Alaska blackfish	Father died so we don't eat these anymore
Alaska blackfish	3 years—still receive
Alaska blackfish	Got too old to chip ice to set trap
Alaska blackfish	Scarce lately
Burbot	Traveled to "volcanoes" for fishing when young
Whitefishes	We don't have good transportation. The locations are less abundant up the Kun River (beaver dams)
Broad whitefish	They were gone 30 years ago now they are coming back. They used to catch more than now

Source ADF&G Division of Subsistence household surveys, 2018.

Table D3-1.–Selected study findings, Nightmute, 2017.

Category	Community Nightmute
Demography	
Population	233.5
Percentage of population that is Alaska Native	99.3%
Percentage of household heads born in Alaska	96.2%
Average length of residency of household heads (year)	39.8
Nonsalmon fish and marine invertebrate harvest and use	
Per capita harvest, pounds usable weight	251.8
Average household harvest, pounds usable weight	1,088.8
Number of resources used by 50% or more households	11.0
Average number of resources used per household	11.7
Average number of resources attempted to be harvested per household	7.5
Average number of resources harvested per household	7.5
Average number of resources received per household	7.9
Average number of resources given away per household	7.1
Percentage of total harvest taken by top 25% ranked households	68.8%
Percentage of households that harvested 70% of harvest	23.5%
Per capita harvest by lowest ranked 50% of households	21.9
Percentage of total harvest taken by lowest ranked 50% of harvesting households	8.7%
Average number of resources used by lowest ranked 50% of households	10.4
Average number of resources used by top 25% ranked households	15.1

Source ADF&G Division of Subsistence household surveys, 2018.

Table D3-2.–Population profile, Nightmute, 2017.

	Male			Female			Total		
Age	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage
0–4	12.7	10.3%	10.3%	15.9	14.5%	14.5%	28.6	12.2%	12.2%
5–9	14.3	11.5%	21.8%	7.9	7.2%	21.7%	22.2	9.5%	21.8%
10–14	6.4	5.1%	26.9%	6.4	5.8%	27.5%	12.7	5.4%	27.2%
15–19	9.5	7.7%	34.6%	3.2	2.9%	30.4%	12.7	5.4%	32.7%
20–24	6.4	5.1%	39.7%	11.1	10.1%	40.6%	17.5	7.5%	40.1%
25–29	7.9	6.4%	46.2%	12.7	11.6%	52.2%	20.6	8.8%	49.0%
30–34	9.5	7.7%	53.8%	6.4	5.8%	58.0%	15.9	6.8%	55.8%
35–39	7.9	6.4%	60.3%	3.2	2.9%	60.9%	11.1	4.8%	60.5%
40–44	4.8	3.8%	64.1%	3.2	2.9%	63.8%	7.9	3.4%	63.9%
45–49	6.4	5.1%	69.2%	7.9	7.2%	71.0%	14.3	6.1%	70.1%
50–54	9.5	7.7%	76.9%	0.0	0.0%	71.0%	9.5	4.1%	74.1%
55–59	7.9	6.4%	83.3%	3.2	2.9%	73.9%	11.1	4.8%	78.9%
60–64	0.0	0.0%	83.3%	6.4	5.8%	79.7%	6.4	2.7%	81.6%
65–69	1.6	1.3%	84.6%	4.8	4.3%	84.1%	6.4	2.7%	84.4%
70–74	3.2	2.6%	87.2%	1.6	1.4%	85.5%	4.8	2.0%	86.4%
75–79	4.8	3.8%	91.0%	0.0	0.0%	85.5%	4.8	2.0%	88.4%
80–84	1.6	1.3%	92.3%	1.6	1.4%	87.0%	3.2	1.4%	89.8%
85–89	1.6	1.3%	93.6%	0.0	0.0%	87.0%	1.6	0.7%	90.5%
90–94	0.0	0.0%	93.6%	0.0	0.0%	87.0%	0.0	0.0%	90.5%
95–99	0.0	0.0%	93.6%	1.6	1.4%	88.4%	1.6	0.7%	91.2%
100–104	0.0	0.0%	93.6%	0.0	0.0%	88.4%	0.0	0.0%	91.2%
Missing	7.9	6.4%	100.0%	12.7	11.6%	100.0%	20.6	8.8%	100.0%
Total	**123.9**	**100.0%**	**100.0%**	**109.6**	**100.0%**	**100.0%**	**233.5**	**100.0%**	**100.0%**

Source ADF&G Division of Subsistence household surveys, 2018.

Table D3-3.–Birthplaces of population, Nightmute, 2017.

Birthplace	Percentage
Akiachak	1.4%
Alakanuk	0.7%
Anchorage	4.1%
Bethel	10.9%
Chefornak	1.4%
Galena	0.7%
Kasigluk	0.7%
Kipnuk	2.0%
Kotzebue	0.7%
Newtok	1.4%
Nightmute	55.1%
North Pole	6.8%
Stebbins	1.4%
Toksook Bay	0.7%
Tuntutuliak	0.7%
Tununak	0.7%
Mount Edgecumbe	0.7%
Other Alaska	5.4%
Other U.S.	1.4%
Missing	3.4%

Source ADF&G Division of Subsistence household surveys, 2018.
Note "Birthplace" means the place of residence of the parents of the individual when the individual was born.

Table D3-4.–Birthplaces of household heads, Nightmute, 2017.

Birthplace	Percentage
Alakanuk	1.9%
Bethel	1.9%
Chefornak	3.8%
Kasigluk	1.9%
Kipnuk	5.7%
Newtok	3.8%
Nightmute	43.4%
North Pole	7.5%
Stebbins	3.8%
Toksook Bay	1.9%
Tuntutuliak	1.9%
Tununak	1.9%
Mount Edgecumbe	1.9%
Other Alaska	13.2%
Other U.S.	3.8%
Missing	1.9%

Source ADF&G Division of Subsistence household surveys, 2018.
Note "Birthplace" means the place of residence of the parents of the individual when the individual was born.

Table D3-5.–Nonsalmon fish and marine invertebrate resources used, NIghtmute, 2017.

Resource	Scientific name
Pacific herring	*Clupea pallasi*
Pacific herring roe	*Clupea pallasi*
Capelin (grunion)	*Mallotus villosus*
Rainbow smelt	*Osmerus mordax*
Pacific (gray) cod	*Gadus macrocephalus*
Saffron cod	*Eleginus gracilis*
Walleye pollock (whiting)	*Theragra chalcogramma*
Unknown flounders	
Pacific halibut	*Hippoglossus stenolepis*
Unknown sculpins	
Sticklebacks (needlefish)	
Alaska blackfish	*Dallia pectoralis*
Burbot	*Lota lota*
Unknown chars	*Salvelinus spp.*
Northern pike	*Esox lucius*
Sheefish	*Stenodus leucichthys*
Broad whitefish	*Coregonus nasus*
Bering cisco	*Coregonus laurettae*
Least cisco	*Coregonus sardinella*
Humpback whitefish	*Coregonus pidschian*
Round whitefish	*Prosopium cylindraceum*
Unknown chitons	
Butter clams	*Saxidomus gigantea*
Razor clams	*Siliqua spp.*
Unknown clams	
Unknown mussels	*Mytilus spp.*

Source ADF&G Division of Subsistence household surveys, 2018.

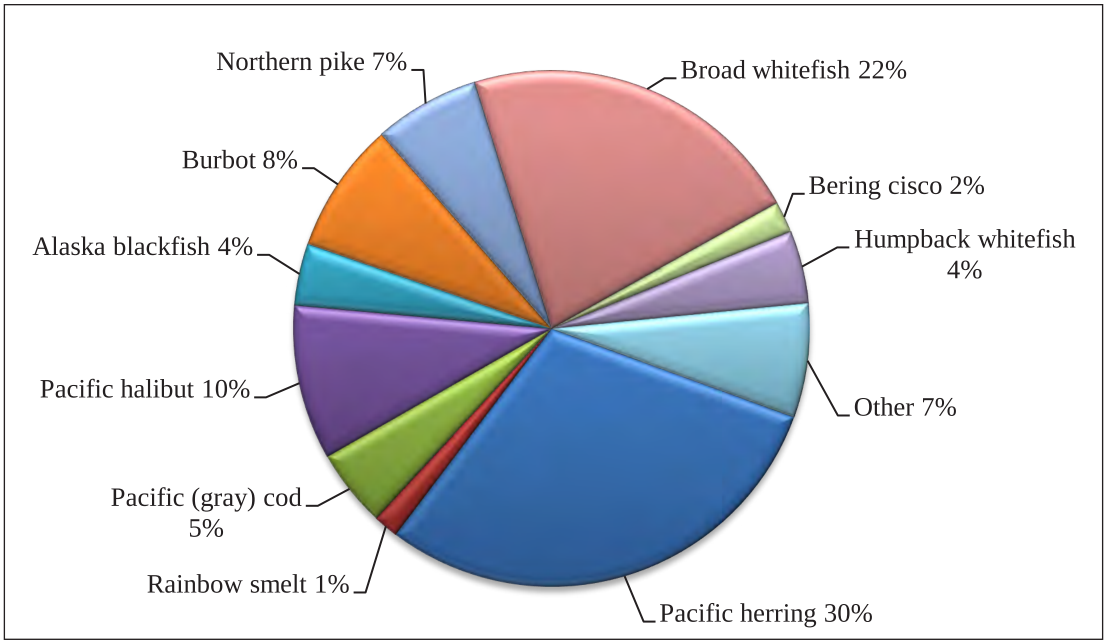


Figure D3-1.–Composition of nonsalmon fish harvest by weight, Nightmute, 2017.

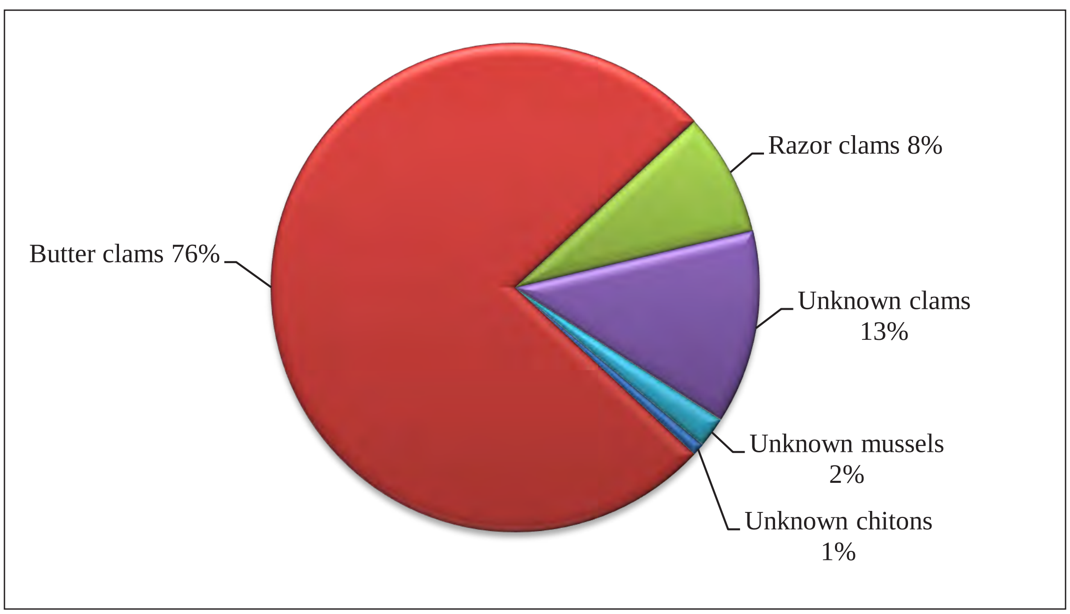


Figure D3-2.–Composition of marine invertebrate harvest by weight, Nightmute, 2017.

Table D3-6.–Changes in household uses of nonsalmon fish and marine invertebrates compared to recent years, Nightmute, 2017.

Resource category	Sampled households	Valid responses[a]	Households reporting use: Total households Number	Percentage	Less Number	Percentage	Same Number	Percentage	More Number	Percentage	Households not using Number	Percentage
Whitefish and sheefish	34	33	32	97.0%	14	42.4%	14	42.4%	4	12.1%	1	3.0%
Other nonsalmon fish	34	33	32	97.0%	17	51.5%	13	39.4%	2	6.1%	1	3.0%
Marine invertebrates	34	34	31	91.2%	8	23.5%	21	61.8%	2	5.9%	3	8.8%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Valid responses do not include households that did not provide any response.

Table D3-7.–Reasons for less household uses of nonsalmon fish and marine invertebrates compared to recent years, Nightmute, 2017.

Resource category	Valid responses[a]	Households reporting reasons for less use	Family/ personal Number	Percentage	Resources less available Number	Percentage	Too far to travel Number	Percentage	Lack of equipment Number	Percentage	Less sharing Number	Percentage	Lack of effort Number	Percentage	Unsuccessful Number	Percentage	Weather/ environment Number	Percentage
Whitefish and sheefish	33	11	1	9.1%	2	18%	0	0.0%	1	9%	0	0%	3	27%	0	0.0%	4	36.4%
Other nonsalmon fish	33	17	2	11.8%	6	35%	0	0.0%	0	0%	0	0%	3	18%	0	0.0%	6	35.3%
Marine invertebrates	34	7	0	0.0%	2	29%	0	0.0%	1	14%	0	0%	1	14%	0	0.0%	2	28.6%

-continued-

Table D3-7.–Continued.

Resource category	Valid responses[a]	Households reporting reasons for less use	Other reasons Number	Percentage	Working/ no time Number	Percentage	Regulations Number	Percentage	Small/ diseased animals Number	Percentage	Did not need Number	Percentage	Equipment/ fuel expense Number	Percentage	Used other resources Number	Percentage	Too much competition Number	Percentage
Whitefish and sheefish	33	11	1	9%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Other nonsalmon fish	33	17	0	0%	2	11.8%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Marine invertebrates	34	7	0	0%	0	0.0%	0	0.0%	1	14.3%	1	14.3%	0	0.0%	0	0.0%	0	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Valid responses do not include households that did not provide any response and households reporting never using the resource.

Table D3-8.–Reasons for more household uses of nonsalmon fish and marine invertebrates compared to recent years, Nightmute, 2017.

Resource category	Valid responses[a]	Households reporting reasons for more use	Increased availability		Used other resources		Favorable weather		Received more		Needed more		Increased effort		Had no substitution	
			Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	33	3	0	0.0%	0	0.0%	0	0.0%	2	66.7%	0	0.0%	1	33.3%	0	0.0%
Other nonsalmon fish	33	2	1	50.0%	0	0.0%	0	0.0%	1	50.0%	0	0.0%	0	0.0%	0	0.0%
Marine invertebrates	34	2	1	50.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	50.0%	0	0.0%

-continued-

Table D3-8.–Continued.

Resource category	Valid responses[a]	Households reporting reasons for more use	Other		Regulations		Traveled farther		More success		Had more time		Store-bought expense		Got/ fixed equipment	
			Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	33	3	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Other nonsalmon fish	33	2	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Marine invertebrates	34	2	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Valid responses do not include households that did not provide any response and households reporting never use.

Table D3-9.–Reasons that households did not get enough nonsalmon fish or marine invertebrates, Nightmute, 2017.

Resource category	Valid responses[a]	Family/personal		Resources less available		Too far to travel		Lack of equipment		Less sharing		Lack of effort		Unsuccessful		Weather/ environment	
		Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	6	0	0.0%	1	16.7%	0	0.0%	1	16.7%	0	0.0%	2	33.3%	0	0.0%	1	16.7%
Other nonsalmon fish	9	0	0.0%	2	22.2%	0	0.0%	0	0.0%	0	0.0%	3	33.3%	0	0.0%	4	44.4%
Marine invertebrates	5	0	0.0%	1	20.0%	0	0.0%	1	20.0%	0	0.0%	2	40.0%	0	0.0%	1	20.0%

-continued-

Table D3-9.–Continued.

Resource category	Valid responses[a]	Other reasons		Working/no time		Regulations		Small/diseased animals		Equipment/fuel expense		Unspecified		Too much competition	
		Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	6	1	16.7%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	16.7%	0	0.0%
Other nonsalmon fish	9	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	11.1%
Marine invertebrates	5	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Includes households failing to respond to the question and those households that never used the resource.

Table D3-10.–Things households did differently because they did not get enough nonsalmon fish or marine invertebrates, Nightmute, 2017.

Resource category	Valid responses[a]	Bought/bartered		Used more commercial foods		Replaced with other subsistence foods		Asked others for help		Made do without	
		Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	5	0	0.0%	2	40.0%	4	80.0%	0	0.0%	0	0.0%
Other nonsalmon fish	2	0	0.0%	0	0.0%	1	50.0%	0	0.0%	0	0.0%
Marine invertebrates	0	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

-continued-

Table D3-10.–Continued.

Resource category	Valid responses[a]	Increased effort to harvest		Got a job		Obtained food from other sources		Got public assistance		Other	
		Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	5	0	0.0%	0	0.0%	1	20.0%	0	0.0%	0	0.0%
Other nonsalmon fish	2	1	50.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Marine invertebrates	0	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Includes households failing to respond to the question and those households that never used the resource.

Table D3-11.–Nonsalmon fish and marine invertebrates used in the past but not in the present, Nightmute, 2017.

Resource	Reason
Rainbow smelt	Became allergic to them
Pacific (gray) cod	Taste changed

Source ADF&G Division of Subsistence household surveys, 2018.

Table D4-1.–Selected study findings, Kipnuk, 2017.

Category	Community Kipnuk
Demography	
Population	654.0
Percentage of population that is Alaska Native	97.2%
Percentage of household heads born in Alaska	91.9%
Average length of residency of household heads (year)	31.1
Nonsalmon fish and marine invertebrate harvest and use	
Per capita harvest, pounds usable weight	166.9
Average household harvest, pounds usable weight	747.5
Number of resources used by 50% or more households	6.0
Average number of resources used per household	8.9
Average number of resources attempted to be harvested per household	4.7
Average number of resources harvested per household	4.6
Average number of resources received per household	5.1
Average number of resources given away per household	3.7
Percentage of total harvest taken by top 25% ranked households	78.6%
Percentage of households that harvested 70% of harvest	18.4%
Per capita harvest by lowest ranked 50% of households	8.8
Percentage of total harvest taken by lowest ranked 50% of harvesting households	5.3%
Average number of resources used by lowest ranked 50% of households	6.9
Average number of resources used by top 25% ranked households	12.7

Source ADF&G Division of Subsistence household surveys, 2018.

Table D4-2.–Population profile, Kipnuk, 2017.

	Male			Female			Total		
Age	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage
0–4	28.7	8.4%	8.4%	27.1	8.7%	8.7%	55.8	8.5%	8.5%
5–9	25.5	7.5%	15.9%	16.0	5.1%	13.8%	41.5	6.3%	14.9%
10–14	31.9	9.3%	25.2%	41.5	13.3%	27.0%	73.4	11.2%	26.1%
15–19	23.9	7.0%	32.2%	30.3	9.7%	36.7%	54.2	8.3%	34.4%
20–24	27.1	7.9%	40.2%	8.0	2.6%	39.3%	35.1	5.4%	39.8%
25–29	20.7	6.1%	46.3%	25.5	8.2%	47.4%	46.3	7.1%	46.8%
30–34	19.1	5.6%	51.9%	14.4	4.6%	52.0%	33.5	5.1%	52.0%
35–39	8.0	2.3%	54.2%	17.5	5.6%	57.7%	25.5	3.9%	55.9%
40–44	22.3	6.5%	60.7%	4.8	1.5%	59.2%	27.1	4.1%	60.0%
45–49	9.6	2.8%	63.6%	9.6	3.1%	62.2%	19.1	2.9%	62.9%
50–54	17.5	5.1%	68.7%	12.8	4.1%	66.3%	30.3	4.6%	67.6%
55–59	9.6	2.8%	71.5%	8.0	2.6%	68.9%	17.5	2.7%	70.2%
60–64	14.4	4.2%	75.7%	12.8	4.1%	73.0%	27.1	4.1%	74.4%
65–69	6.4	1.9%	77.6%	1.6	0.5%	73.5%	8.0	1.2%	75.6%
70–74	1.6	0.5%	78.0%	4.8	1.5%	75.0%	6.4	1.0%	76.6%
75–79	1.6	0.5%	78.5%	3.2	1.0%	76.0%	4.8	0.7%	77.3%
80–84	3.2	0.9%	79.4%	1.6	0.5%	76.5%	4.8	0.7%	78.0%
85–89	1.6	0.5%	79.9%	4.8	1.5%	78.1%	6.4	1.0%	79.0%
90–94	0.0	0.0%	79.9%	1.6	0.5%	78.6%	1.6	0.2%	79.3%
95–99	0.0	0.0%	79.9%	0.0	0.0%	78.6%	0.0	0.0%	79.3%
100–104	0.0	0.0%	79.9%	0.0	0.0%	78.6%	0.0	0.0%	79.3%
Missing	68.6	20.1%	100.0%	67.0	21.4%	100.0%	135.6	20.7%	100.0%
Total	**341.4**	**100.0%**	**100.0%**	**312.7**	**100.0%**	**100.0%**	**654.0**	**100.0%**	**100.0%**

Source ADF&G Division of Subsistence household surveys, 2018.

Table D4-3.–Birthplaces of household heads, Kipnuk, 2017.

Birthplace	Percentage
Bethel	0.6%
Chefornak	1.3%
Fairbanks	0.6%
Iliamna	0.6%
Kipnuk	59.7%
Kongiganak	1.3%
Kwigillingok	5.0%
Manokotak	0.6%
Napakiak	0.6%
Napaskiak	1.9%
Nunapitchuk	0.6%
Quinhagak	0.6%
Toksook Bay	0.6%
Tuluksak	1.3%
Tuntutuliak	0.6%
Kasegelok	0.6%
Other Bristol Bay Communities	1.3%
Other Alaska	1.3%
Other U.S.	5.7%
Missing	15.1%

Source ADF&G Division of Subsistence household surveys, 2018.
Note "Birthplace" means the place of residence of the parents of the individual when the individual was born.

Table D4-4.–Birthplaces of population, Kipnuk, 2017.

Birthplace	Percentage
Bethel	1.1%
Chefornak	0.5%
Fairbanks	0.2%
Iliamna	0.2%
Kipnuk	67.9%
Kongiganak	0.5%
Kwigillingok	1.8%
Manokotak	0.2%
Napakiak	0.2%
Napaskiak	0.7%
Nunapitchuk	0.2%
Quinhagak	0.2%
Toksook Bay	0.2%
Tuluksak	0.5%
Tuntutuliak	0.2%
Kasegelok	0.2%
Other Bristol Bay Communities	0.5%
Other Alaska	1.4%
Other U.S.	2.7%
Missing	20.5%

Source ADF&G Division of Subsistence household surveys, 2018.
Note "Birthplace" means the place of residence of the parents of the individual when the individual was born.

Table D4-5.–Nonsalmon fish and marine invertebrate resources used, Kipnuk, 2017.

Resource	Scientific name
Pacific herring	*Clupea pallasi*
Pacific herring roe	*Clupea pallasi*
Capelin (grunion)	*Mallotus villosus*
Rainbow smelt	*Osmerus mordax*
Pacific (gray) cod	*Gadus macrocephalus*
Saffron cod	*Eleginus gracilis*
Walleye pollock (whiting)	*Theragra chalcogramma*
Flounders	
Pacific halibut	*Hippoglossus stenolepis*
Sculpins	
Sticklebacks (needlefish)	
Alaska blackfish	*Dallia pectoralis*
Burbot	*Lota lota*
Unknown chars	*Salvelinus spp.*
Northern pike	*Esox lucius*
Sheefish	*Stenodus leucichthys*
Rainbow trout	*Oncorhynchus mykiss*
Broad whitefish	*Coregonus nasus*
Bering cisco	*Coregonus laurettae*
Least cisco	*Coregonus sardinella*
Humpback whitefish	*Coregonus pidschian*
Round whitefish	*Prosopium cylindraceum*
Unknown whitefishes	
Unknown nonsalmon fish	
Butter clams	*Saxidomus gigantea*
Razor clams	*Siliqua spp.*
Unknown clams	
Unknown cockles	
Unknown mussels	*Mytilus spp.*

Source ADF&G Division of Subsistence household surveys, 2018.

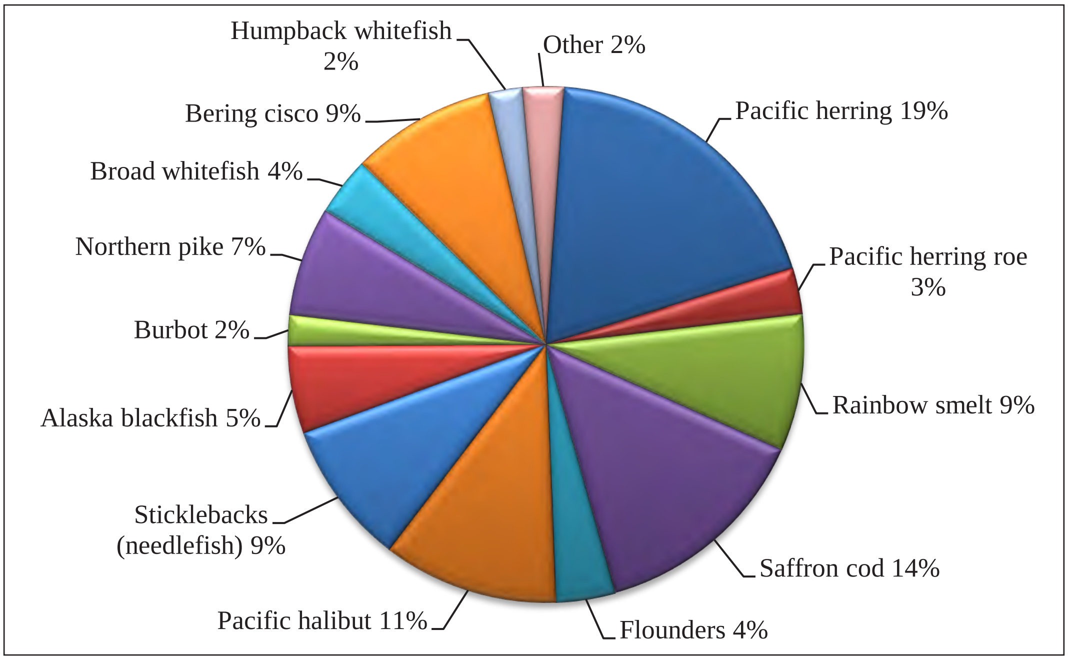


Figure D4-1.–Composition of nonsalmon fish harvest by weight, Kipnuk, 2017.

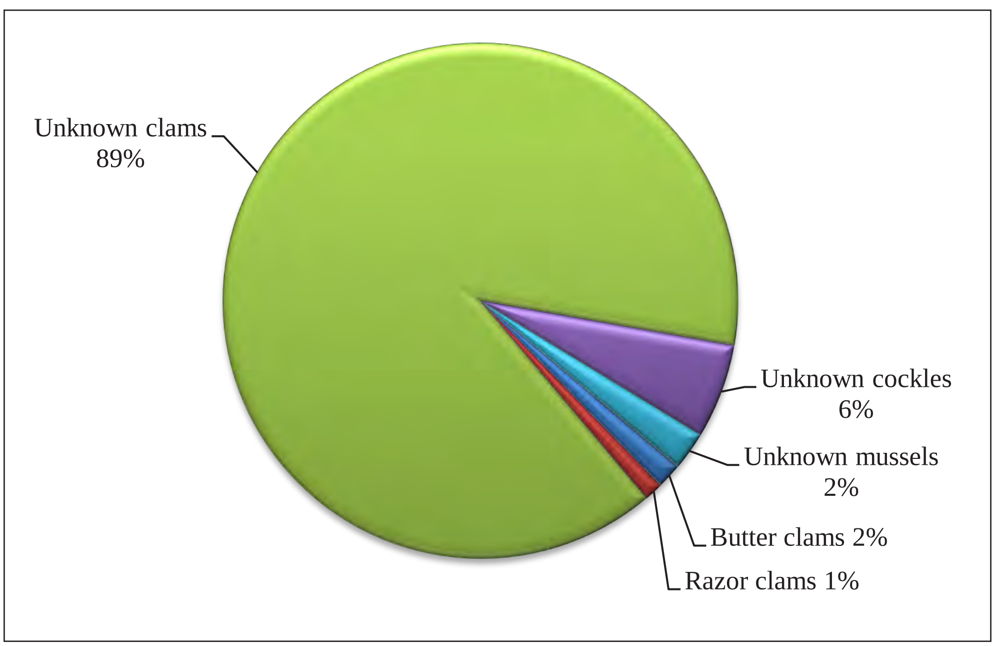


Figure D4-2.–Composition of marine invertebrate harvest by weight, Kipnuk, 2017.

Table D4-6.–Changes in household uses of nonsalmon fish and marine invertebrates, Kipnuk, 2017.

			Households reporting use								Households not using	
			Total households		Less		Same		More			
Resource category	Sampled households	Valid responses[a]	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	98	91	83	91.2%	11	12.1%	64	70.3%	8	8.8%	8	8.8%
Other nonsalmon fish	98	90	88	97.8%	21	23.3%	53	58.9%	14	15.6%	2	2.2%
Marine invertebrates	98	90	60	66.7%	22	24.4%	28	31.1%	10	11.1%	30	33.3%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Valid responses do not include households that did not provide any response.

Table D4-7.–Reasons for less household uses of nonsalmon fish and marine invertebrates compared to recent years, Kipnuk, 2017.

			Family/ personal		Resources less available		Too far to travel		Lack of equipment		Less sharing		Lack of effort		Unsuccessful		Weather/ environment	
Resource category	Valid responses[a]	Households reporting reasons for less use	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	90	11	1	9.1%	0	0%	0	0.0%	2	18%	3	27%	2	18%	0	0.0%	0	0.0%
Other nonsalmon fish	91	21	1	4.8%	3	14%	0	0.0%	3	14%	5	24%	5	24%	2	9.5%	3	14.3%
Marine invertebrates	90	21	1	4.8%	7	33%	0	0.0%	3	14%	2	10%	6	29%	2	9.5%	2	9.5%

-continued-

Table D4-7.–Continued.

			Other reasons		Working/ no time		Regulations		Small/ diseased animals		Did not need		Equipment/ fuel expense		Used other resources		Too much competition	
Resource category	Valid responses[a]	Households reporting reasons for less use	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	90	11	0	0%	1	9.1%	0	0.0%	0	0.0%	0	0.0%	2	18.2%	0	0.0%	0	0.0%
Other nonsalmon fish	91	21	1	5%	1	4.8%	0	0.0%	0	0.0%	0	0.0%	1	4.8%	0	0.0%	0	0.0%
Marine invertebrates	90	21	1	5%	1	4.8%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	4.8%	0	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Valid responses do not include households that did not provide any response and households reporting never using the resource.

Table D4-8.–Reasons for more household uses of nonsalmon fish and marine invertebrates compared to recent years, Kipnuk, 2017.

Resource category	Valid responses[a]	Households reporting reasons for more use	Increased availability		Used other resources		Favorable weather		Received more		Needed more		Increased effort		Had no substitution	
			Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	90	6	2	33.3%	0	0.0%	1	16.7%	3	50.0%	1	16.7%	1	16.7%	0	0.0%
Other nonsalmon fish	91	13	3	23.1%	0	0.0%	1	7.7%	2	15.4%	1	7.7%	5	38.5%	0	0.0%
Marine invertebrates	90	10	1	10.0%	0	0.0%	1	10.0%	2	20.0%	0	0.0%	2	20.0%	0	0.0%

-continued-

Table D4-8.–Continued.

Resource category	Valid responses[a]	Households reporting reasons for more use	Other		Regulations		Traveled farther		More success		Had more time		Store-bought expense		Got/ fixed equipment	
			Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	90	6	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Other nonsalmon fish	91	13	1	7.7%	0	0.0%	0	0.0%	2	15.4%	0	0.0%	0	0.0%	0	0.0%
Marine invertebrates	90	10	0	0.0%	0	0.0%	1	10.0%	4	40.0%	0	0.0%	0	0.0%	0	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Valid responses do not include households that did not provide any response and households reporting never use.

Table D4-9.–Reasons that households did not get enough nonsalmon fish or marine invertebrates, Kipnuk, 2017.

Resource category	Valid responses[a]	Family/personal		Resources less available		Too far to travel		Lack of equipment		Less sharing		Lack of effort		Unsuccessful		Weather/ environment	
		Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	4	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	25.0%	2	50.0%	0	0.0%	0	0.0%
Other nonsalmon fish	5	0	0.0%	0	0.0%	0	0.0%	1	20.0%	0	0.0%	2	40.0%	0	0.0%	0	0.0%
Marine invertebrates	9	0	0.0%	2	22.2%	0	0.0%	3	33.3%	0	0.0%	2	22.2%	2	22.2%	1	11.1%

-continued-

Table D4-9.–Continued.

Resource category	Valid responses[a]	Other reasons		Working/no time		Regulations		Small/diseased animals		Equipment/fuel expense		Unspecified		Too much competition	
		Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	4	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	25.0%	0	0.0%	0	0.0%
Other nonsalmon fish	5	0	0.0%	1	20.0%	0	0.0%	0	0.0%	1	20.0%	0	0.0%	0	0.0%
Marine invertebrates	9	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Includes households failing to respond to the question and those households that never used the resource.

Table D4-10.–Things households did differently because they did not get enough nonsalmon fish or marine invertebrates, Kipnuk, 2017.

Resource category	Valid responses[a]	Bought/bartered		Used more commercial foods		Replaced with other subsistence foods		Asked others for help		Made do without	
		Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	0	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Other nonsalmon fish	1	0	0.0%	1	100.0%	0	0.0%	0	0.0%	0	0.0%
Marine invertebrates	1	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

-continued-

Table D4-10.–Continued.

Resource category	Valid responses[a]	Increased effort to harvest		Got a job		Obtained food from other sources		Got public assistance		Other	
		Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	0	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Other nonsalmon fish	1	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Marine invertebrates	1	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Includes households failing to respond to the question and those households that never used the resource.

Table D4-11.–Nonsalmon fish and marine invertebrates used in the past but not in the present, Kipnuk, 2017.

Resource	Reason
Pacific herring	Husband used to commercial fish
Smelts	Jigged a bit first couple of years but no time lately
Capelin (grunion)	Just don't—sometimes ask
Saffron cod	Too busy, working
Saffron cod	Just don't—sometimes ask
Flounders	
Pacific halibut	No time
Pacific halibut	Haven't been able to get out last several years
Sticklebacks (needlefish)	
Sticklebacks (needlefish)	Don't come around anymore. Need some really small mesh nets
Sticklebacks (needlefish)	Used to have lots of dogs
Alaska blackfish	Heartburn, grew up with them.
Alaska blackfish	Working, no time
Burbot	No longer receive
Northern pike	Too far—gas
Sheefish	Allergic reactions
Unknown nonsalmon fish	Small as needlefish, clear see through. Don't see them as much anymore.
Cockles	Used to go [to] Cheeching [abandoned village]—back surgery, can't Sno-go now
Cockles	Hard to find, don't bother

Source ADF&G Division of Subsistence household surveys, 2018.

Table D5-1.–Selected study findings, Mekoryuk, 2017.

Category	Community Mekoryuk
Demography	
Population	195.6
Percentage of population that is Alaska Native	92.9%
Percentage of household heads born in Alaska	90.0%
Average length of residency of household heads (year)	34.9
Nonsalmon fish and marine invertebrate harvest and use	
Per capita harvest, pounds usable weight	97.3
Average household harvest, pounds usable weight	247.2
Number of resources used by 50% or more households	4.0
Average number of resources used per household	5.8
Average number of resources attempted to be harvested per household	4.1
Average number of resources harvested per household	3.9
Average number of resources received per household	2.6
Average number of resources given away per household	2.1
Percentage of total harvest taken by top 25% ranked households	73.5%
Percentage of households that harvested 70% of harvest	22.0%
Per capita harvest by lowest ranked 50% of households	5.1
Percentage of total harvest taken by lowest ranked 50% of harvesting households	5.2%
Average number of resources used by lowest ranked 50% of households	4.5
Average number of resources used by top 25% ranked households	7.0

Source ADF&G Division of Subsistence household surveys, 2018.

Table D5-2.–Population profile, Mekoryuk, 2017.

	Male			Female			Total		
Age	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage
0–4	3.1	3.1%	3.1%	7.7	8.1%	8.1%	10.8	5.5%	5.5%
5–9	13.9	13.8%	16.9%	10.8	11.3%	19.4%	24.6	12.6%	18.1%
10–14	4.6	4.6%	21.5%	7.7	8.1%	27.4%	12.3	6.3%	24.4%
15–19	1.5	1.5%	23.1%	9.2	9.7%	37.1%	10.8	5.5%	29.9%
20–24	1.5	1.5%	24.6%	3.1	3.2%	40.3%	4.6	2.4%	32.3%
25–29	4.6	4.6%	29.2%	6.2	6.5%	46.8%	10.8	5.5%	37.8%
30–34	4.6	4.6%	33.8%	3.1	3.2%	50.0%	7.7	3.9%	41.7%
35–39	3.1	3.1%	36.9%	3.1	3.2%	53.2%	6.2	3.1%	44.9%
40–44	6.2	6.2%	43.1%	3.1	3.2%	56.5%	9.2	4.7%	49.6%
45–49	4.6	4.6%	47.7%	1.5	1.6%	58.1%	6.2	3.1%	52.8%
50–54	9.2	9.2%	56.9%	3.1	3.2%	61.3%	12.3	6.3%	59.1%
55–59	16.9	16.9%	73.8%	4.6	4.8%	66.1%	21.6	11.0%	70.1%
60–64	10.8	10.8%	84.6%	1.5	1.6%	67.7%	12.3	6.3%	76.4%
65–69	3.1	3.1%	87.7%	4.6	4.8%	72.6%	7.7	3.9%	80.3%
70–74	1.5	1.5%	89.2%	3.1	3.2%	75.8%	4.6	2.4%	82.7%
75–79	3.1	3.1%	92.3%	4.6	4.8%	80.6%	7.7	3.9%	86.6%
80–84	1.5	1.5%	93.8%	1.5	1.6%	82.3%	3.1	1.6%	88.2%
85–89	0.0	0.0%	93.8%	1.5	1.6%	83.9%	1.5	0.8%	89.0%
90–94	0.0	0.0%	93.8%	0.0	0.0%	83.9%	0.0	0.0%	89.0%
95–99	0.0	0.0%	93.8%	0.0	0.0%	83.9%	0.0	0.0%	89.0%
100–104	0.0	0.0%	93.8%	0.0	0.0%	83.9%	0.0	0.0%	89.0%
Missing	6.2	6.2%	100.0%	15.4	16.1%	100.0%	21.6	11.0%	100.0%
Total	**100.1**	**100.0%**	**100.0%**	**95.5**	**100.0%**	**100.0%**	**195.6**	**100.0%**	**100.0%**

Source ADF&G Division of Subsistence household surveys, 2018.

Table D5-3.–Birthplaces of household heads, Mekoryuk, 2017.

Birthplace	Percentage
Alakanuk	1.4%
Anchorage	2.8%
Bethel	7.0%
Kodiak City	1.4%
Koliganek	1.4%
Marshall (Fortuna Ledge)	1.4%
Mekoryuk	62.0%
Mountain Village	1.4%
Scammon Bay	1.4%
Nunivak Island	8.5%
Other U.S.	9.9%
Missing	1.4%

Source ADF&G Division of Subsistence household surveys, 2018.

Note "Birthplace" means the place of residence of the parents of the individual when the individual was born.

Table D5-4.–Birthplaces of population, Mekoryuk, 2017.

Birthplace	Percentage
Alakanuk	0.8%
Anchorage	2.4%
Bethel	9.4%
Chefornak	0.8%
Kivalina	0.8%
Kodiak City	0.8%
Koliganek	0.8%
Kwigillingok	0.8%
Marshall (Fortuna Ledge)	0.8%
Mekoryuk	70.1%
Mountain Village	0.8%
Scammon Bay	0.8%
Nunivak Island	4.7%
Other U.S.	5.5%
Missing	0.8%

Source ADF&G Division of Subsistence household surveys, 2018.

Note "Birthplace" means the place of residence of the parents of the individual when the individual was born.

Table D5-5.–Nonsalmon fish and marine invertebrate resources used, Mekoryuk, 2017.

Resource	Scientific name
Pacific herring	*Clupea pallasi*
Pacific herring roe	*Clupea pallasi*
Capelin (grunion)	*Mallotus villosus*
Unknown smelts	
Pacific (gray) cod	*Gadus macrocephalus*
Saffron cod	*Eleginus gracilis*
Walleye pollock (whiting)	*Theragra chalcogramma*
Flounders	
Pacific halibut	*Hippoglossus stenolepis*
Sculpins	
Alaska blackfish	*Dallia pectoralis*
Burbot	*Lota lota*
Unknown chars	*Salvelinus spp.*
Arctic grayling	*Thymallus arcticus*
Northern pike	*Esox lucius*
Rainbow trout	*Oncorhynchus mykiss*
Broad whitefish	*Coregonus nasus*
Bering cisco	*Coregonus laurettae*
Least cisco	*Coregonus sardinella*
Humpback whitefish	*Coregonus pidschian*
Razor clams	*Siliqua spp.*
Unknown clams	
Unknown cockles	
Blue king crab	*Paralithodes platypus*
Red king crab	*Paralithodes camtschaticus*
Unknown mussels	*Mytilus spp.*
Sea anemone	

Source ADF&G Division of Subsistence household surveys, 2018.

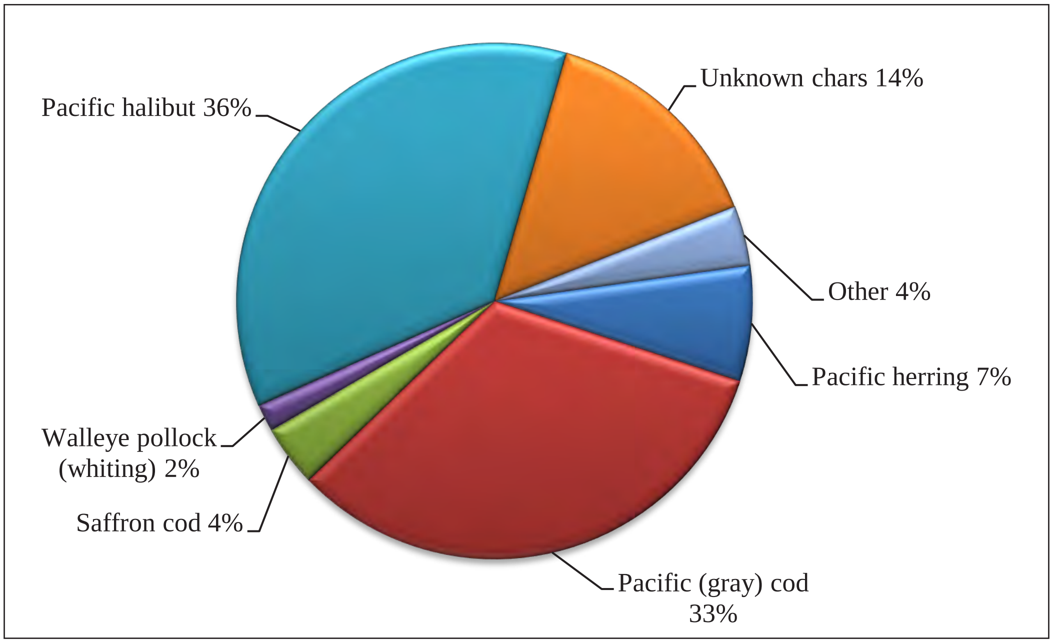


Figure D5-1.–Composition of nonsalmon fish harvest by weight, Mekoryuk, 2017.

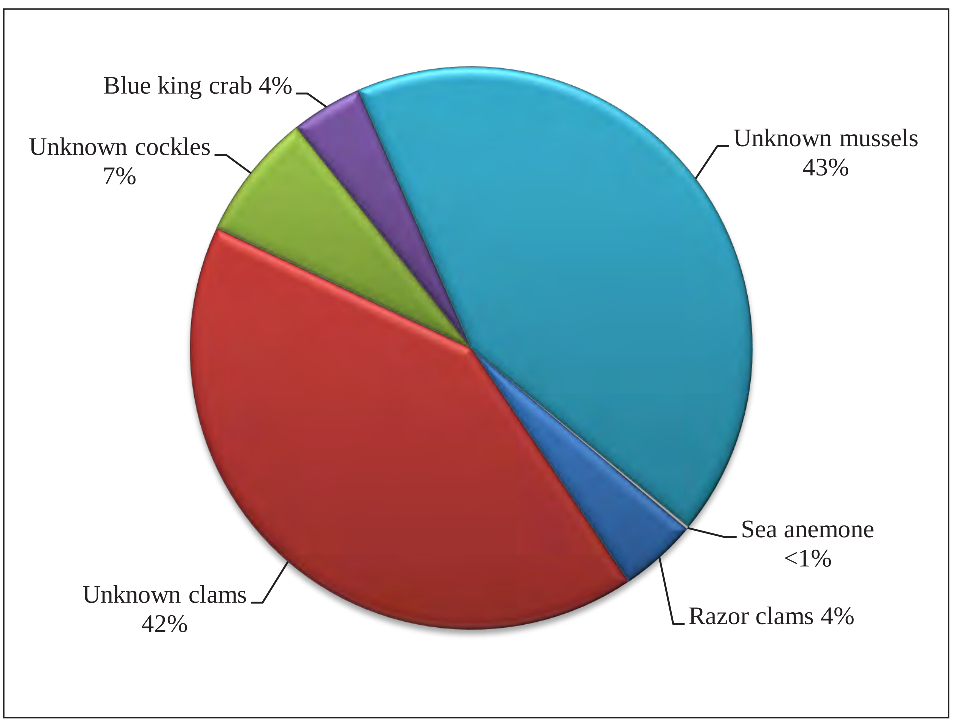


Figure D5-2.–Composition of marine invertebrate harvest by weight, Mekoryuk, 2017.

Table D5-6.–Changes in household uses of nonsalmon fish and marine invertebrates, Mekoryuk, 2017.

			Households reporting use								Households not using	
	Sampled	Valid	Total households		Less		Same		More			
Resource category	households	responses[a]	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	50	49	6	12.2%	2	4.1%	3	6.1%	1	2.0%	43	87.8%
Other nonsalmon fish	50	49	48	98.0%	20	40.8%	23	46.9%	5	10.2%	1	2.0%
Marine invertebrates	50	50	41	82.0%	10	20.0%	25	50.0%	6	12.0%	9	18.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Valid responses do not include households that did not provide any response.

Table D5-7.–Reasons for less household uses of nonsalmon fish and marine invertebrates compared to recent years, Mekoryuk, 2017.

		Households reporting	Increased availability		Used other resources		Favorable weather		Received more		Needed more		Increased effort		Had no substitution	
Resource category	Valid responses[a]	reasons for more use	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	49	1	1	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Other nonsalmon fish	49	5	0	0.0%	0	0.0%	1	20.0%	1	20.0%	0	0.0%	2	40.0%	0	0.0%
Marine invertebrates	50	6	0	0.0%	0	0.0%	0	0.0%	4	66.7%	1	16.7%	1	16.7%	0	0.0%

-continued-

Table D5-8.–Continued.

		Households reporting	Other		Regulations		Traveled farther		More success		Had more time		Store-bought expense		Got/ fixed equipment	
Resource category	Valid responses[a]	reasons for more use	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	49	1	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Other nonsalmon fish	49	5	0	0.0%	0	0.0%	0	0.0%	2	40.0%	0	0.0%	0	0.0%	0	0.0%
Marine invertebrates	50	6	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Valid responses do not include households that did not provide any response and households reporting never use.

Table D5-8.–Reasons for more household uses for nonsalmon fish and marine invertebrates compared to recent years, Mekoryuk, 2017.

Resource category	Valid responses[a]	Households reporting reasons for more use	Increased availability		Used other resources		Favorable weather		Received more		Needed more		Increased effort		Had no substitution	
			Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	49	1	1	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Other nonsalmon fish	49	5	0	0.0%	0	0.0%	1	20.0%	1	20.0%	0	0.0%	2	40.0%	0	0.0%
Marine invertebrates	50	6	0	0.0%	0	0.0%	0	0.0%	4	66.7%	1	16.7%	1	16.7%	0	0.0%

-continued-

Table D5-8.–Continued.

Resource category	Valid responses[a]	Households reporting reasons for more use	Other		Regulations		Traveled farther		More success		Had more time		Store-bought expense		Got/ fixed equipment	
			Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	49	1	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Other nonsalmon fish	49	5	0	0.0%	0	0.0%	0	0.0%	2	40.0%	0	0.0%	0	0.0%	0	0.0%
Marine invertebrates	50	6	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Valid responses do not include households that did not provide any response and households reporting never use.

Table D5-9.–Reasons that households did not get enough nonsalmon fish or marine invertebrates, Mekoryuk, 2017.

Resource category	Valid responses[a]	Family/personal		Resources less available		Too far to travel		Lack of equipment		Less sharing		Lack of effort		Unsuccessful		Weather/ environment	
		Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	2	0	0.0%	2	100.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	50.0%	0	0.0%
Other nonsalmon fish	14	5	35.7%	2	14.3%	0	0.0%	2	14.3%	0	0.0%	1	7.1%	0	0.0%	5	35.7%
Marine invertebrates	5	0	0.0%	2	40.0%	0	0.0%	0	0.0%	0	0.0%	1	20.0%	0	0.0%	1	20.0%

-continued-

Table D5-9.–Continued.

Resource category	Valid responses[a]	Other reasons		Working/no time		Regulations		Small/diseased animals		Equipment/fuel expense		Unspecified		Too much competition	
		Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	2	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Other nonsalmon fish	14	0	0.0%	3	21.4%	1	7.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Marine invertebrates	5	1	20.0%	0	0.0%	0	0.0%	1	20.0%	0	0.0%	0	0.0%	0	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Includes households failing to respond to the question and those households that never used the resource.

Table D5-10.–Things households did differently because they did not get enough nonsalmon fish or marine invertebrates, Mekoryuk, 2017.

Resource category	Valid responses[a]	Bought/bartered		Used more commercial foods		Replaced with other subsistence foods		Asked others for help		Made do without	
		Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Other nonsalmon fish	7	0	0.0%	3	42.9%	3	42.9%	0	0.0%	2	28.6%
Whitefish and sheefish	1	0	0.0%	0	0.0%	1	100.0%	0	0.0%	0	0.0%
Marine invertebrates	1	0	0.0%	1	100.0%	0	0.0%	0	0.0%	0	0.0%

-continued-

Table D5-10.–Continued.

Resource category	Valid responses[a]	Increased effort to harvest		Got a job		Obtained food from other sources		Got public assistance		Other	
		Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Other nonsalmon fish	7	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Whitefish and sheefish	1	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Marine invertebrates	1	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Includes households failing to respond to the question and those households that never used the resource.

Table D5-11.–Nonsalmon fish and marine invertebrates used in the past but not in the present, Mekoryuk, 2017.

Resource	Reason
Unknown marine invertebrates	Small shrew-size invertebrate used in Unalakleet.
Blue king crab	Not going out for it. Elder mom passed away, 2017 weather was bad, distant location, expensive.
Sea anemone	Elder mom passed. Not gathering here. Just got 1 in 2017.
Clams	When catch walrus people not eating stomach clams from walrus anymore. Use clams, but not from stomach.
Cockles	Used to be more, and more important.
Clams	
Cockles	Used to dig from Shoal Bay but sand from dunes is blowing in and making less habitable for them.
Mussels	
Blue king crab	Abundant on South and West sides but rarely recieves anymore.
Limpets	
Sea anemone	4 last year. Used to use them a lot.
Sea cucumber	Just don't pick them.
Blue king crab	Too much gas and work. Harvest location on the ice at Miqsarmiut
Cockles	Usually not available in this region (seem to be getting more available).
Sculpins	Sculpins for elder. Do not get now that grandmother passed away.
Flounders	Flounder but now just a few elders enjoy. We do not go out for it.
Arctic grayling	Not going out for it since elder parent passed. Got as preferred food to treat elder. Too expensive to go get, far away and elder passed.
Pacific (gray) cod	When small got cod fish but people don't really fish for cod because busy getting dog salmon—chum. Parents used to dry cod.
Pacific herring	Still uses but very little compared to past.
Pacific herring roe	
Alaska blackfish	Used to be important, long time ago.
Capelin (grunion)	
Pacific halibut	Used to be good
Flounders	Used to catch lots when kid; people got lazy.
Flounders	Mom and dad passed away.
Sculpins	Had to look under rock for little reward.
Rock sole	Forgot how to prepare.
Alaska blackfish	No transportation.
Alaska blackfish	Not catching in traps.
Flounders	Flounders, long time ago.
Pacific herring	Still uses some but nothing like in the past. They don't urn like they used to, they used to always run, now sometimes they don't. We are loosing our herring.
Saffron cod	Sons that were I town don't fish tomcod (didn't received) but the one who just returned went jigging the date of survey. Used to age them—"candied" tomcod.
Flounder	No provider
Dolly Varden	Helped parents in the past put up dried now too many flies to put up and dry and smoke. When easy to catch.
Blue king crab	Too much gas and work. Harvest location on the ice at Miqsarmiut
Bering cisco	Parents got Bering cisco fall time but not now during silver season. We don't try for that now.

-continued-

Table D5-11.–Continued

Resource	Reason
Broad whitefish	Not available in Mekoryuk. Used in Bethel.
Sheefish	Received when living in a different region of Alaska.
Humpback whitefish	Not being given to them and moved to Mekoryuk. Got in Kipnik and Napaskiak.
Least cisco	Least cisco in lake on east side; never used much.
Least cisco	Least on south side—lots when young.
Sheefish Broad whitefish	Used in Bethel.

Source ADF&G Division of Subsistence household surveys, 2018.

Table D6-1.–Selected study findings, Quinhagak, 2017.

Category	Community Quinhagak
Demography	
Population	665.8
Percentage of population that is Alaska Native	97.0%
Percentage of household heads born in Alaska	94.1%
Average length of residency of household heads (year)	43.1
Nonsalmon fish and marine invertebrate harvest and use	
Per capita harvest, pounds usable weight	80.6
Average household harvest, pounds usable weight	335.4
Number of resources used by 50% or more households	3.0
Average number of resources used per household	5.5
Average number of resources attempted to be harvested per household	3.7
Average number of resources harvested per household	3.7
Average number of resources received per household	2.4
Average number of resources given away per household	1.7
Percentage of total harvest taken by top 25% ranked households	70.4%
Percentage of households that harvested 70% of harvest	24.7%
Per capita harvest by lowest ranked 50% of households	6.0
Percentage of total harvest taken by lowest ranked 50% of harvesting households	7.4%
Average number of resources used by lowest ranked 50% of households	3.5
Average number of resources used by top 25% ranked households	8.6

Source ADF&G Division of Subsistence household surveys, 2018.

Table D6-2.–Population profile, Quinhagak, 2017.

	Male			Female			Total		
Age	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage
0–4	28.1	8.0%	8.0%	26.4	8.4%	8.4%	54.5	8.2%	8.2%
5–9	22.8	6.5%	14.5%	26.4	8.4%	16.8%	49.2	7.4%	15.6%
10–14	43.9	12.5%	27.0%	45.7	14.5%	31.3%	89.6	13.5%	29.0%
15–19	45.7	13.0%	40.0%	31.6	10.1%	41.3%	77.3	11.6%	40.6%
20–24	31.6	9.0%	49.0%	24.6	7.8%	49.2%	56.2	8.4%	49.1%
25–29	15.8	4.5%	53.5%	14.1	4.5%	53.6%	29.9	4.5%	53.6%
30–34	10.5	3.0%	56.5%	14.1	4.5%	58.1%	24.6	3.7%	57.3%
35–39	17.6	5.0%	61.5%	12.3	3.9%	62.0%	29.9	4.5%	61.7%
40–44	17.6	5.0%	66.5%	14.1	4.5%	66.5%	31.6	4.7%	66.5%
45–49	14.1	4.0%	70.5%	14.1	4.5%	70.9%	28.1	4.2%	70.7%
50–54	21.1	6.0%	76.5%	15.8	5.0%	76.0%	36.9	5.5%	76.3%
55–59	15.8	4.5%	81.0%	10.5	3.4%	79.3%	26.4	4.0%	80.2%
60–64	17.6	5.0%	86.0%	22.8	7.3%	86.6%	40.4	6.1%	86.3%
65–69	19.3	5.5%	91.5%	10.5	3.4%	89.9%	29.9	4.5%	90.8%
70–74	5.3	1.5%	93.0%	7.0	2.2%	92.2%	12.3	1.8%	92.6%
75–79	0.0	0.0%	93.0%	5.3	1.7%	93.9%	5.3	0.8%	93.4%
80–84	5.3	1.5%	94.5%	1.8	0.6%	94.4%	7.0	1.1%	94.5%
85–89	0.0	0.0%	94.5%	1.8	0.6%	95.0%	1.8	0.3%	94.7%
90–94	0.0	0.0%	94.5%	0.0	0.0%	95.0%	0.0	0.0%	94.7%
95–99	0.0	0.0%	94.5%	0.0	0.0%	95.0%	0.0	0.0%	94.7%
100–104	0.0	0.0%	94.5%	0.0	0.0%	95.0%	0.0	0.0%	94.7%
Missing	19.3	5.5%	100.0%	15.8	5.0%	100.0%	35.1	5.3%	100.0%
Total	**351.3**	**100.0%**	**100.0%**	**314.5**	**100.0%**	**100.0%**	**665.8**	**100.0%**	**100.0%**

Source ADF&G Division of Subsistence household surveys, 2018.

Table D6-3.–Birthplaces of household heads, Quinhagak, 2017.

Birthplace	Percentage
Atmautluak	0.7%
Bethel	1.4%
Eek	5.8%
Goodnews Bay	1.4%
Hooper Bay	1.4%
Kipnuk	0.7%
Kwethluk	0.7%
Manokotak	0.7%
Napaskiak	0.7%
Quinhagak	76.8%
Scammon Bay	1.4%
Tuntutuliak	0.7%
Other U.S.	5.8%
Missing	1.4%

Source ADF&G Division of Subsistence household surveys, 2018.
Note "Birthplace" means the place of residence of the parents of the individual when the individual was born.

Table D6-4.–Birthplaces of population, Quinhagak, 2017.

Birthplace	Percentage
Atmautluak	0.3%
Bethel	0.5%
Eek	3.4%
Goodnews Bay	0.5%
Hooper Bay	0.5%
Kipnuk	0.3%
Kwethluk	0.3%
Manokotak	0.8%
Napaskiak	0.3%
Quinhagak	82.7%
Scammon Bay	0.5%
Tuntutuliak	0.3%
Other U.S.	2.3%
Missing	7.5%

Source ADF&G Division of Subsistence household surveys, 2018.
Note "Birthplace" means the place of residence of the parents of the individual when the individual was born.

Table D6-5.–Nonsalmon fish and marine invertebrate resources used, Quinhagak, 2017.

Resource	Scientific name
Pacific herring	*Clupea pallasi*
Pacific herring roe	*Clupea pallasi*
Rainbow smelt	*Osmerus mordax*
Pacific (gray) cod	*Gadus macrocephalus*
Saffron cod	*Eleginus gracilis*
Walleye pollock (whiting)	*Theragra chalcogramma*
Flounders	
Pacific halibut	*Hippoglossus stenolepis*
Sculpins	
Sticklebacks (needlefish)	
Alaska blackfish	*Dallia pectoralis*
Burbot	*Lota lota*
Lake trout	*Salvelinus namaycush*
Unknown chars	*Salvelinus spp.*
Arctic grayling	*Thymallus arcticus*
Northern pike	*Esox lucius*
Sheefish	*Stenodus leucichthys*
Rainbow trout	*Oncorhynchus mykiss*
Unknown trouts	
Broad whitefish	*Coregonus nasus*
Bering cisco	*Coregonus laurettae*
Least cisco	*Coregonus sardinella*
Humpback whitefish	*Coregonus pidschian*
Round whitefish	*Prosopium cylindraceum*
Razor clams	*Siliqua spp.*
Unknown clams	
Unknown cockles	
Unknown mussels	*Mytilus spp.*

Source ADF&G Division of Subsistence household surveys, 2018.

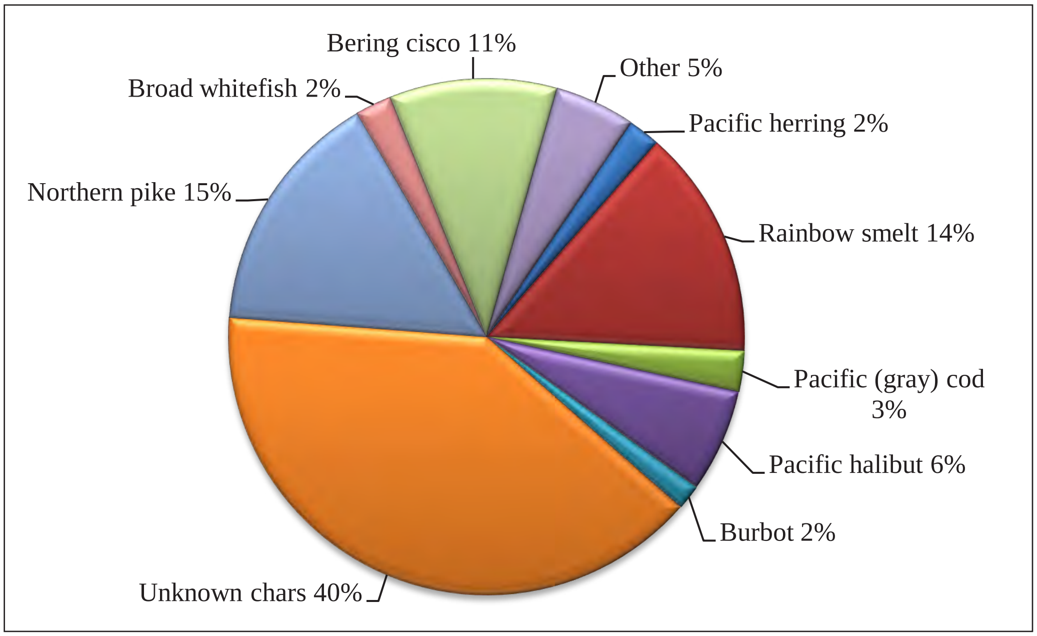


Figure D6-1.–Composition of nonsalmon fish harvest by weight, Quinhagak, 2017.

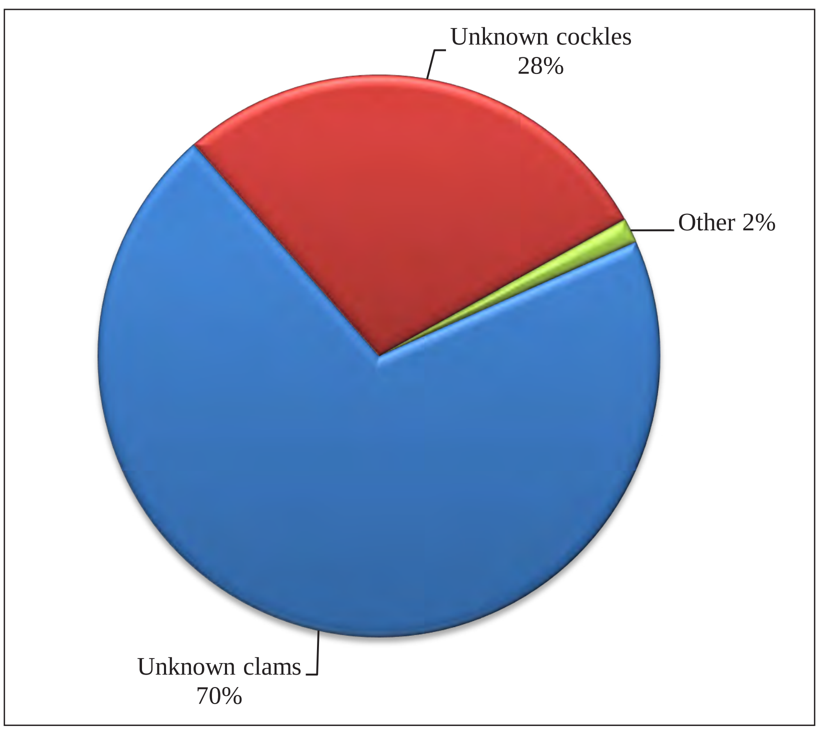


Figure D6-2.–Composition of marine invertebrate harvest by weight, Quinhagak, 2017.

Table D6-6.–Changes in household uses of nonsalmon fish and marine invertebrates, Quinhagak, 2017.

			Households reporting use								Households not using	
			Total households		Less		Same		More			
Resource category	Sampled households	Valid responses[a]	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	93	91	67	73.6%	16	17.6%	43	47.3%	8	8.8%	24	26.4%
Other nonsalmon fish	93	89	80	89.9%	24	27.0%	44	49.4%	12	13.5%	9	10.1%
Marine invertebrates	93	89	20	22.5%	6	6.7%	10	11.2%	4	4.5%	69	77.5%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Valid responses do not include households that did not provide any response.

Table D6-7.–Reasons for less household uses of nonsalmon fish and marine invertebrates, Quinhagak, 2017.

			Family/ personal		Resources less available		Too far to travel		Lack of equipment		Less sharing		Lack of effort		Unsuccessful		Weather/ environment	
Resource category	Valid responses[a]	Households reporting reasons for less use	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	89	14	1	7.1%	3	21%	0	0.0%	0	0%	2	14%	2	14%	0	0.0%	5	35.7%
Other nonsalmon fish	91	22	5	22.7%	4	18%	0	0.0%	4	18%	3	14%	5	23%	1	4.5%	4	18.2%
Marine invertebrates	89	6	1	16.7%	0	0%	0	0.0%	0	0%	1	17%	4	67%	1	16.7%	0	0.0%

-continued-

Table D6-7.–Continued.

			Other reasons		Working/ no time		Regulations		Small/ diseased animals		Did not need		Equipment/ fuel expense		Used other resources		Too much competition	
Resource category	Valid responses[a]	Households reporting reasons for less use	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	89	14	2	14%	1	7.1%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Other nonsalmon fish	91	22	1	5%	1	4.5%	0	0.0%	0	0.0%	1	4.5%	0	0.0%	0	0.0%	0	0.0%
Marine invertebrates	89	6	0	0%	1	16.7%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Valid responses do not include households that did not provide any response and households reporting never using the resource.

Table D6-8.–Reasons for more household uses of nonsalmon fish and marine invertebrates, Quinhagak, 2017.

Resource category	Valid responses[a]	Households reporting reasons for more use	Increased availability		Used other resources		Favorable weather		Received more		Needed more		Increased effort		Had no substitution	
			Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	89	8	5	62.5%	0	0.0%	0	0.0%	2	25.0%	0	0.0%	3	37.5%	0	0.0%
Other nonsalmon fish	91	12	5	41.7%	0	0.0%	2	16.7%	1	8.3%	0	0.0%	5	41.7%	0	0.0%
Marine invertebrates	89	4	1	25.0%	0	0.0%	0	0.0%	3	75.0%	0	0.0%	0	0.0%	0	0.0%

-continued-

Table D6-8.–Continued.

Resource category	Valid responses[a]	Households reporting reasons for more use	Other		Regulations		Traveled farther		More success		Had more time		Store-bought expense		Got/ fixed equipment	
			Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	89	8	0	0.0%	0	0.0%	0	0.0%	1	12.5%	0	0.0%	0	0.0%	0	0.0%
Other nonsalmon fish	91	12	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Marine invertebrates	89	4	0	0.0%	0	0.0%	0	0.0%	1	25.0%	0	0.0%	0	0.0%	0	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Valid responses do not include households that did not provide any response and households reporting never use.

Table D6-9.–Reasons that households did not get enough nonsalmon fish or marine invertebrates, Quinhagak, 2017.

Resource category	Valid responses[a]	Family/personal		Resources less available		Too far to travel		Lack of equipment		Less sharing		Lack of effort		Unsuccessful		Weather/ environment	
		Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	6	1	16.7%	1	16.7%	0	0.0%	1	16.7%	1	16.7%	0	0.0%	0	0.0%	2	33.3%
Other nonsalmon fish	18	3	16.7%	2	11.1%	0	0.0%	2	11.1%	2	11.1%	3	16.7%	1	5.6%	0	0.0%
Marine invertebrates	2	1	50.0%	0	0.0%	0	0.0%	0	0.0%	1	50.0%	1	50.0%	0	0.0%	0	0.0%

-continued-

Table D6-9.–Continued.

Resource category	Valid responses[a]	Other reasons		Working/no time		Regulations		Small/diseased animals		Equipment/fuel expense		Unspecified		Too much competition	
		Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	6	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Other nonsalmon fish	18	1	5.6%	3	16.7%	0	0.0%	0	0.0%	0	0.0%	3	16.7%	0	0.0%
Marine invertebrates	2	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Includes households failing to respond to the question and those households that never used the resource.

Table D6-10.–Things households did differently because they did not get enough nonsalmon fish or marine invertebrates, Quinhagak, 2017.

Resource category	Valid responses[a]	Bought/bartered		Used more commercial foods		Replaced with other subsistence foods		Asked others for help		Made do without	
		Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	2	0	0.0%	0	0.0%	1	50.0%	1	50.0%	0	0.0%
Other nonsalmon fish	9	0	0.0%	3	33.3%	5	55.6%	1	11.1%	0	0.0%
Marine invertebrates	1	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%

-continued-

Table D6-10.–Continued.

Resource category	Valid responses[a]	Increased effort to harvest		Got a job		Obtained food from other sources		Got public assistance		Other	
		Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
Whitefish and sheefish	2	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Other nonsalmon fish	9	0	0.0%	0	0.0%	1	11.1%	0	0.0%	1	11.1%
Marine invertebrates	1	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%

Source ADF&G Division of Subsistence household surveys, 2018.

a. Includes households failing to respond to the question and those households that never used the resource.

Table D6-11.–Nonsalmon fish and marine invertebrates used in the past but not in the present, Quinhagak, 2017.

Resource	Reason
Nonsalmon fish	No more parents
Pacific halibut	
Alaska blackfish	
Whitefishes	
Pacific halibut	
Alaska blackfish	Son moved to Bethel, he was fisher
Whitefishes	
Mussels	Mussels used when her grandmother alive but now aftaid of toxic shellfish disease
Saffron cod	Developed allergy
Alaska blackfish	Used to do blackfish trapping. Now just metal traps instead of wood traps that were handmade
Sticklebacks (needlefish)	Needlefish couple times
Sheefish	In Kotlik
Broad whitefish	
Sheefish	Ciiq from Kotlik—used to recieve, still does but rarer
Humpback whitefish	Humpback whitefish here when she was young. People do not get anymore.
Sticklebacks (needlefish)	They disappeared 3 years ago. I used to get them for dad
Sheefish	I used to fish by Bethel
Humpback whitefish	
Sticklebacks (needlefish)	When I was little we used to see lots of needlefish. Sometimes in Kwigillingok or Kipnuk frozen raw with seal oil and salt.
Dry fish	Used to wash and cut to pieces, now just freeze.
Clams	Grandpa used to dig clams, 6 miles down south—two 5 gallon buckets; nobody else knew where
Flounders	Smooth ones—allergic, used to love them
Saffron cod	Climate change, not around here anymore
Lake trout	I don't go to the mountains anymore
Sculpins	Long time ago
Sticklebacks (needlefish)	
Sticklebacks (needlefish)	Haven't went out to look for them in years
Broad whitefish	Usually get from Kasigkuk but haven't gone there for a while
Clams	At Wrangell
Clams	Clams used to be taken around the village in the mud but not anymore. Clams are here, just not gathered
Sticklebacks (needlefish)	
Alaska blackfish	Husband passed away
Burbot	
Clams	Late dad would go down south
Razor clams	Used to get razor clams at Ninilchik—no more. Too many people, too few clams.
Pacific halibut	Stopped giving me
Mussels	Just mussel shells here, live ones when she was little

-continued-

Table D6-11.–Continued.

Resource	Reason
Broad whitefish	Husband passed away so we don't go to Eek anymore
Northern pike	Bad experience, choked on bone once
Flounders	Turns out they taste good!
Rainbow trout	Found out they eat mice.
Bering cisco	When younger
Dogfish	Don't use anymore
Stickleback (needlefish)	Moved away from Hooper Bay; they don’t have down here
Flounders	Flounders in Jack Smith Bay, yellow fin flounder
Clams	Emply clam shells, now empty mussels here only
Mussels	Empty mussel now only here

Source ADF&G Division of Subsistence household surveys, 2018.